CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE
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March 2, 2023

Patricia Poire
Kern County Subbasin Point of Contact
Kern Groundwater Authority
1800 30th Street, Suite 280
Bakersfield, CA 93301
ppoire@kerngwa.com

RE: Inadequate Determination of the Revised 2020 Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Kern County Subbasin.

Dear Patricia Poire,

The Department of Water Resources (Department) has evaluated the six groundwater sustainability plans (GSPs or Plan) submitted for the San Joaquin Valley – Kern County Subbasin (Subbasin), as well as the materials considered to be part of the required coordination agreement. Collectively, the six GSPs and the coordination agreement are referred to as the Plan for the Subbasin. The Department has evaluated the revised Plan for the Kern County Subbasin in response to the Department's incomplete determination on January 28, 2022, and has determined that the actions taken to correct deficiencies identified by the Department were not sufficient (23 CCR § 355.2(e)(3)(C)).

The Department based its inadequate determination on recommendations from the Staff Report, included as an enclosure to the attached Statement of Findings, which explains why the Department believes that the Subbasin's Plan did not take sufficient actions to correct the deficiencies previously identified by the Department and, therefore, does not substantially comply with the GSP Regulations nor satisfy the objectives of the Sustainable Groundwater Management Act (SGMA).

Once the Department determines that a GSP is inadequate, primary jurisdiction shifts from the Department to the State Water Resources Control Board (State Board), which may designate the basin probationary (Water Code § 10735.2(a)). However, Department involvement does not end at that point; the Department may, at the request of the State Board, further assess a plan, including any updates, and may provide technical recommendations to remedy deficiencies to that plan. In addition, the responsibilities of the GSA do not end with an inadequate determination. Regardless of the status of a plan, a GSA remains obligated to continue collecting and submitting monitoring network data (Water Code Part 2.11; Water Code § 10727.2; 23 CCR § 353.40; 23 CCR § 354.40), submit an annual report to the Department (Water Code § 10728; 23 CCR § 356.2), conduct periodic updates to the plan at least every five years (Water Code § 10728.2; 23 CCR § 356.4), and submit this information to DWR's SGMA

Portal (23 CCR § 354.40). The Department also encourages GSAs to continue implementation efforts on project and management actions that will support the Subbasin's progress towards achieving sustainability.

Prior to this determination, the Department consulted with the State Board as required by SGMA (Water Code § 10735.2(a)(3)). Moving forward, for questions related to state intervention, please send a request to sgma@Waterboards.ca.gov. For any questions related to assessments, the State Board will coordinate with the Department.

For any other questions, please contact Sustainable Groundwater Management staff by emailing sgmps@water.ca.gov.

Thank You,

Paul Gosselin

Paul Gosselin
Deputy Director
Sustainable Groundwater Management

Attachment:

1. Statement of Findings Regarding the Inadequate Determination of the San Joaquin Valley – Kern County Subbasin Groundwater Sustainability Plans

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

STATEMENT OF FINDINGS REGARDING THE DETERMINATION OF INADEQUATE STATUS OF THE SAN JOAQUIN VALLEY BASIN – KERN COUNTY SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

The Department of Water Resources (Department) is required to evaluate whether a submitted groundwater sustainability plan (GSP or Plan) conforms to specific requirements of the Sustainable Groundwater Management Act (SGMA or Act), is likely to achieve the sustainability goal for the basin covered by the Plan, and whether the Plan adversely affects the ability of an adjacent basin to implement its GSP or impedes achievement of sustainability goals in an adjacent basin. (Water Code § 10733.) The Department is directed to issue an assessment of the Plan within two years of its submission. (Water Code § 10733.4.) If a Plan is determined to be Incomplete, the Department identifies deficiencies that preclude approval of the Plan and identifies corrective actions required to make the Plan compliant with SGMA and the GSP Regulations. The GSA has up to 180 days from the date the Department issues its assessment to make the necessary corrections and submit a revised Plan. (23 CCR § 355.2(e)(2)). This Statement of Findings explains the Department's decision regarding the revised Plan for the San Joaquin Valley Basin – Kern County Subbasin (No. 5-022.14).

SGMA allows for multiple GSPs implemented by multiple GSAs and coordinated pursuant to a single coordination agreement that covers the entire basin to be an acceptable planning scenario. (Water Code § 10727.) In the San Joaquin Valley – Kern County Subbasin (Subbasin), six GSPs were prepared by 17 GSAs for the various management areas established in the Subbasin pursuant to the coordination agreement. Collectively, the six GSPs and the coordination agreement are referred to as the Plan for the Subbasin. Individually, the GSPs include the following:

- *Kern Groundwater Authority Groundwater Sustainability Plan* – Amended July 2022 (KGA GSP) – prepared by the Kern Groundwater Authority (KGA) GSA, Semitropic Water Storage District (SWSD) GSA, Cawelo Water District (CWD) GSA, City of McFarland GSA, Pioneer GSA, West Kern Water District (WKWD) GSA, and Westside District Water Authority GSA.
- *Amended Kern River Groundwater Sustainability Plan* – July 2022 (Kern River GSP) – prepared by the Kern River GSA and Greenfield County Water District GSA.

- *Buena Vista Water Storage District GSA Groundwater Sustainability Plan* – July 2022 (Buena Vista GSP) – prepared by the Buena Vista Water Storage District (Buena Vista) GSA.
- *Olcese Groundwater Sustainability Agency Groundwater Sustainability Plan* – July 2022 (Olcese GSP) – prepared by the Olcese Water District (OWD) GSA.
- *Henry Miller Water District Groundwater Sustainability Plan* – July 2022 (Henry Miller GSP) – prepared by the Henry Miller Water District (HMWD) GSA.
- *South of Kern River Groundwater Sustainability Plan* – July 2022 (SOKR GSP) – prepared by the Arvin GSA, Tejon-Castac Water District (TCWD) GSA, and the Wheeler Ridge-Maricopa GSA.

Department management has discussed the Plan with staff and has reviewed the Department Staff Report, entitled *Groundwater Sustainability Plan Assessment Staff Report – San Joaquin Valley – Kern County Subbasin*, attached as Exhibit A, recommending an inadequate determination of the GSP. Department management is satisfied that staff have conducted a thorough evaluation and assessment of the resubmitted Plan and concurs with staff's recommendation. The Department therefore finds the resubmitted Plan **INADEQUATE** and makes the following findings:

A. The initial Plan for the basin submitted by the GSA for the Department's evaluation satisfied the required conditions as outlined the required conditions regarding the submission deadline, completeness, coordination, and Basin coverage, as outlined in § 355.4(a) of the GSP Regulations (23 CCR § 350 et seq.), and Department Staff therefore evaluated the initial Plan.

B. On January 28, 2022, the Department issued a Staff Report and Findings determining the initial GSP submitted by the Agencies for the basin to be incomplete, because the GSP did not satisfy the requirements of SGMA, nor did it substantially comply with the GSP Regulations. At that time, the Department provided corrective actions in the Staff Report that were intended to address the deficiencies that precluded approval. Consistent with the GSP Regulations, the Department provided the Agencies with up to 180 days to address the deficiencies detailed in the Staff Report. On July 27, 2022, within the 180 days provided to remedy the deficiencies identified in the Staff Report related to the Department's initial incomplete determination, the Agencies resubmitted the basin GSP to the Department for reevaluation. When evaluating a resubmitted GSP that was initially determined to be incomplete, the Department reviews the materials (e.g., revised or amended GSP) that were submitted within the 180-day deadline and does not review or rely on materials that were submitted to the Department by the GSAs after the resubmission deadline. Furthermore, the Department does not conduct a full evaluation of all components of a resubmitted Plan, but rather focuses on how the Agency has addressed the previously identified deficiencies that precluded approval of the initially submitted Plan. The

Department shall find a Plan previously determined to be incomplete to be inadequate if, after consultation with the State Water Resources Control Board, the Agency has not taken sufficient actions to correct the deficiencies previously identified by the Department. (23 CCR § 355.2(e)(3)(C).)

C. The Department's initial Staff Report identified the deficiencies that precluded approval of the initially submitted Plan. After staff's thorough evaluation of the resubmitted Plan, the Department makes the following findings regarding the sufficiency of the actions taken by the Agency to correct those deficiencies:

1. Deficiency 1: involved how the Plan established and justified undesirable results that represent effects caused by groundwater conditions occurring throughout the Subbasin. The corrective action advised the Agencies to evaluate the groundwater conditions that would be occurring throughout the Subbasin at the defined quantitative criteria described in the Plan. The corrective action also advised the Plan to explain how the Subbasin has utilized the same data and methodologies to define the Subbasin-wide undesirable results and how the Plan has considered the interests of beneficial uses and users of groundwater. The corrective actions included developing clear and consistent terminology and reporting processes for the Subbasin. The Staff Report indicates that the Agencies did not take sufficient actions to correct this deficiency, which materially affects the ability of the Agencies to achieve sustainability and the ability of the Department to evaluate the likelihood of the Plan to achieve sustainability.

2. Deficiency 2: involved the establishment of minimum thresholds for the chronic lowering of groundwater levels. The corrective action advised the Agencies to describe the various methods used to establish minimum thresholds and the potential effects on beneficial uses and users. The corrective action also advised the Plan to explain how the lowering of groundwater levels minimum thresholds and measurable objectives that are set below historical lows will impact other applicable sustainability indicators. The Staff Report indicates that the Agencies made progress toward describing the specific minimum thresholds at the management area plan scale but still did not take sufficient action to explain how the various minimum thresholds will collectively achieve the sustainability goals and avoid undesirable results for the Subbasin, which materially affects the ability of the Agencies to achieve sustainability and the ability of the Department to evaluate the likelihood of the Plan to achieve sustainability.

3. Deficiency 3: involved the establishment of sustainable management criteria for land subsidence. The corrective action advised the Plan to establish a Subbasin-wide approach to land subsidence, including Subbasin-wide subsidence sustainable management criteria and assessment of critical infrastructure that would be susceptible to substantial interference from future subsidence. The Staff Report indicates that the Agencies did not take sufficient actions to correct this deficiency, which materially affects the ability of the Agencies to achieve sustainability and the ability of the Department to evaluate the likelihood of the Plan to achieve sustainability.

D. In addition to the grounds listed above, the Department also finds that:

1. The Department developed its GSP Regulations consistent with and intending to further the state policy regarding the human right to water (Water Code § 106.3) 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. (23 CCR § 350.4(g).)

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

SGMA requires basins to achieve sustainability within 20 years of Plan implementation and requires local GSAs and the Department to continually evaluate a basin's progress towards achieving its sustainability goals. SGMA also requires GSAs to encourage the active involvement of diverse social, cultural, and economic elements of the population within each basin prior to and during development and implementation of Plans. Under SGMA, the GSP is the primary document disclosing and informing the Department, local GSA boards, other local and state agencies, and interested or affected parties of the intended management program for the basin and the potential physical or regulatory impacts or changes that may occur within the basin during decades of Plan implementation. It is therefore essential that each basin begin with a Plan that adequately analyzes, discloses, and informs and that each Plan conform with certain requirements of SGMA and substantially comply with the GSP Regulations. For the reasons stated here and further discussed in the Staff Report, the revised Plan for the Kern County Subbasin is hereby determined to be **INADEQUATE**.

Signed:

Karla Nemeth

Karla Nemeth, Director
Date: March 2, 2023

Enclosure: Groundwater Sustainability Plan Assessment Staff Report – San Joaquin Valley – Kern County Subbasin

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

Groundwater Basin Name:	San Joaquin Valley Basin – Kern County Subbasin (No. 5-022.14)
Number of GSPs:	6 (see list below)
Number of GSAs:	17 (see list below)
Submittal Type:	Revised Plan in Response to Incomplete Determination
Submittal Date:	July 27, 2022
Recommendation:	Inadequate
Date:	March 2, 2023

On July 27, 2022, multiple GSAs submitted multiple groundwater sustainability plans (GSPs) for the entire Kern County Subbasin (Kern Subbasin or Subbasin), which are coordinated pursuant to a required coordination agreement, to the Department of Water Resources (Department) in response to the Department's incomplete determination on January 28, 2022[1] for evaluation and assessment as required by the Sustainable Groundwater Management Act (SGMA)[2] and GSP Regulations.[3] In total, six GSPs, 5 revised GSPs and one new GSP, which are adopted and will be implemented by 17 GSAs. Collectively, all GSPs and the coordination agreement are, for evaluation and assessment purposes, treated and referred to as the Plan for the Subbasin. Individually, the GSPs include the following:

- *Kern Groundwater Authority Groundwater Sustainability Plan* – Amended July 2022 (KGA GSP) – prepared by the Kern Groundwater Authority (KGA) GSA, Semitropic Water Storage District (SWSD) GSA, Cawelo Water District (CWD) GSA, City of McFarland GSA, Pioneer GSA, West Kern Water District (WKWD) GSA, and Westside District Water Authority GSA.
- *Amended Kern River Groundwater Sustainability Plan* (Kern River GSP) – July 2022 – prepared by the Kern River GSA and Greenfield County Water District GSA.

[1] Water Code § 10733.4(b); 23 CCR § 355.4(a)(4); https://sgma.water.ca.gov/portal/service/gspdocument/download/7785
[2] Water Code § 10720 *et seq*.
[3] 23 CCR § 350 *et seq*.

- *Buena Vista Water Storage District GSA Amended Groundwater Sustainability Plan* – July 2022 (Buena Vista GSP) – prepared by the Buena Vista Water Storage District (Buena Vista) GSA.
- *Olcese Groundwater Sustainability Agency Groundwater Sustainability Plan* – July 2022 (Olcese GSP) – prepared by the Olcese Water District (OWD) GSA.
- *Henry Miller Water District Groundwater Sustainability Plan* – July 2022 (Henry Miller GSP) – prepared by the Henry Miller Water District (HMWD) GSA.
- *South of Kern River Groundwater Sustainability Plan* – July 2022 (SOKR GSP) – prepared by the Arvin GSA, Tejon-Castac Water District (TCWD) GSA, and the Wheeler Ridge-Maricopa GSA. This is the new GSP.

After evaluation and assessment, Department staff conclude the Plan has not taken sufficient actions to address the deficiencies identified in the Department's incomplete determination.[4]

- **Based on the evaluation of the Plan, Department staff recommend the Plan be determined inadequate.**

This assessment includes five sections:

- **Section 1 – Summary:** Provides an overview of the Department staff's assessment.
- **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 – Staff Recommendation:** Includes the staff recommendation for the Plan.

[4] 23 CCR § 352.2(e)(3)(C).

1 SUMMARY

Department staff recommend the Plan for the Kern County Subbasin be determined **INADEQUATE**.

Department staff concluded the GSAs did not take sufficient action to correct the following deficiencies identified in the incomplete determination:

Deficiency 1 – The GSPs do not establish undesirable results that are consistent for the entire Subbasin.

Deficiency 2 – The Subbasin's chronic lowering of groundwater levels sustainable management criteria do not satisfy the requirements of SGMA and the GSP Regulations.

Deficiency 3 – The Subbasin's land subsidence sustainable management criteria do not satisfy the requirements of SGMA and the GSP Regulations.

Generally, while the GSAs have put forth a great amount of effort to respond to the Department's corrective actions identified in the incomplete determination staff report, Department staff conclude that the information provided was not sufficiently detailed and the analysis was not sufficiently thorough and reasonable to correct the deficiencies identified by the Department. These deficiencies have been found to materially affect the ability of the Department to evaluate the likelihood of the Plan to attain sustainability.

2 EVALUATION CRITERIA

The Department evaluates whether a Plan conforms to the statutory requirements of SGMA[5] and is likely to achieve the basin's sustainability goal,[6] whether evaluating a basin's first Plan,[7] a Plan previously determined incomplete,[8] an amended Plan,[9] or a GSA's periodic update to an approved Plan.[10] 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.[11] 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.[12]

[5] Water Code §§ 10727.2, 10727.4, 10727.6.
[6] Water Code § 10733; 23 CCR § 354.24.
[7] Water Code § 10720.7.
[8] 23 CCR § 355.2(e)(2).
[9] 23 CCR § 355.10.
[10] 23 CCR § 355.6.
[11] Water Code § 10721(v).
[12] Water Code § 10733(c).

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 approve[13] the Plan or determine the Plan inadequate.[14]

The Department's reevaluation and reassessment of a Plan previously determined to be incomplete, as presented in this Staff Report, continues to follow Article 6 of the GSP Regulations[15] to determine whether the Plan, with revisions or additions prepared by the GSA, complies with SGMA and substantially complies with the GSP Regulations.[16] 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."[17]

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 reassessment of a Plan previously determined to be incomplete may involve the review of new information presented by the GSA(s), including models and assumptions, and a reevaluation of that information based on scientific reasonableness. In conducting its reassessment, Department staff does not recalculate or reevaluate technical information or perform its own geologic or engineering analysis of that information.

The recommendation that a Plan previously determined to be incomplete be determined to be inadequate is based on staff's conclusion that the GSAs have not taken sufficient actions to correct the deficiencies previously identified by the Department when it found the Plan incomplete.[18]

[13] 23 CCR §§ 355.2(e)(1).
[14] 23 CCR §§ 355.2(e)(3).
[15] 23 CCR § 355 *et seq*.
[16] 23 CCR § 350 *et seq*.
[17] 23 CCR § 355.4(b).
[18] Water Code § 10735 *et seq*.

3 REQUIRED CONDITIONS

For a Plan that the Department determined to be incomplete, the Department identifies corrective actions to address those deficiencies that preclude approval of the Plan as initially submitted. The GSAs in a basin, whether developing a single GSP covering the basin or multiple GSPs, must attempt to sufficiently address those corrective actions within the time provided, not to exceed 180 days, for the Plan to be evaluated by the Department.

3.1 INCOMPLETE RESUBMITTAL

GSP Regulations specify that the Department shall evaluate a resubmitted GSP in which the GSAs have taken corrective actions within 180 days from the date the Department issued an incomplete determination to address deficiencies.[19]

The Department issued the incomplete determination on January 28, 2022. The GSAs resubmitted their individual GSPs and the coordination agreement on July 27, 2022, in compliance with the 180-day deadline.

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 three principal deficiencies in the Plan related to the establishment of undesirable results and sustainable management criteria for groundwater levels and subsidence, which precluded the Plan's approval in January 2022.[20] The GSAs were 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 revised Plan to determine if the GSAs have taken sufficient actions to correct the deficiencies.

[19] 23 CCR § 355.4(a)(4).
[20] Incomplete Determination of the 2020 Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Kern County Subbasin. California Department of Water Resources, January 28, 2022, https://sgma.water.ca.gov/portal/service/gspdocument/download/7785

Evaluation Summary

As discussed in the initial incomplete determination, the Kern Subbasin is the largest groundwater subbasin and one of the most complex subbasins with regards to entities involved and associated demands. With that, Department staff still believe that in order to comply with SGMA and the GSP Regulations and achieve sustainable groundwater management, the Kern Subbasin needs a well-explained Plan that will be implemented in a coordinated manner. Although the revised Plan (i.e., the GSPs implemented together in accordance with the coordination agreement) made progress toward explaining a coordinated approach to sustainable groundwater management, especially regarding the development of consistent terminology, Department staff continue to find the Plan difficult to evaluate in terms of whether or not implementation will likely achieve the sustainability goals for the Subbasin.

The revised Plan maintains the sustainability goal of collectively bringing the Subbasin into sustainability and achieving long term sustainability through the implementation of more than 180 projects and management actions to be developed and executed by the individual management areas. The Plan also continues to use a percent of land area framework to quantify conditions that would lead to undesirable results. The Plan improved the quantitative metric that indicates when a management area would contribute to the Subbasin-wide percent land area calculation – the Plan considers this a Management Area Exceedance which occurs when 40% of a management area's representative monitoring wells exceed the management area specific minimum thresholds for four consecutive bi-annual measurements (i.e., spring and fall measurements). The Management Area Exceedance concept is an improvement from the original Plan's concept of the "watch area," but the definition still does not represent or explain the groundwater conditions that would be occurring throughout the Subbasin that the GSAs are trying to avoid to achieve sustainability. This continues to be evident because the Subbasin's management areas still employ various data and methodologies to establish minimum thresholds and measurable objectives in which all the individual minimum thresholds are set at differing magnitudes below historic low groundwater levels.

Additionally, the Plan maintains the results of the Todd Groundwater Technical Memorandum, a key piece of the Subbasin's coordinated management, which indicates that the 324,326 acre-feet per year of overdraft estimated from the baseline condition's projected future simulations may be offset by the various 180 projects and management actions "once fully implemented." [21] The Todd Groundwater Technical Memorandum also states that for most of the management areas in the Subbasin, the simulated projected water levels fall near or below the minimum thresholds without projects, but will generally be above the minimum thresholds if the SGMA projects are fully implemented. [22] Therefore, it is Department staff's understanding that if the projects and management actions are effectively implemented and the full allotment of water supply augmentation

[21] First Amended Kern County Subbasin Coordination Agreement, pp. 43-49.
[22] First Amended Kern County Subbasin Coordination Agreement, p. 49.

is realized then the management approach described in the coordination agreement may marginally address the initial estimate of overdraft, maintain conditions above the minimum thresholds, and avoid undesirable results.

However, after reviewing the revised Plan, Department staff believe that even though the Subbasin has developed consistent terminology and conducted well impact analyses and while the GSPs often state that the minimum thresholds for groundwater levels were coordinated and compared, there still appears to be no real analysis or understanding of the effects of the groundwater conditions if the minimum thresholds are exceeded and groundwater levels continue to decline for years before a Subbasin-wide undesirable result is declared. Department staff remain concerned that the varied and fragmented approaches to establish individual water budgets (i.e., the checkbook budgets) and sustainable management criteria might allow for groundwater conditions to worsen at a greater rate or extent than otherwise would have occurred with a more coordinated Plan.

As mentioned above, being that the Kern Subbasin maintains the sustainability goal to "achieve sustainable groundwater management in the Kern County Subbasin through the implementation of projects and management actions at the member agency level of each GSA,"[23] Department staff still consider the implementation of projects and management actions to be absolutely critical to assessing the progress toward sustainable groundwater management in the Kern Subbasin. However, being that the various data and methodologies used to establish sustainable management criteria and the fine margins indicated by the results of the Todd Groundwater Technical Memorandum to achieve sustainability (e.g., -45,965 acre-feet per year change in storage at 2070 climate with projects)[24] were not reevaluated or revisited, Department staff continue to believe and be concerned that if proposed projects and management actions are not diligently pursued, are significantly delayed, or are not likely to be implemented, it may lead to inadequate progress toward achieving sustainability for the Subbasin.

4.1 Deficiency 1 – The GSPs do not establish undesirable results that are consistent for the entire Subbasin.

4.1.1 Corrective Action 1

As described in the Department's GSP Assessment Staff Report released in January 2022, Department staff recommended the GSAs consider and address the following:

a) The Plan's Coordination Agreement should be revised to explain how the undesirable results definitions are consistent with the requirements of SGMA and the GSP Regulations, which specify that undesirable results represent effects caused by groundwater conditions occurring throughout the Subbasin.[25] The discussion should include descriptions of how the Plans have utilized the same

[23] First Amended Kern County Subbasin Coordination Agreement, p. 11
[24] First Amended Kern County Subbasin Coordination Agreement, p. 44.
[25] 23 CCR § 354.26(a).

data and methodologies to define the Subbasin-wide undesirable results and how the Plan has considered the interests of beneficial uses and users of groundwater.[26]

b) Because of the fragmented approach used in the Subbasin that could allow for substantial exceedances of locally defined minimum thresholds over sustained periods of time, the GSAs must commit to comprehensively reporting on the status of minimum threshold exceedances by area in the annual reports and describe how groundwater conditions at or below the minimum thresholds may impact beneficial uses and users prior to the occurrence of a formal undesirable result.[27]

c) The GSAs must adopt clear and consistent terminology to ensure the various plans are comparable and reviewable by the GSAs, interested parties, and Department staff. This terminology should also adhere to the definitions of various terms in SGMA and the GSP Regulations including the understanding that undesirable results are conditions occurring throughout the Subbasin.[28] The Plan and associated coordination materials must also be revised to clearly document how all of the various undesirable results definitions and methodologies achieve the same common sustainability goal.[29] Department staff recommend the revisions should include, at minimum:

- A map of the entire Subbasin showing each of the GSP areas, including management areas and the management areas within the management area plans, associated monitoring zones, etc. that have a locally defined "undesirable result" that can contribute to the Subbasin's undesirable result area-based definitions described in the Coordination Agreement
- A comprehensive table or another organized form of identifying each of the areas, the land coverage – both absolutely and as a percentage – of each of those listed areas in comparison to the Subbasin in total, and a clear and concise description of the conditions that would cause that area to trigger a localized undesirable result (i.e., a watch area, etc.). These materials should demonstrate that 100 percent of the Subbasin area is being managed under the various GSPs with reasonable definitions for undesirable results.

In addition to the graphical and tabular representation of the definition of the Subbasin-wide undesirable results, and if the GSAs elect to maintain the percentage of land area definition for undesirable results, the GSAs need to provide a comprehensive description of the groundwater conditions that would lead to localized undesirable results in the GSAs and other management areas which ultimately contribute to the 15 percent or 30 percent of land area criteria.

[26] 23 CCR §§ 354.26(b), 357.4(a).
[27] 23 CCR § 354.26(b)(4).
[28] 23 CCR § 354.26(a).
[29] 23 CCR § 357.4(a).

4.1.2 Evaluation

In response to Deficiency 1, the GSAs made appreciable efforts to develop consistent Subbasin-wide terminology and definitions for certain components of the Subbasin's sustainable groundwater management program. One key component was establishing the concept of a Management Area Exceedance which represents localized undesirable conditions specific to each management area (i.e., distinct from an undesirable result associated with groundwater conditions occurring throughout the Subbasin that may be impacting beneficial uses and users of groundwater). The Management Area Exceedance is quantitatively defined as when 40% of a specific management area's representative monitoring sites exceed the management area defined minimum thresholds for four consecutive bi-annual measurements.[30] The amended Coordination Agreement maintains the quantitative Subbasin-wide undesirable result definition for chronic lowering of groundwater levels as "when the minimum threshold for groundwater levels are exceeded in at least three (3) adjacent management areas that represent at least 15% of the Subbasin or greater than 30% of the Subbasin (as measured by each management area). Minimum thresholds shall be set by each of the management areas through their respective management area plans or Groundwater Sustainability Plans."[31] From a quantitative metric perspective, Department staff understand that if a management area observes conditions that exceed the minimum thresholds in 40 percent of their representative monitoring sites for four consecutive bi-annual measurements, then that management area would contribute to the 15 percent or 30 percent of land area criteria that represents a Subbasin-wide undesirable result. Effectively the Plan maintains a two-tier undesirable result definition for the Subbasin in which a management area prerequisite must occur before an undesirable result would be declared in the Subbasin.

While progress was made in standardizing terminology and definitions across the various management areas – including the Management Area Exceedance concept – the Plan continues to generally lack a comprehensive description of the groundwater conditions that would lead to localized undesirable results in the GSAs and other management areas (i.e., conditions that would result in a Management Area Exceedance) which then would ultimately contribute to the 15 percent or 30 percent of land area criteria. Looking at chronic lowering of groundwater levels as an example, it remains unclear to Department staff what effects or conditions would be occurring in each management area if a Management Area Exceedance was to be realized without triggering a Subbasin-wide undesirable result, especially being that the data and methodologies to establish groundwater level minimum thresholds varies across the management areas. In more general terms, Department staff maintain the position that the Plan still contains a complex set of minimum threshold values established in approximately 186 regional monitoring wells[32] that must be observed and evaluated before a Management Area Exceedance occurs, and consequently, before a collection of Management Area

[30] First Amended Kern County Subbasin Coordination Agreement, p. 12.
[31] First Amended Kern County Subbasin Coordination Agreement, p. 298.
[32] First Amended Kern County Subbasin Coordination Agreement, pp. 48, 110-296.

Exceedances result in an undesirable condition for the Subbasin via the land area criteria.[33] Department staff also reiterate, and discuss in further detail below in Deficiency 2, that the chronic lowering of groundwater minimum thresholds are still established using various datasets and methodologies across the management area plans. The specific management area methods utilized for developing the water level sustainable management criteria allow for differing degrees of lowering of groundwater levels – all beyond historical lows. The complexity involved with the variety of water level minimum threshold values, the four consecutive measurement condition, and the two-tier percentage definition to declare an undesirable result for the Subbasin, continues to be problematic because it can allow for situations where groundwater conditions could degrade for potentially sustained periods of time in potentially significant portions of the Subbasin without triggering Subbasin-wide management actions necessary to address Subbasin-wide undesirable results.

Regarding the chronic lowering of groundwater levels, many of the proposed sustainable management criteria in the Plan do not appear to consider the analysis and results of the Subbasin-wide California Central Valley Groundwater-Surface Water Simulation Model (C2VSim) Kern County model (i.e., C2VSimFG-Kern).[34] The model is presented in the Coordination Agreement and is used to produce estimates of the sustainable yield, total change in storage for a baseline period and future projections, and native yield as well as evaluate how sustainability will be achieved through the implementation of the assorted projects and management actions. In the view of Department staff, some management areas' approach to setting sustainable management criteria do not appear to be informed by the Todd Groundwater Technical Memorandum results indicating how, through the full implementation of the proposed projects and management actions, sustainability will be achieved and undesirable results will be avoided.[35] It should be noted that the sustainability assessment described in the Todd Groundwater Technical Memorandum indicates that without the implementation of any of the proposed projects and management actions the Subbasin groundwater extractions would exceed the estimated sustainable yield by 25 percent to 34 percent.[36] Below, Department staff describe select examples presenting the discrepancies between where the sustainable management criteria were established versus the C2VSim Kern County model simulations:

- In the KGA GSP Semitropic Water Storage District (SWSD) management area the measurable objectives and minimum thresholds for groundwater levels are set

[33] The total number of representative monitoring wells varies. The Todd Groundwater Memorandum in the Coordination Agreement contains hydrographs depicting simulated groundwater conditions and the associated measurable objectives and minimum thresholds for 186 regional monitoring wells. The Kern County Subbasin Third Annual Report submitted March 30, 2022, contains hydrographs comparing groundwater levels to measurable objectives and minimum thresholds in 203 representative monitoring wells. As of February 2023, the Department's Monitoring Network Module indicates 238 groundwater level representative monitoring wells.
[34] First Amended Kern County Subbasin Coordination Agreement, pp. 15-296.
[35] First Amended Kern County Subbasin Coordination Agreement, pp. 43-44.
[36] First Amended Kern County Subbasin Coordination Agreement, p. 48.

below all of the projected water level model scenarios, including the projected climate scenarios that exclude the implementation of the projects and management actions. In evaluating the hydrographs presented in the amended management area plan, it appears that the SWSD minimum thresholds would allow for approximately more than 100 feet of groundwater level decline beyond the simulated groundwater levels for water year 2040 where projects and management actions are not implemented.[37] This indicates to Department staff that if groundwater conditions reached the minimum thresholds in SWSD, then pumping would not likely be within the sustainable yield and undesirable results may be occurring.

- The Kern River GSP has established a narrower margin of operational flexibility (i.e., water level difference between the measurable objectives and minimum threshold) with many of the established measurable objectives aligning with the simulated projected groundwater conditions with the implementation of projects and management actions. However, the minimum thresholds, with the exception of two representative monitoring wells (RMW-026 and RMW-030), are set at groundwater levels below the projected water level scenarios that exclude projects and management actions. In some representative monitoring wells, the difference between the simulated water level without projects and management actions and the minimum threshold is upwards of 100 feet at water year 2040.[38] This indicates to Department staff that, although Kern River's measurable objectives appear to be correlated with the projected water levels with projects and management actions, without the full implementation of the various projects and management actions, the GSA may not achieve their sustainability goal. Additionally, the data indicate that – with the exception of the two wells listed above – if groundwater levels were to reach the minimum thresholds, then the management area and Subbasin may not be operating within its sustainable yield resulting in the Subbasin not likely achieving the sustainability goals.

As highlighted in the examples above, the locally derived minimum thresholds – and in some cases the measurable objectives – are well below the range of simulated water levels in model runs where sustainability was achieved through the implementation of projects and management actions at the member agency level of each GSA. This indicates that the baseline conditions in the model do not consider the groundwater conditions occurring throughout the Subbasin if the management areas were operating at or near their specific minimum thresholds. Additionally, in some management areas, the minimum thresholds – and in some cases the measurable objectives – are set below the model simulations which evaluate projected future climate conditions with no GSA actions taken (i.e., without the implementation of projects and management actions).

[37] First Amended Kern County Subbasin Coordination Agreement, pp. 200-216; KGA GSP Semitropic Water Storage District Revised Management Area Plan (MAP), Figures 5-7 through 5-18, pp. 329-340.
[38] First Amended Kern County Subbasin Coordination Agreement, pp. 127-146; Kern River Amended GSP, Appendix H, pp. 974-1016.

After evaluating the proposed management area minimum thresholds and the simulation results from the Todd Groundwater Technical Memorandum, Department staff cannot understand how the Plan's assessment of overdraft conditions were incorporated into the development of sustainable management criteria, and how the Subbasin will achieve its sustainability goal, especially if the estimated benefits of the various projects and management actions are not fully realized.

Department staff recognize that the amended Coordination Agreement includes a table and maps identifying each of the management areas and their land coverage (both absolute and as a percentage of the Subbasin), the total number of representative monitoring wells in each area, and the number of representative monitoring wells exceeding the minimum thresholds required to trigger a Management Area Exceedance which would contribute to the calculation for a Subbasin-wide undesirable result.[39] The entirety of the Subbasin appears to be represented on the maps and in the accompanying table. With the submission of these materials, Department staff find that sufficient action was taken by the GSAs in developing a graphical and tabular representation of the definition of the Subbasin-wide undesirable results as requested in Corrective Action 1c of Deficiency 1. However, as highlighted above and being that the Plan maintains the percent land area definition, Department staff do not believe the GSAs took sufficient action to provide a comprehensive description of the groundwater conditions that would lead to localized undesirable results in the GSAs and other management areas which ultimately contribute to the 15 percent or 30 percent of land area criteria.

Related to the graphical and tabular documentation of how the quantification of undesirable results will be triggered, it is still unclear to Department staff how minimum threshold exceedances will be tracked and reported in each management area and evaluated against the land area-based Subbasin-wide undesirable result definition. While Department staff understand the Subbasin has launched an initial version of their data management system[40] and the GSAs collectively produce and submit annual reports, Department staff cannot evaluate how the various management areas would assess whether any minimum threshold exceedance, for any amount of time and in any area, is causing effects that could be or become significant and unreasonable. It is Department staff's understanding that with the current two-tier undesirable result quantification with the associated multi-seasonal measurement component, the Subbasin could be experiencing minimum threshold exceedances at a large number of sites for a sustained period without this being considered undesirable by the Subbasin's groundwater managers – meaning localized conditions could be degrading while GSP and management area specific water budgets do not clearly show where the overdraft is occurring.

Additionally, the four consecutive bi-annual water level measurements constraint for minimum threshold exceedances associated with the Management Area Exceedance

[39] First Amended Kern County Subbasin Coordination Agreement, pp. 301-303.
[40] Kern County Subbasin GSPs Third Annual Report Water Year 2021, Section 7.1.2, p. 45.

criterion can allow for isolated or anomalous groundwater recharge events raising water levels above the minimum thresholds which would reset the temporal trigger incorporated in the two-tier Subbasin-wide undesirable result calculation framework. The occurrence of these nuanced groundwater level conditions may cause significant fluctuations in water levels in a selection of representative monitoring wells, occurring over relatively short time periods, and may be influenced by local groundwater banking operations. It is unclear to Department staff how or if groundwater banking operations occurring throughout the Subbasin would affect the quantitative metrics that define a Management Area Exceedance.

To support the evaluation of potential impacts to beneficial uses and users at the locally established sustainable management criteria, each GSP resubmission included some variation of a well impact analysis to identify wells that could go dry at proposed minimum thresholds and measurable objects. In addition to the well impact studies, the South of Kern River GSAs[41] and BVGSA[42] include (or will develop) some variation of a well mitigation plan if impacts are observed. Furthermore, all management areas in the KGA are required to have a mitigation plan if more than 5% of identified domestic wells are predicted to be dewatered at the minimum thresholds.[43]

Department staff are encouraged by the inclusion of the well impact studies and believe that the GSAs took steps to understand how beneficial users of groundwater, including drinking water users, may be affected during Plan implementation. These studies provide transparency of the potential magnitude of impacts to beneficial users that can be expected if water levels decline to local sustainable management criteria minimum thresholds. However, these studies provide less clarity on how an individual GSP's implementation may affect beneficial uses and users across the greater Subbasin given that excessive pumping in any given Management Area could affect water levels beyond that management area's jurisdictional boundaries. Again, this becomes problematic with the disparate methodologies used to establish sustainable management criteria and conflicts with GSP Regulations,[44] which require that management areas operating under different minimum thresholds and measurable objectives explain how they will not cause undesirable results outside the management area.

4.1.3 Conclusion

Ultimately, the fragmented management area approach to groundwater management, particularly in establishing minimum thresholds and measurable objectives, undermines the GSAs ability to clearly define the Subbasin-wide significant and unreasonable effects they hope to avoid. It is, therefore, unclear to Department staff how or whether the sustainable groundwater management approach described in the Plan will achieve the sustainability goals included in the amended Coordination Agreement, specifically: (1)

[41] South of Kern River GSP, Section 18.1.6.2, pp. 599-600.
[42] Buena Vista Amended GSP, Section 5.4.1.3, p. 144.
[43] KGA Amended GSP, p. 15.
[44] 23 CCR § 354.20(b)(4).

collectively bringing the Subbasin into sustainability and maintaining sustainability over the implementation horizon; (2) maintaining groundwater use within the sustainable yield as demonstrated by monitoring and reporting groundwater conditions; and (3) operating within the established sustainable management criteria which are based on collective technical information.[45]

4.2 Deficiency 2 – The Subbasin's chronic lowering of groundwater levels sustainable management criteria do not satisfy the requirements of SGMA and the GSP Regulations.

4.2.1 Corrective Action 2 and GSA Responses

Below is a table highlighting Department staff's recommendations from the Department's GSP Assessment Staff Report released in January 2022 and brief descriptions of what each management area provided in response to the corrective actions.

Kern Groundwater Authority GSP
Areas Outside of Management Areas (Umbrella Document)
Corrective Action Provide a comprehensive discussion of areas covered by the KGA GSP, but that are not contained within the various management area plans. Among other items, provide maps of these areas, describe the uses and users of groundwater in these areas, and either set sustainable management criteria for these areas or include robust discussions justifying why sustainable management criteria are not required. GSA Response to Corrective Action The Umbrella Plan states that descriptions of areas covered by the KGA GSP, such as non-districted lands, were included in the Umbrella Plan. However, the GSA was unable to include these lands at time of submittal due to the landowner not signing to become a member of KGA. The Umbrella Plan states that the GSA will retain and monitor over all lands under its jurisdiction. The Umbrella Plan states that activities in the non-districted lands that are still not under a management area include oil and grazing activities and do not require sustainable management criteria. A figure visualizing non-districted lands[46] and another figure reflecting the lack of water wells[47] within these lands are included in the Umbrella Plan.
Cawelo Water District Management Area

[45] First Amended Kern County Coordination Agreement, p. 11.
[46] KGA Amended GSP, Figure 1-5a, p. 81.
[47] KGA Amended GSP, Figure 1-6a, p. 83.

Corrective Action
The KGA GSP must describe how the minimum thresholds in the Cawelo management area may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

GSA Response to Corrective Action
The management area performed a 'well completion analysis.' The analysis compared screen intervals and saturated thickness of 290 water supply wells to the proposed minimum thresholds from nearby representative monitoring wells. The analysis determined that 3% of domestic wells and <1% of agricultural/industrial supply wells would be potentially impacted if water level conditions reached the proposed minimum thresholds. The Cawelo management area developed a summary table correlating each sustainability indicator to their respective beneficial uses/users, effects to beneficial uses and users, undesirable result causes, local undesirable result criteria and definitions, justification for local undesirable results, minimum threshold definitions and justification, and measurable objective definition. The minimum threshold definitions included a summary of how the conditions will avoid undesirable results for other sustainability indicators.[48]

Eastside Water Management Area

Corrective Action
The KGA GSP must describe how the minimum thresholds in the Eastside management area may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

GSA Response to Corrective Action
The Eastside Water Management Area (EWMA) conducted a well impact analysis to evaluate potential impacts to beneficial users. The analysis included developing a management area specific analytical model that established a radius of influence for each representative monitoring well, then existing well information was collected to see what well types (i.e., beneficial use) were within the radius of the monitoring location. The model then estimated the impacts to the well types as groundwater levels decreased to the minimum thresholds. EWMA then reviewed the potential impacts to agricultural and domestic wells in an area of influence at each representative monitoring well. The results of the well impact indicates 20 agricultural production wells, five domestic wells, and two municipal wells could be impacted if water levels reach the minimum thresholds. The EWMA management area plan states that the GSA ensures well information in the analysis includes all current, publicly available data.[49]

Kern Water Bank Management Area

Corrective Actions

[48] KGA GSP Cawelo Revised MAP, Section 7.2.6, pp. 200-202.
[49] KGA GSP Eastside Revised MAP, Section 12.1.3, p. 85.

- While the Department understands the unique circumstances with the Kern Water Bank, compliance with SGMA and the GSP Regulations is still a requirement and while the thresholds established in the Joint Operation Plan are being utilized to meet these requirements, all parts of the GSP Regulations related to the sustainable management criteria must be addressed. The KGA GSP must provide an explanation of how the Joint Operation Plan meets the requirements of SGMA and the GSP Regulations.
- It is also noted that the Joint Operation Plan expired on January 31, 2019. Provide an updated explanation if these thresholds have changed and the latest Joint Operation Plan if applicable.

GSA Response to Corrective Actions

The Kern Water Bank GSA renewed the Joint Operations Plan through 2023 and have not changed the original thresholds. The Joint Operations Plan was established to "prevent, eliminate or mitigate significant adverse impacts as a result of project implementation" in the Kern Water Bank, Rosedale-Rio Bravo, and Pioneer Project management areas. The Umbrella Plan states that the Kern Water Bank operations cannot recover native groundwater supplies.[50] However, the management area plan states the Kern Water Bank Memorandum of Understanding allows 0.3 acre-feet per acre of native groundwater to be extracted for farmed acreage. The management area plan explains that because irrigation does not occur in the management area, the allowance is not used.[51] As a result, the minimum threshold for a reduction of native groundwater supplies is when stored water accounts equal zero.[52]

Kern-Tulare Water District Management Area

Corrective Actions

- The KGA GSP must provide and explanation of how minimum thresholds within the Kern-Tulare management area at the monitoring sites are consistent with the requirement to be based on a groundwater elevation indicating a significant and unreasonable depletion of supply at a given location. If the minimum thresholds were not set consistent with levels indicating an undesirable depletion of supply, the thresholds should be revised accordingly.
- Provide a discussion identifying how the minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

GSA Response to Corrective Actions

The management area plan states that minimum thresholds were initially established as the historical low water elevation within the Santa Margarita Formation observed during the peak of the drought in August 2015. The Kern-Tulare Water District (KTWD) management area plan states that after discussing the minimum thresholds with the

[50] KGA Amended GSP, Table 2a, p. 18.
[51] KGA GSP Kern Water Bank Revised MAP, Section 2.1.3.1, p. 15.
[52] KGA GSP Kern Water Bank Revised MAP, Section 2.1.2.8, p. 14, Appendix I, pp. 183-190.

adjacent EWMA it became apparent that some of EWMA's monitoring locations were much shallower than KTWD and were at risk of going dry at KTWD's proposed minimum thresholds. Based on the feedback from EWMA and local landowners in KTWD, the minimum thresholds were adjusted on a well-by-well basis to prevent impacts to agricultural users. The KTWD management area plan states that all domestic wells within KTWD are to depths less than 700 feet below ground surface and would not be impacted by groundwater extractions occurring in the Santa Margarita Formation which is located at approximately 1,800 to 2,400 feet below ground surface.[53]

North Kern Water Storage District/Shafter-Wasco Irrigation District Management Area

Corrective Actions

- The KGA GSP must establish sustainable management criteria for management area NKWSD-MA-2.
- The KGA GSP must be revised to explain how minimum thresholds within the North Kern Water Storage District/Shafter-Wasco Irrigation District management area at the monitoring sites are consistent with the requirement to be based on a groundwater elevation indicating a significant and unreasonable depletion of supply at a given location. If the minimum thresholds were not set consistent with levels indicating an undesirable depletion of supply, the thresholds should be revised accordingly.
- Verify how the subset of wells used in the well impact analysis is representative of the wells in the management area. Provide an explanation of the mitigation plan for domestic wells.

GSA Response to Corrective Actions

The North Kern Water Storage District (NKWSD) identified two representative monitoring wells for MA-2, conducted a Well Impact Study, and established minimum thresholds and measurable objectives for each location. The Well Impact Study utilized groundwater elevation and well completion report data to identify monitoring locations to better evaluate impacts to beneficial uses and users in the management area. Groundwater level data was collected from State and local agency databases and filtered to include a subset of wells with similar groundwater elevations. The management area plan states that groundwater elevation data was then used to establish hydrogeologic zones and subzones, which were used to characterize well types in the management area. The Well Impact Study used well completion report data from the Department's public database, however, the NKWSD management area plan recognized a data gap in obtaining domestic well information. The GSA intends to address this data gap with the Domestic Well Survey management action, which is expected to be completed in the 2025 Plan update. The NKWSD management area plan states that the results of the Well Impact Study show the median minimum threshold is approximately 542 feet below ground surface, median well depth is 656

[53] KGA GSP Kern-Tulare Water District MAP, Section 3.5.1, pp. 74-76.

feet below ground surface, and the median value for the base of fresh water is 2,200 feet below ground surface.[54] The NKWSD management area plan states that minimum thresholds and measurable objectives were established at levels that had minor potential impacts on domestic wells and were protective of municipal wells. The NKWSD management area plan states that minimum thresholds are consistent with the requirement to be based on a groundwater elevation indicating a significant and unreasonable depletion of supply at a given location and set at depths that are sufficiently protective of beneficial uses and users and groundwater supply. The NKWSD management area plan included a draft Domestic Well Mitigation Plan, planned to be finalized and adopted by the end of 2022, which intends to designate measures to mitigate adverse impacts to domestic wells resulting from GSP implementation.[55]

Kern County Water Agency Pioneer GSA Management Area

Corrective Action

The KGA GSP must explain the selection of groundwater level minimum thresholds for the Pioneer management area, including how they represent site-specific levels of depletion that could cause undesirable results, how they may affect the interests of beneficial uses and users of groundwater, and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels.

GSA Response to Corrective Action

The Pioneer management area plan states that sustainable management criteria were established to provide operational flexibility and maintain long-term sustainability for beneficial uses and users. The management area plan also states that participants of the Pioneer Project, the sole beneficial users of groundwater in the management area, were consulted during sustainable management criteria development to determine what minimum thresholds were appropriate for groundwater elevations and storage to trigger an undesirable result as it related to the Pioneer Project's banking operations. The management area plan states that potential impacts of undesirable results on the beneficial uses and uses are increased operation costs. The management area plan also states that coordination efforts took place with neighboring GSA's during the establishment of sustainable management criteria to ensure that neighboring beneficial uses and users were protected and that minimum thresholds were consistent with minimum thresholds in adjacent management areas. The management area plan provides an analysis on the relationship between historical groundwater quality, land subsidence, and groundwater elevation data. For the water quality sustainability indicator, the analysis correlated historical groundwater elevation to arsenic, nitrate, and specific conductance data in four of the five monitoring locations through linear

[54] KGA GSP North Kern Water Storage District/Shafter-Wasco Irrigation District Revised MAP, Section 3.5.1, pp. 240-241.
[55] KGA GSP North Kern Water Storage District/Shafter-Wasco Irrigation District Revised MAP, Appendix N, pp. 922-928.

regression. The results of the analysis concluded that none of the constituents of concern, with the exception of arsenic at one monitoring location, would exceed minimum thresholds using the proposed chronic lowering of groundwater sustainable management criteria.[56] The management area plan states that land subsidence is anticipated to be influenced by groundwater level sustainable management criteria and that the minimum thresholds established for groundwater levels were set at elevations to mitigate potential inelastic subsidence.[57] The management area plan does not provide any additional information or analysis on the relationship between groundwater levels and inelastic subsidence used to make this determination.

Rosedale Rio Bravo Management Area

Corrective Action

The KGA GSP must provide clarification regarding why minimum threshold exceedances are allowed to occur in one of the North, Central, or South of the River zones for this management area (i.e., why it takes two of those zones to exceed their threshold before the management area plan considers an undesirable result to have occurred). Describe any projects or management actions that may be implemented if the minimum threshold is exceeded in one of those areas and users are impacted but an undesirable result is not triggered.

GSA Response to Corrective Action

The Rosedale-Rio Bravo Management Area (RRBMA) management area plan states that all monitoring areas (North, Central, South of River) will be included in one single management area and the entire management area will be subject to the Subbasin-wide undesirable result trigger. The RRBMA GSA conducted a Well Impact Analysis to evaluate wells that would be impacted at varying minimum thresholds. The minimum thresholds in the RRBMA plan were updated from 75 feet to 50 feet below the lowest groundwater elevation from the latest drought.[58] The RRBMA plan states that monitoring locations which exceed chronic lowering of groundwater levels minimum thresholds will be subject to the protocols of existing mitigation requirements or proposed adaptive management actions. The existing mitigation requirements are conducted through the Joint or Long-Term Operations Plan, including investigation of claims and pump lowering, well replacement, or reduction or adjustment of banking project recovery activities.[59] The proposed adaptive management action discussed in the RRBMA plan is intended to avoid undesirable results as a result of the chronic lowering of groundwater levels. This management action includes identifying the minimum threshold exceedance, investigation of the monitoring location area, evaluate contributing factors outside the management area, considerations towards developing new or modifying existing management actions and/or projects, and considerations

[56] KGA GSP Pioneer Revised MAP, Section 7.6.3, p. 143, Table 7-2, p. 143.
[57] KGA GSP Pioneer Revised MAP, Section 7.7.3, p. 144.
[58] KGA GSP Rosedale-Rio Bravo Water Storage District Revised MAP, Section 5.1, pp. 96-97.
[59] KGA GSP Rosedale-Rio Bravo Water Storage District Revised MAP, Section 1.4.4.4, p. 28.

towards developing and/or implementing policies and programs to mitigate or eliminate the exceedance.[60]

Semitropic Water Storage District Management Area

Corrective Actions

- The KGA GSP must explain the selection of groundwater level minimum thresholds for the Semitropic Water Storage District management area, including how they represent site-specific levels of depletion that could cause undesirable results and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels. If minimum thresholds were not set consistent with levels indicating a depletion of supply, the minimum thresholds should be revised accordingly.
- Reconcile Figure 3-1 and Table 3-1 to utilize the same well naming convention so that Department staff and other interested parties may correlate the two.
- Verify how the subset of wells used in the well impact analysis is representative of the wells in the management area. Provide an explanation of the mitigation plan for domestic wells.

GSA Response to Corrective Actions

The Semitropic Water Storage District (SWSD) GSA performed a Well Impact Analysis to evaluate impacts of declining groundwater elevations on beneficial uses and users. The Well Impact Analysis used well completion report data from the Department and Kern County Environmental Health Department to estimate the percentage of beneficial use wells that would be impacted by proposed sustainable management criteria. The wells used in the analysis were selected based on those that contained complete construction data. The proposed sustainable management criteria were selected based on groundwater levels that were able to support access to groundwater while considering costs those beneficial uses and users were able to self-mitigate. The results of the Well Impact Analysis, based on worst case drought scenarios, concluded that 25%, 37%, and 23% of domestic and small community wells would be dewatered by the proposed minimum thresholds in Management Areas 1, 2, and 3, respectively. The analysis also concluded that 15% of domestic and small community wells would be dewatered by the proposed measurable objectives in Management Areas 2 and 3.[61] The SWSD management area plan states that the sustainable management criteria utilized in the Well Impact Analysis were discussed with SWSD GSA stakeholders and landowners and ultimately accepted and adopted by the GSA.[62] The SWSD management area plan explains the relationship between the chronic lowering of groundwater levels and degraded water quality sustainability indicators are negligible as water quality is not significantly affected by groundwater elevations above the

[60] KGA GSP Rosedale-Rio Bravo Water Storage District Revised MAP, Section 7.5.2, pp. 121-122.
[61] KGA GSP Semitropic Water Storage District Revised MAP, Tables 3-3, 3-4, 3-5, pp. 238-239.
[62] KGA GSP Semitropic Water Storage District Revised MAP, Section 3.5.1, p. 232.

minimum threshold.[63] The SWSD management area plan states that groundwater elevation changes and sodium concentrations in the lower zone aquifer west of the spreading ground show a direct correlation. However, groundwater elevation changes and sodium concentrations in the upper zone aquifer and the lower zone aquifer south of the spreading ground show an inverse correlation.[64] The SWSD management area plan states that as groundwater elevations decrease in the lower aquifer zone, arsenic concentrations tend to decrease as well. Conversely, as groundwater elevations increase in the upper aquifer zone, arsenic concentrations increase.[65] The SWSD management area plan does not include an analysis of the relationship between groundwater elevations and the other identified constituents of concern, nitrate and 1,2,3-Trichloropropane. The SWSD management area plan acknowledges that inelastic subsidence can occur from aquifer compact by overdraft caused by groundwater extraction;[66] however, the SWSD management area plan does not provide an analysis of the relationship between the chronic lowering of groundwater levels and land subsidence sustainability indicators.

The SWSD management area plan revised the original Figure 3-1 and Table 3-1 so that well numbers were able to be correlated. The SWSD management area plan included a Domestic Well Mitigation Program, funded by a Tiered Pricing Structure, which intends to designate measures to mitigate adverse impacts to domestic wells resulting from GSP implementation. The mitigation program consists of providing a short-term emergency water supply, providing funds to lower existing well pumps, providing funds to complete a connection to a water provider, supply water from an alternative source, provide funds to mitigate the impact of the affected well with a deeper domestic well, reduce or adjust groundwater storage recovery pumping to prevent the impact, and other mitigation measures not fully discussed in the SWSD management area plan.[67]

Shafter-Wasco Irrigation District (7th Standard Rd.) Management Area

Corrective Action

The KGA GSP must explain the selection of groundwater level minimum thresholds for the Shafter-Wasco Irrigation District management area, including how they represent site-specific levels of depletion that could cause undesirable results and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels. If minimum thresholds were not set consistent with levels indicating a depletion of supply, the minimum thresholds should be revised accordingly.

[63] KGA GSP Semitropic Water Storage District Revised MAP, Section 3.5.1.1, p. 233.
[64] KGA GSP Semitropic Water Storage District Revised MAP, Figures 2-34, 2-36, 2-37, pp. 160-161.
[65] KGA GSP Semitropic Water Storage District Revised MAP, Figures 2-39 and 2-40, pp. 167-168.
[66] KGA GSP Semitropic Water Storage District Revised MAP, Section 2.3.6, pp. 171-172.
[67] KGA GSP Semitropic Water Storage District Revised MAP, Section 5.2.6, p. 325.

GSA Response to Corrective Action

The Shafter-Wasco Irrigation District 7th Standard Annex (SWID) amended management area plan states that the minimum thresholds for the chronic lowering of groundwater levels indicator were raised by 50 feet based on coordination efforts with neighboring management areas.[68] Minimum thresholds were established utilizing historical water level data from select monitoring locations, well construction information, and coordination with and consideration of adjacent GSAs, basins, and other sustainability indicators.[69] Monitoring locations were selected by those that contained long-term historical records, ranging from 1968 to 2018. The SWID management area plan states that minimum thresholds were established using a trendline analysis assuming that groundwater elevations that occurred during periods of overdraft (2006 – 2016) would continue over the 20-year GSP implementation horizon ending in 2040. The trendline analysis estimated that the lowest groundwater elevation in the management area by 2040 would be -137 feet above mean sea level. The SWID management area plan established the minimum threshold in this area at 50 feet above this projected groundwater elevation, ultimately setting the minimum threshold at -87 feet above mean sea level for all monitoring locations.[70] The SWID management area plan states that minimum thresholds for groundwater levels were established to avoid depletion of supply that would lead to undesirable results as they were set above projected low groundwater elevations based on historical groundwater trends in the management area. The SWID management area plan states that the chronic lowering of groundwater sustainability indicator is directly related to the reduction of groundwater storage and is used as a proxy for this indicator. However, the SWID management area plan does not believe that the chronic of lowering of groundwater indicator is correlated to degraded water or land subsidence in the management area based on the best available data.[71] The SWID states that due to limited data on constituent of concern concentrations statistically significant trends related to groundwater elevation changes were unable to be established.[72]

Southern San Joaquin Municipal Utility District Management Area

Corrective Actions

- The KGA GSP must explain the selection of groundwater level minimum thresholds for the Southern San Joaquin Municipal Utilities District management area, including how they represent site-specific levels of depletion that could cause undesirable results, how they may affect the interests of beneficial uses and users of groundwater, and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels. If minimum thresholds were not set consistent with levels

[68] KGA GSP Shafter-Wasco Irrigation District (7th Standard Rd.) Revised MAP, Section 13.1, p. 176.
[69] KGA GSP Shafter-Wasco Irrigation District (7th Standard Rd.) Revised MAP, Section 13.1, p. 175.
[70] KGA GSP Shafter-Wasco Irrigation District (7th Standard Rd.) Revised MAP, Table SMC-5, p. 176.
[71] KGA GSP Shafter-Wasco Irrigation District (7th Standard Rd.) Revised MAP, Section 13.1.1, p. 176.
[72] KGA GSP Shafter-Wasco Irrigation District (7th Standard Rd.) Revised MAP, Section 7.4.1, p. 90.

indicating a depletion of supply, the minimum thresholds should be revised accordingly.

- Verify how the subset of wells used in the well impact analysis is representative of the wells in the management area. Provide an explanation of the mitigation plan for domestic wells.

GSA Response to Corrective Actions

The Southern San Joaquin Municipal Utility District (SSJMUD) amended management area plan states that a Well Impact Analysis was completed to determine minimum thresholds for chronic lowering of groundwater levels and to determine if site-specific levels of depletions that could eventually lead to undesirable results. The Well Impact Analysis used well completion report data provided by the Department and proposed sustainable management criteria based on what groundwater elevations were appropriate for reasonable access and recovery. The SSJMUD management area plan states that the Well Impact Analysis was also performed to better understand the amount and type of wells in the management area. The analysis identified 19 municipal wells, 67 domestic and small community wells, and 243 agricultural and industrial wells. The SSJMUD management area plan concluded that 43% of domestic and small communities and 10% agricultural and industrial users would be impacted by the minimum thresholds. Also, 19% of domestic and small community wells and 5% of agricultural and industrial wells would be impacted by the measurable objectives.[73] The SSJMUD management area plan states that the results of the Well Impact Analysis concluded that minimum thresholds were set at depths that are protective of groundwater supply. The SSJMUD management area plan bases this statement on the fact that the GSA has elected to maintain approximately 10-years of groundwater supply above the groundwater level minimum threshold as method of managing a 10-year operational drought.

The SSJMUD management area plan explains that the chronic lowering of groundwater levels sustainability indicator is a proxy for the reduction of groundwater storage and degraded water quality indicators. The SSJMUD explains that the relationship between these sustainability indicators is based on the inverse relationship of constituents of concern and groundwater elevation changes, such as 1,2,3-Trichloropropane[74] and nitrate.[75] Arsenic concentrations, conversely, were observed to decline with decreasing groundwater elevations.[76] The SSJMUD management area plan did not provide an analysis discussing the correlation between groundwater elevations and sodium and chloride concentrations. The SSJMUD management area plan concludes that water quality in the SSJMUD management area is not significantly affected by groundwater elevation fluctuations above the minimum thresholds. The SSJMUD management area plan does not consider the impacts of the chronic lowering of groundwater elevations

[73] KGA GSP Southern San Joaquin Municipal Utility District Revised MAP, Table 3-2, p. 201.
[74] KGA GSP Southern San Joaquin Municipal Utility District Revised MAP, Figures 2-25 and 2-26, pp. 115-116.
[75] KGA GSP Southern San Joaquin Municipal Utility District Revised MAP, Figure 2-29, 2-30, 2-31, pp. 124-125.
[76] KGA GSP Southern San Joaquin Municipal Utility District Revised MAP, Figure 2-27, p. 118.

to the land subsidence sustainability indicator, but it does acknowledge that groundwater elevation decline will continue to cause land subsidence in the management area.[77]

The SSJMUD management area plan included a draft Domestic Well Mitigation Program, planned to be finalized and adopted by the end of 2022, which intends to designate measures to mitigate adverse impacts to domestic wells resulting from GSP implementation. The program includes a well vulnerability and impact analysis, domestic well monitoring, adaptive triggers and actions, and additional actions.[78] The management actions described in the program include notifications to well owners, GSA inspections, short-term water supply, and funding for increasing well depth to groundwater levels needed to avoid impacts. These actions are dependent on triggers such as groundwater elevations reaching measurable objectives, approaching minimum thresholds, landowner claims that wells are impacted, and if impacted wells meet criteria for mitigation.[79]

West Kern Water District Management Area

Corrective Actions

- The KGA GSP must provide sustainable management criteria for all identified management areas.
- The minimum thresholds must include a description of the selection of groundwater level minimum thresholds, including how they represent site-specific levels of significant and unreasonable depletion of supply that could cause undesirable results, how they may affect the interests of beneficial uses and users of groundwater, and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels.

GSA Response to Corrective Actions

The West Kern Water District (WKWD) management area plan states that the management area plan was revised to characterize the following areas to match the Subbasin-wide definition: North Project Management Area, South Project Management Area, Lake Watch Area, Western Watch Area, and Little Santa Maria Valley Watch Area. The WKWD management area plan states that sustainable management criteria were previously established for the two management areas in the 2020 management area plan submittal and that sustainable management criteria were not developed for the three watch areas as there is no significant ongoing or future use of groundwater.[80]

[77] KGA GSP Southern San Joaquin Municipal Utility District Revised MAP, Section 3.5.2.5, p. 214.
[78] KGA GSP Southern San Joaquin Municipal Utility District Revised MAP, Appendix L, pp. 552-556.
[79] KGA GSP Southern San Joaquin Municipal Utility District Revised MAP, Appendix L, Table 1, p. 556.
[80] KGA GSP West Kern Water District Revised MAP, Section 7.3, pp. 180-181.

The WKWD management area plan determined that the minimum threshold trigger for groundwater levels would signify an undesirable result which would impact the management area's sole beneficial user, WKWD. According to the WKWD management area plan, the WKWD GSA was consulted during the GSP development process to ensure that sustainable management criteria accurately represented the quantitative and qualitative conditions required by SGMA. WKWD GSA coordinated with neighboring GSAs to ensure that the management area's minimum thresholds and measurable objectives would not negatively impact the adjacent management area's beneficial uses and users. A water level trend analysis was conducted by WKWD to ensure that minimum thresholds within the management area were consistent with those of adjacent management areas. The water level trend analysis for minimum thresholds was conducted by determining the maximum and minimum historical groundwater elevations for each monitoring location. Once historical groundwater elevations were established, the difference between the maximum and minimum was calculated and then 20% of the calculated difference from each well was subtracted from that monitoring location's historically low groundwater elevation. The resulting value was then used as that monitoring locations minimum threshold. Measurable objectives established by calculating a water level where groundwater elevations were above the minimum thresholds during three years of drought usage and/or storage decline.[81]

Minimum thresholds and measurable objectives were calculated in the same manner for both the North and South Project Management Areas. The WKWD management area plan provides an analysis on the relationship between historical groundwater quality and groundwater elevation minimum thresholds. The analysis consisted of performing a linear regression between constituent of concern concentration data to minimum thresholds in representative monitoring locations. The WKWD management area plan provides the results of the analysis for one monitoring location, where no groundwater quality thresholds would be exceeded at the minimum threshold for groundwater levels.[82] The WKWD management area plan acknowledges that land subsidence may be a result of groundwater extraction, however it does not provide an analysis on the relationship with the chronic lowering of groundwater sustainability indicator.[83]

Westside District Authority Management Area

Corrective Actions

- The KGA GSP must explain the selection of groundwater level minimum thresholds for the Westside management area, including how they represent site-specific levels of depletion that could cause undesirable results, how they may affect the interests of beneficial uses and users of groundwater, and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels. If minimum

[81] KGA GSP West Kern Water District Revised MAP, Section 7.4.1, pp. 182-183.
[82] KGA GSP West Kern Water District Revised MAP, Table 7-3, p. 189.
[83] KGA GSP West Kern Water District Revised MAP, Section 7.8.3, p. 191.

thresholds were not set consistent with levels indicating a depletion of supply, the minimum thresholds should be revised accordingly.
- The larger portion of the management area must establish sustainable management criteria, including the establishment of minimum thresholds and monitoring; otherwise, further evaluation and justification is needed to negate management criteria in this portion of the management area.

GSA Response to Corrective Actions

The Westside District Water Authority (WDWA) management area plan states that there is no significant use of groundwater within the management area that would be subject to SGMA. The WDWA management area plan also states that changes in groundwater levels and storage are attributed to underflow beneath WDWA and that the GSA has no control over this phenomenon.[84] The WDWA management area plan states that definitions of watch areas, including Lost Hills Watch Area and Southwest Watch Area have been revised to match Subbasin-wide definitions. The WDWA management area plan has included KGA Undistricted Lands as a watch area within WDWA. The WDWA management area plan states that two additional monitoring locations were added to the monitoring network, with one additional monitoring location under consideration. The minimum thresholds for the added wells are considered preliminary and were established based on historic groundwater elevations within the management area.[85] The management area plan states that through hydrogeologic modeling efforts, the proposed sustainable management criteria would not negatively impact beneficial uses and users nor lead to an undesirable result. Additional information on the establishment of sustainable management criteria or their impacts on beneficial uses and users was not provided. The management area plan acknowledges that inelastic subsidence is occurring within the management area, but data gaps exist to fully understand the cause of the subsidence.[86]

KERN RIVER GSP

KRGSA Agricultural Management Area

Corrective Action

The Kern River GSP must provide clarification regarding the management action mentioned in the sustainable management criteria section of the GSP related to identification of well users, including domestic users and small water systems, in the agricultural subareas of the Agricultural Management Area.

GSP Response to Corrective Action

As a response to the Department's Corrective Action, the Kern River GSP now includes a standalone management action, which extends across the entire Plan Area, that was developed to avoid widespread impacts to domestic and small water systems wells. The GSP states that the evaluation of the management action has allowed the GSA to

[84] KGA GSP Westside District Water Authority Revised MAP, Section 4.2.1, p. 146.
[85] KGA GSP Westside District Water Authority Revised MAP, Section 4.1.1, p. 143.
[86] KGA GSP Westside District Water Authority Revised MAP, Section 4.1.2, pp. 144-145.

update domestic well numbers and depths. The Kern River GSA has developed a more comprehensive dataset of active domestic wells, which was used to conduct a recent Well Impact Analysis.[87]

BUENA VISTA GSP

Maples Management Area

Corrective Action

The Buena Vista GSP must be revised to include sustainable management criteria, including groundwater level minimum thresholds, for the Maples Management Area. Reference the specific methodologies from the Kern River GSP (of which there are several, depending on nearby beneficial uses and users, as noted herein) that guide development of the Maples Management Area's criteria and describe how those criteria are consistent with the requirements of the GSP Regulations. Department staff recommend providing similar detail regarding the hydrogeologic and beneficial user considerations as were provided for the Buttonwillow Management Area sustainable management criteria development.

GSP Response to Corrective Action

The Maples Management Area (MMA) in the Buena Vista Water Storage District did not contain applicable sustainable management criteria in the 2020 GSP submittal. The amended GSP states that minimum thresholds in the MMA were established using historically low groundwater elevations observed in the management area. Minimum thresholds were set at elevations ranging from 20 to 50 feet below historical lows to adjust to Kern River GSA minimum thresholds within the same groundwater elevations.[88] Measurable objectives were established using a similar method as the minimum thresholds; however, the measurable objectives were set at groundwater elevations ranging from 40 to 118 below historical high groundwater elevations. The GSP states that measurable objectives were established at groundwater elevations similar to those in the adjacent Kern River GSA area.[89] The GSP does not include additional information validating the establishment of the sustainable management criteria or how these may impact beneficial uses and users.

The GSP states that chronic lowering of groundwater sustainable management criteria will be used as a proxy for the reduction of groundwater storage.[90] Groundwater elevations were used as a proxy for the degraded water quality sustainability indicator, however the groundwater elevations differed from the chronic lowering of groundwater sustainable management criteria. The minimum thresholds for degraded water quality were established at 50 feet below the historic low groundwater elevation. Measurable objectives were established based on the average high groundwater elevation, minimum threshold, and four benchmark Kern River GSA monitoring wells. The methodology for establishing the MMA water quality measurable objectives is not

[87] Kern River Amended GSP, Section 5.4.4.2, pp. 311-314.
[88] Buena Vista Amended GSP, Section 5.9.1, pp. 193-194.
[89] Buena Vista Amended GSP, Section 5.9.2, pp. 195-196.
[90] Buena Vista Amended GSP, Section 5.10, pp. 197-199.

discussed in the Plan. The GSP states that available water quality data is insufficient to establish baseline minimum thresholds based on constituent of concern concentrations.[91] The GSP states that sustainable management criteria for land subsidence are based historical groundwater elevations. Minimum thresholds were set at 20 feet below the historical low groundwater level at the monitoring location.[92] Measurable objectives for land subsidence were established using the average historical high groundwater elevation, the minimum threshold, and four benchmark Kern River GSA monitoring wells.[93] Similar to the degraded water quality sustainability indicator, the GSP does not provide a full analysis of how sustainable management criteria were established or their impacts to beneficial uses and users.

HENRY MILLER GSP

Corrective Action

The Henry Miller GSP must provide a sufficient description of the selection of groundwater level minimum thresholds, including how they represent site-specific levels of significant and unreasonable depletion of supply that could cause undesirable results, how they may affect the interests of beneficial uses and users of groundwater, and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels.

GSP Response to Corrective Action

The HMWD GSP states that groundwater level minimum thresholds are based on historical groundwater levels, the potential for future decline, and well construction information. The GSP states that a minimum threshold has been exceeded when a static depth to groundwater of 350 feet is exceeded in 40% or more of monitoring locations over four consecutive bi-annual monitoring events. The GSP states that the minimum thresholds will not adversely affect beneficial uses and users as a subset of monitoring locations will have pump settings that prevent groundwater extraction and will only temporarily prevent access to groundwater. The GSP further explains that these monitoring locations have well screens that extend much deeper into the aquifer and the pumps would be lowered for affected monitoring sites and access would be reestablished. Additionally, the GSP does not consider the operational cost of lowering pumps to 350 feet below ground surface to be a burden economically and not considered an undesirable result by agricultural beneficial users.[94]

SOUTH OF KERN RIVER GSP

Arvin-Edison Water Storage District Management Area

Corrective Action (Previously Identified in the KGA GSP)

[91] Buena Vista Amended GSP, Section 5.11, pp. 199-201.
[92] Buena Vista Amended GSP, Table 5-32, p. 203.
[93] Buena Vista Amended GSP, Table 5-33, p. 203.
[94] Henry Miller Amended GSP, Section 3.3.1, p. 155.

As the Arvin-Edison management area plan appears to rely, at least to some extent, on the Impacted Well Mitigation Program to justify its minimum thresholds, which allow for continued lowering of groundwater levels in some areas, the KGA GSP must provide specific details, including timeline for implementation, of the program. Describe the scope of the program and how users impacted by continued groundwater level decline, particularly early in implementation of the Plan, will be addressed.

GSP Response to Corrective Action

The South of Kern River (SOKR) GSA includes three management areas, Arvin-Edison, Wheeler Ridge-Maricopa, and Tejon-Castac, that were previously members of the KGA GSP. The SOKR GSP provided responses to the Corrective Actions directed towards its management areas. The GSP identified beneficial uses and users for each sustainability indicator, how each sustainability indicator impacts the other, potential impacts of sustainable management criteria to neighboring basins and management areas and expanded the discussion of data and methodologies used to conduct the Well Impact Analysis. The GSP also developed multiple approaches related to the degraded water quality sustainability indicator, including an approach to developing Local Management Area Exceedance Criteria in accordance with the Water Code,[95] additional justification for screening constituents of concern, and establishing sustainable management criteria for arsenic at two monitoring locations in the Arvin-Edison management area.[96]

Tejon-Castac Water District Management Area

Corrective Action (Previously Identified in the KGA GSP)

The KGA GSP must explain the selection of groundwater level minimum thresholds for the Tejon-Castac management area, including how they represent site-specific levels of depletion that could cause undesirable results, how they may affect the interests of beneficial uses and users of groundwater, and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels. If minimum thresholds were not set consistent with levels indicating a depletion of supply, the minimum thresholds should be revised accordingly.

GSP Response to Corrective Action

The GSP states that minimum thresholds for the chronic lowering of groundwater in the Tejon-Castac management area were set at the average historical low groundwater elevation for wells within the Arvin-Edison management area nearest the respective Tejon-Castac monitoring location. The Plan concludes that the relationship between these two management areas justifies both areas avoiding an undesirable result.[97]

Wheeler Ridge-Maricopa Water Storage District Management Area

[95] South of Kern River GSP, Section 14.4.1, p. 443.
[96] South of Kern River GSP, Section 14.4.2, pp. 443-447.
[97] South of Kern River GSP, Section 14.1.1, pp. 430-439.

Corrective Action (Previously Identified in the KGA GSP)
As the KGA GSP Wheeler Ridge-Maricopa management area appears to rely, at least to some extent, on the Impacted Well Mitigation Program to justify its minimum thresholds, which allow for continued lowering of groundwater levels in some areas, provide specific details, including timeline for implementation, of the program. Describe the scope of the program and how users impacted by continued groundwater level decline, particularly early in implementation of the Plan, will be addressed.

GSP Response to Corrective Actions
The South of Kern River (SOKR) GSA includes three management areas, Arvin-Edison, Wheeler Ridge-Maricopa, and Tejon-Castac, that were previously members of the Kern Groundwater Authority GSA. The SOKR GSP provided responses to the Corrective Actions directed towards its management areas. The GSP identified beneficial uses and users for each sustainability indicator, how each sustainability indicator impacts the other, potential impacts of sustainable management criteria to neighboring basins and management areas and expanded the discussion of data and methodologies used to conduct the Well Impact Analysis. The GSP also developed multiple approaches related to the degraded water quality sustainability indicator, including an approach to developing Local Management Area Exceedance Criteria in accordance with the Water Code[98], additional justification for screening constituents of concern, and establishing sustainable management criteria for arsenic at nine monitoring locations in the Wheeler Ridge-Maricopa management area.[99] The GSP also provides details related to the proposed Well Mitigation Program, which aims to address negative impacts related to groundwater level decline.

ALL GSPs

Corrective Action
All the GSPs must demonstrate the relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the GSA has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.

GSP Response to Corrective Action
As discussed in detail in Deficiency 1, the Plan does not adequately describe the basin conditions at each minimum threshold that would lead to or help avoid undesirable results in the Subbasin.

[98] South of Kern River GSP, Section 14.4.1, p. 443.
[99] South of Kern River GSP, Section 14.4.2, pp. 443-447.

4.2.2 Evaluation

The Department reviewed the GSA's responses to the Incomplete Determination in each revised GSP (including management area plans). Department staff believe the individual management areas made progress toward addressing the specific management area corrective actions and are encouraged by the Plan's analysis of potential impacts to the various water supply wells throughout the Subbasin. Department staff recognize that nearly every GSP has provided some level of assessment of potential well impacts and some GSPs, such as the KGA GSP and the Kern River GSP, provide discussion related to projects and management actions that can be implemented to help offset impacts to drinking water users (i.e., KGA member agencies agreed to develop a well mitigation strategy if it's predicted that more that 5% of wells within their management area may be dewatered; the Kern River GSA has proposed developing allocation schemes and reducing agricultural pumping and municipal pumping via conjunctive use efforts). After reviewing the revised GSPs, however, Department staff still believe the approaches used for developing chronic lowering of groundwater levels minimum thresholds and the level of analysis to support those approaches, is disparate across the various plans.

Based on the Department's evaluation, although progress was made on the individual management area scale it is still unclear how the various approaches to developing sustainable management criteria help achieve the sustainability goals for the Subbasin. The following has been determined to still be lacking with respect to Deficiency 2:

- The Plans still use various data and methods to establish the sustainable management criteria which generally do not incorporate the analysis and results of the Todd Groundwater Technical Memorandum.
- The Plan's discussion related to why the various minimum thresholds reflect different groundwater conditions across the Subbasin and between adjacent management areas is still incomplete. These discussions should include how other sustainability indicators may be affected by the various minimum thresholds within the specific management areas but also in adjacent management areas.

As discussed in the evaluation of Deficiency 1 above, Department staff believe the various approaches, data, and methodologies used to establish minimum thresholds across the management areas complicates understanding the groundwater conditions the Subbasin identifies as significant and unreasonable and would lead to a Subbasin-wide undesirable result. For example, some of the management areas in the northern portion of the Subbasin still project recent historic conditions (i.e., 2006 to 2016 conditions) to 2040 and establish the minimum threshold at that projected value which in some cases is over 200 feet below historical lows.[100] In contrast, some management areas in the southern portion of the Subbasin utilize a formula approach to establish the minimum thresholds that incorporates the historical low groundwater levels, a "variability correction factor", and a

[100] KGA GSP Semitropic Water Storage District Revised MAP, Section 3.5, pp. 232-240; KGA GSP North Kern Water Storage District/Shafter-Wasco Irrigation District Revised MAP, Section 3.5, pp. 235-258.

"trend continuation factor."[101] The minimum thresholds in these southern management areas are still below historical lows but within approximately 100 feet of the lowest observed water level. It remains unclear to Department staff why the management areas have employed such different approaches to establishing sustainable management criteria that results in a disparate level of continued groundwater declines beyond historical lows. Additionally, none of the methods to establish sustainable management criteria described in the management area plans incorporate or discuss the results of the Todd Groundwater Technical Memorandum, which as discussed in length above, establishes estimates of overdraft and sustainable yield. It should also be noted that the Todd Groundwater Technical Memorandum also does not incorporate the analyses or final minimum threshold values into the evaluation of change in storage or future projected conditions – with the exception of superimposing sustainable management criteria values on simulated hydrographs.

Because of the various methods employed that result in continued groundwater declines at different magnitudes across the management areas, Department staff are still unable to fully evaluate the potential effects conditions in one management area may have on adjacent management areas. Department staff understand that some management areas have consulted neighboring management areas and adjusted minimum thresholds in representative monitoring sites; however, given the Management Area Exceedance criteria, it is conceivable that multiple management areas could operate at or near the minimum thresholds without resulting in a Management Area Exceedance. And because the definition of a Management Area Exceedance does not include a description of the significant and unreasonable groundwater conditions that would be occurring in the management areas at the 40% of minimum threshold exceedances over a four consecutive biannual measurement timeframe, it is unclear how one management area's operations may affect another or how a collection of management areas may affect a particular region of the Subbasin, especially as it relates to effects on the other sustainability indicators.

4.3 Deficiency 3 – The Subbasin's land subsidence sustainable management criteria do not satisfy the requirements of SGMA and the GSP Regulations.

4.3.1 Corrective Action 3

As described in the Department's GSP Assessment Staff Report released in January 2022, Department staff recommended the GSAs consider and address the following:

> The Subbasin's GSAs should coordinate and collectively satisfy the requirements of SGMA and the GSP Regulations to develop the sustainable management criteria for land subsidence. The GSPs should document the conditions for undesirable results for which the GSAs are trying to avoid, supported by their

[101] South of Kern River GSP, Section 14.1, pp. 430-439.

understanding of land uses and critical infrastructure in the Subbasin and the amount of subsidence that would substantially interfere with those uses.[102] The revised Plan, and component GSPs and management areas, should identify the rate and extent of subsidence corresponding with substantial interference that will serve as the minimum threshold, or should thoroughly demonstrate that another metric can serve as a proxy for that rate and extent. [103] As described in Deficiency 1, the Coordination Agreement should be revised to clearly identify the undesirable result parameters for each of the GSPs, management areas, and management area plans so it is clear how the various plans work together at the Subbasin level.

The revised Plan should explain how implementing projects and management actions proposed in the various GSPs is consistent with avoiding subsidence minimum thresholds, sufficient to avoid substantial interference, similar to the original Plan's assessment of whether implementation would avoid undesirable results for groundwater levels.

If land subsidence is not applicable to parts of the Subbasin, the GSPs must provide supported justification of such. The supporting information must be sufficiently detailed and the analyses sufficiently thorough and reasonable based on the best available information and best available science.

4.3.2 Subbasin's Response to Deficiency 3

In response to Deficiency 3, the Subbasin's GSAs submitted a revised Plan including updated content related to subsidence in its amended Coordination Agreement and the various GSPs and management area plans.

As part of its "Basin-wide Coordinated GSP Subsidence Plan", the amended Coordination Agreement establishes new Subbasin-wide definitions for "Regional Critical Infrastructure" and "Management Area Critical Infrastructure" as part of the Subbasin-wide response to subsidence.[104] Most of the GSPs and management area plans were updated to also include these new definitions.

Regional Critical Infrastructure is defined as "infrastructure located within the Subbasin that serves multiple areas of the Subbasin and whose loss of significant functionality due to inelastic subsidence, if caused by SGMA related Subbasin groundwater extractions, would have significant impacts to beneficial users."[105] The Regional Critical Infrastructure within the Subbasin were then collectively identified as the California Aqueduct and the Friant-Kern Canal. The amended Coordination Agreement also provided definitions for interim sustainable management criteria for subsidence for both Regional Critical Infrastructure.

[102] 23 CCR § 354.26(b).
[103] 23 CCR § 354.28(c)(5).
[104] First Amended Kern County Subbasin Coordination Agreement, pp. 362 and 392.
[105] First Amended Kern County Subbasin Coordination Agreement, pp. 362 and 392.

The amended Coordination Agreement explains that the sustainable management criteria were established as interim criteria for subsidence due to Subbasin's GSAs' concerns about setting sustainable management criteria with "significant" data gaps.[106] The Plan intends to establish new sustainable management criteria in 2025 that will be informed by data from additional studies and subsidence modeling.[107] The interim minimum threshold is intended to be used until 2025, with several "caveats". These caveats include:

1) the sustainable management criteria would be valid until 2025 then updated in the 2025 GSP update;

2) the GSAs would not be required to manage or otherwise be liable for "impacts resulting from actions outside the authority of the GSA or outside the GSA's ability to manage sustainability under SGMA"; and

3) the GSAs would not be held responsible for addressing subsidence caused by activities outside the jurisdiction of SGMA.[108]

The KGA GSP, Buena Vista GSP, and Henry Miller GSP specify the activities outside the jurisdiction of SGMA as the "[p]ermanent loss of freeboard from land subsidence due to other causes including but not limited to oil or gas production, natural compaction of shallow underlying soils beneath or near the Aqueduct, or any other cause that is not within the jurisdiction of a GSA, shall not be considered as a loss of freeboard that contributes to the amount specified for any [measurable objective] or [minimum threshold]".[109]

The amended Coordination Agreement also includes two new white papers describing the process and methods for defining the interim sustainable management criteria for the California Aqueduct and Friant-Kern Canal. Both white papers reference two studies, conducted by Earth Consultants International[110] and Lawrence Berkeley National Laboratory,[111] that provided the Subbasin with baseline subsidence rates. The studies documented analyses using Differential Interferometric Synthetic Aperture Radar data (i.e., InSAR). The analysis considered a "long-time series" (ranging from 2015 to 2021)[112] to capture the "cyclical pumping and recharge [pattern] of underlying aquifers and… long-term effects such as drought conditions [in the Subbasin]".[113] They have expressed that the subsidence rates previously calculated by the National Aeronautics and Space Administration/Jet Propulsion Laboratory for "shorter time intervals" were overestimated by 45% to 50%.[114] The Subbasin used these studies and their results to develop a

[106] First Amended Kern County Subbasin Coordination Agreement, pp. 363 and 393.
[107] First Amended Kern County Subbasin Coordination Agreement, pp. 367, 396-397.
[108] First Amended Kern County Subbasin Coordination Agreement, pp. 363 and 393.
[109] KGA Amended GSP, Section 3.5.3.2, p. 301; Buena Vista Amended GSP, Section 5.7.11, p. 185; Henry Miller Amended GSP, Section 3.3.4, p. 156.
[110] First Amended Kern County Subbasin Coordination Agreement, pp. 417-520.
[111] First Amended Kern County Subbasin Coordination Agreement, pp. 399-415.
[112] First Amended Kern County Subbasin Coordination Agreement, pp. 400 and 429.
[113] First Amended Kern County Subbasin Coordination Agreement, p. 429.
[114] First Amended Kern County Subbasin Coordination Agreement, p. 429.

methodology for developing the Subbasin's interim minimum thresholds and measurable objectives.[115]

The amended Coordination Agreement defines Management Area Critical Infrastructure as "infrastructure located within a particular Subbasin Management Area whose loss of significant functionality due to inelastic subsidence if caused by SGMA related Subbasin groundwater extractions would have significant impacts to beneficial users within that Subbasin Management Area."[116] Identification of Management Area Critical Infrastructure was delegated to the individual GSPs and management area plans.

The revised GSPs and management area plans in which the California Aqueduct or Friant-Kern Canal runs through their jurisdictional boundaries updated their sustainable management criteria to be consistent with the amended Coordination Agreement.

4.3.2.1 Regional Critical Infrastructure: The California Aqueduct

The California Aqueduct White Paper defines an undesirable result for land subsidence along the California Aqueduct as "the point at which the amount of inelastic subsidence, if caused by SGMA-related Subbasin groundwater extractions, creates a significant and unreasonable impact (requiring either retrofitting or replacement to a point that is economically unfeasible to the beneficial users) to surface land uses or critical infrastructure. A significant loss in functionality that could be mitigated through retrofitting and is considered economically feasible to the beneficial users would not be considered undesirable."[117] An undesirable result will occur when a single minimum threshold is exceeded along the California Aqueduct.[118]

The interim minimum threshold for the California Aqueduct is defined as "[t]he avoidance of a permanent loss (associated with inelastic subsidence) of conveyance capacity as attributable to subsidence as limited by remaining concrete liner freeboard for a specific Aqueduct Pool that exceeds twice the average observed rate from 2016-2022."[119] The minimum threshold rate was established by calculating twice the average subsidence rate along the portion of the California Aqueduct that lies in the Subbasin from 2016-2022 (i.e., -0.05 feet per year) using the Department's California Aqueduct Subsidence Program (CASP) data.[120] This is equivalent to a land surface elevation change of -0.1 feet per year and cumulatively -1.8 feet by 2040.[121] The measurable objective rate is set at the 2016-2022 average, or -0.05 feet per year and cumulatively -0.9 feet by 2040. The Plan intends

[115] First Amended Kern County Subbasin Coordination Agreement, p. 367.
[116] First Amended Kern County Subbasin Coordination Agreement, pp. 362 and 392.
[117] First Amended Kern County Subbasin Coordination Agreement, pp. 363-364.
[118] First Amended Kern County Subbasin Coordination Agreement, p. 362.
[119] First Amended Kern County Subbasin Coordination Agreement, p. 367.
[120] First Amended Kern County Subbasin Coordination Agreement, p. 367. Note: The First Amended Kern County Subbasin Coordination Agreement provides the average observed rate of -0.05 feet per year "for all Pools of the Aqueduct within the Kern Subbasin" however, Table 2 contradicts this statement by establishing a different rate for Pools 33 through 35 of -0.07 feet per year.
[121] First Amended Kern County Subbasin Coordination Agreement, Table 2, p. 368.

to assess the minimum threshold and measurable objective as a respective average annual rate over a rolling 6-year period. [122]

The California Aqueduct is contained within the boundaries of the KGA GSP Westside District Water Authority Management Area, the KGA GSP West Kern Water District Management Area, Henry Miller Water District GSP, Buena Vista Water Storage District GSP, and the South of Kern River Wheeler Ridge Maricopa Water Storage District Management Area. These GSPs and management area plans were all updated to include the definition of Regional Critical Infrastructure and were updated to include or reference the amended Coordination Agreement Subbasin-wide sustainable management criteria for subsidence.

4.3.2.2 Regional Critical Infrastructure: The Friant-Kern Canal

In addition to the California Aqueduct white paper, the amended Coordination Agreement provided the Friant-Kern Canal White Paper for the Lower Reach of the Friant-Kern Canal, which is nearly entirely located in the Subbasin between its northern boundary and terminates at the Kern River. [123] The Friant-Kern Canal White Paper defines an undesirable result for land subsidence along the Friant Kern Canal as when "the flow capacity through the Lower Reach is reduced to capacities below historical operational flow capacities over the previous 10 years, impacting surface land uses of available water supplies, as a result of groundwater extractions from agricultural, domestic, municipal, or urban beneficial users within the Kern County Subbasin."[124]

The interim minimum threshold for the lower reach of the Friant Kern Canal is defined as a land surface elevation change of -0.2 feet per year and cumulatively -3.6 feet by 2040.[125] The interim minimum threshold values were established by using the average annual rate of subsidence along the Lower Reach of the Friant Kern Canal between 2016 to 2022.[126] The Plan intends to assess the minimum threshold as an average annual rate over a rolling 6-year period and monitor within a 2.5 mile corridor on either side of the Friant -Kern Canal.[127] The measurable objective is defined as a land surface elevation change of -0.1 feet per year and cumulative -1.8 feet by 2040.[128] As described previously, the amended Coordination Agreement states that new sustainable management criteria will be established for the Friant -Kern Canal in 2025.[129]

The Friant-Kern Canal is contained within the boundaries of the KGA GSP Southern San Joaquin Municipal Utilities District Management Area, KGA GSP North Kern Water Storage District Management Area, and the Kern River GSP. All these plans were

[122] First Amended Kern County Subbasin Coordination Agreement, p. 367.
[123] First Amended Kern County Subbasin Coordination Agreement, pp. 392-393.
[124] First Amended Kern County Subbasin Coordination Agreement, p. 395.
[125] First Amended Kern County Subbasin Coordination Agreement, p. 396.
[126] First Amended Kern County Subbasin Coordination Agreement, p. 396, Table 1, p. 397.
[127] First Amended Kern County Subbasin Coordination Agreement, pp. 396 and 398.
[128] First Amended Kern County Subbasin Coordination Agreement, p. 397.
[129] First Amended Kern County Subbasin Coordination Agreement, p. 396.

updated to define the Friant-Kern Canal as Regional Critical Infrastructure consistently with the amended Coordination Agreement.

4.3.2.3 *Plan Areas Outside of Regional Critical Infrastructure*

There are several management areas that do not contain Regional Critical Infrastructure but may still be within the boundaries of the respective monitoring corridors, extending 2.5 miles on each side of the California Aqueduct and Friant Kern Canal. These management areas are discussed below.

- The KGA GSP Kern Water Bank Management Area is located to the east of the California Aqueduct and may be within the monitoring corridor, corresponding to Pools 28 and 29.[130] The management area plan describes that the management area has experienced subsidence ranging from 0.16 feet to -0.36 feet from 2015-2018.[131] In terms of the California Aqueduct, mile post 238 is reported to have risen by 0.3 feet and subsided by 0.35 feet. Available freeboard for most of the area adjacent has not changed from as-built conditions.[132] The management area plan concludes that the changes are indicative of elastic rebound and recovery for Pools 28 and 29.[133]
- The KGA GSP Semitropic Water Storage District Management Area is located to the east of the California Aqueduct and may be within the monitoring corridor, corresponding to Pool 24.[134] The management area plan did not establish minimum thresholds for subsidence since the management area has not historically experienced impacts to local infrastructure[135] and the Semitropic Water Storage District GSA identifies the need for greater understanding of the causes of local and regional subsidence.[136] However, the management area plan does provide the Subbasin-wide minimum threshold definition for Regional Critical Infrastructure[137] but there is no discussion of adopting the Subbasin-wide minimum threshold nor is there a discussion on potential impacts to Pool 24.
- The Buena Vista GSP Buttonwillow Management Area border lies near the California Aqueduct, corresponding to Pool 24, Pool 25, and a portion of Pool 26.[138] Additionally, it may be within the monitoring corridor for Pools 27 and 28.[139] The Buena Vista GSP provides minimum thresholds for Pools 24 through 28 that differ from the amended Coordination Agreement's minimum thresholds, ranging

[130] First Amended Kern County Subbasin Coordination Agreement, p. 366.
[131] KGA GSP Kern Water Bank Revised MAP, Section 2.2.2.11 and Figure 16, pp. 33 and 34.
[132] KGA GSP Kern Water Bank Revised MAP, Section 2.2.2.11, p. 33.
[133] KGA GSP Kern Water Bank Revised MAP, Section 2.2.2.11 and Figure 17, pp. 33 and 35.
[134] First Amended Kern County Subbasin Coordination Agreement, p. 366.
[135] KGA GSP Semitropic Water Storage District Revised MAP, Section 3.5.2.3, p. 240.
[136] KGA GSP Semitropic Water Storage District Revised MAP, Section 3.5.2.3, p. 241.
[137] KGA GSP Semitropic Water Storage District Revised MAP, Section 3.5.2.3, p. 241.
[138] Buena Vista Amended GSP, Section 5.7.1.2, p. 179, Section 5.7.9, p. 183.
[139] Buena Vista Amended GSP, Table 5-22, p. 184.

from -0.38 feet to -2.62 feet.[140] The GSP states that these minimum thresholds were established by multiplying the average existing freeboard by 75 percent.[141] Measurable objectives ranged between -0.25 and -1.75 feet and were established by multiplying the existing freeboard by 50 percent.[142] Additionally, while the California Aqueduct is defined as critical infrastructure within the GSP, the GSP does not use the Regional Critical Infrastructure definition as described in the amended Coordination Agreement.[143]

- The South of Kern River Arvin Edison Water Storage District Management Area is located to the east in the vicinity of the California Aqueduct.
- The KGA GSP Shafter Wasco Irrigation District Management Area is located to the west of the Friant-Kern Canal. Because the KGA Shafter Wasco Irrigation District Management Area submitted a joint management area plan with the KGA North Kern Water Storage District Management Area, the Sustainable Management Criteria for the Shafter Wasco Irrigation District is the same and is consistent with the amended Coordination Agreement's sustainable management criteria.[144]
- The KGA GSP Cawelo Water District Management Area is located to the east of the Friant-Kern Canal.

4.3.2.4 *Management Area Critical Infrastructure*

The GSPs and management area plans within the Subbasin were tasked with defining their own Management Area Critical Infrastructure, which included but were not limited to roadways, water conveyances, transportation routes, utility lines, and wells. The definitions of Management Area Critical Infrastructure and the responses from their respective agencies vary across the Subbasin. Some GSPs or management area plans defined Management Area Critical Infrastructure but did not develop sustainable management criteria, some GSPs or management area plans did not define Management Area Critical Infrastructure nor sustainable management criteria, and some GSPs or Management Areas defined Management Area Critical Infrastructure and defined sustainable management criteria. Below are descriptions of select examples of where Department staff identified the various scenarios related to management area critical infrastructure.

Examples of GSPs or management area plans that defined Management Area Critical Infrastructure but did not define sustainable management criteria include the following:

[140] Buena Vista Amended GSP, Table 5-24, p. 185.
[141] Buena Vista Amended GSP, Section 5.7.11, p. 185.
[142] Buena Vista Amended GSP, Section 5.7.12, p. 186, Table 5-25, p. 187.
[143] Buena Vista Amended GSP, Section 5.7.1, p. 171.
[144] KGA GSP North Kern Water Storage District/Shafter-Wasco Irrigation District Revised MAP, Section 3.5.5, p. 261.

- The KGA GSP Semitropic Water District Management Area acknowledges "critical infrastructure" within its plan boundaries; however, it does not specify what the critical infrastructure is. The management area plan states that subsidence is occurring primarily in its Management Areas 1 and 3 and that "no impacts to critical infrastructure have been identified" within any of its management areas. The plan states that because no impacts to critical infrastructure have been identified and that the lack of understanding of the relationship between groundwater pumping and subsidence, subsidence was identified as a "data gap" and that no minimum thresholds are established at this time. The plan states the management area will adopt minimum thresholds once "a clear understanding of the causes and effects can be developed."[145] However, a description of how the management area will establish sustainable management criteria in the future is not clearly outlined within the plan.
- The KGA GSP West Kern Water District Management Area identifies natural gas pipelines and electrical transmission lines as Management Area Critical Infrastructure but does not set sustainable management criteria related to these facilities. The plan does not explicitly state why it chooses to not define sustainable management criteria but states that "impacts on this infrastructure due to subsidence caused by groundwater recovery are expected to be minimal."[146] The plan does not explain the process or what factors or evidence were used to reach this conclusion.
- The KGA GSP Southern San Joaquin Municipal Utility District management area plan establishes the Regional Critical Infrastructure sustainable management criteria for the Friant-Kern Canal and states that nine Friant-Kern Canal Turnouts are within its plan area and considered to be Management Area Critical Infrastructure. The plan states that these structures "have not experienced adverse impacts" while acknowledging the historical subsidence experienced within the management area. The plan states that while these facilities will be monitored, no sustainable management criteria are defined at this time.[147] While the Southern San Joaquin Municipal Utility District management area uses the Subbasin-wide sustainable management criteria for the Regional Critical Infrastructure, it states that it does not establish sustainable management criteria "relative to impacts to local infrastructure or beneficial uses and users."[148]
- KGA GSP Kern County Water Authority Pioneer Management Area identifies the Cross Valley Canal and Kern River Canal as Management Area Critical Infrastructure. However, no sustainable management criteria were defined because the management area plan states that no undesirable results have

[145] KGA GSP Semitropic Water Storage District Revised MAP, Section 3.4.4, p. 231.
[146] KGA GSP West Kern Water District Revised MAP, Section 7.8.2, p. 190.
[147] KGA GSP Southern San Joaquin Municipal Utility District Revised MAP, Section 3.4.4, p. 199.
[148] KGA GSP Southern San Joaquin Municipal Utility District Revised MAP, Section 3.5.2.5, p. 214.

historically been identified.[149] The plan did not include any analysis that subsidence has never occurred or analysis that future groundwater elevation declines below historic low levels will not cause subsidence.

- The KGA GSP Kern Water Bank Management Area also identifies the Cross Valley Canal as Management Area Critical Infrastructure.[150] However, the plan states that no sustainable management criteria are provided because "[t]he Kern County Water Agency monitors the elevation of the Cross Valley Canal and has reported no subsidence to the KWBA to date. Likewise, the City of Bakersfield operates the Kern River Canal and no issues have been reported to the [Kern Water Bank]."[151]
- The KGA GSP Shafter-Wasco Irrigation District 7th Standard Annex management area plan identifies the North of River Sanitary Wastewater Treatment Plant, utility infrastructure, and industrial facilities as Management Area Critical Infrastructure. However, no sustainable management criteria were provided because the management area plan states that "no historical subsidence or subsidence related impacts…have been observed".[152] The plan did not include any analysis that subsidence has not ever occurred or analysis that future groundwater elevation declines below historic low levels will not cause subsidence.
- KGA GSP North Kern Water Storage District/Shafter Wasco Irrigation District management area plan establishes criteria for Regional Critical Infrastructure and identifies the Lerdo Canal, Calloway Canal, 8-1 Pump Station, and the Shafter-Wasco FKC Turnout #2 as Management Area Critical Infrastructure. However, while the Agencies commit to "monitoring their respective facilities", sustainable management criteria for the Management Area Critical Infrastructure are not defined.[153]
- The Buena Vista GSP defines its Management Area Critical Infrastructure as Interstate-5. The Plan states that its minimum thresholds for the chronic lowering of groundwater levels "are intended to be protective of critical infrastructure."[154] However, the GSP states that because there have been no impacts to critical infrastructure identified there is not a clear understanding of how groundwater pumping in different areas of the Subbasin affect subsidence and the development of a regional approach to the subsidence undesirable result. The Buena Vista GSP identifies subsidence as a data gap and does not define sustainable management criteria for subsidence.[155]

[149] KGA GSP Pioneer Revised MAP, Section 7.7.3, pp. 144-145.
[150] KGA GSP Kern Water Bank Revised MAP, Section 3.2.4, p. 44.
[151] KGA GSP Kern Water Bank Revised MAP, Section 3.2.4, p. 44.
[152] KGA GSP Shafter-Wasco Irrigation District (7th Standard Rd.) Revised MAP, Section 12.5.3, p. 172.
[153] KGA GSP North Kern Water Storage District/Shafter-Wasco Irrigation District Revised MAP, Section 3.4.4, pp. 232-233.
[154] Buena Vista Amended GSP, Section 5.7.1, p. 171.
[155] Buena Vista Amended GSP, Section 5.7.1.2, pp. 179-180.

SGMA requires sustainable management criteria for all indicators even if subsidence has never previously occurred.

Examples of GSPs or management area plans that did not define Management Area Critical Infrastructure nor subsidence sustainable management criteria include the following:

- The KGA GSP Tejon-Castac Water District management area plan states that there is no Regional or Management Area Critical Infrastructure within the management area and that groundwater level minimum thresholds "are set to be protective of potential subsidence." Therefore, the management area plan does not set sustainable management criteria for subsidence.[156]
- The KGA GSP Eastside Water management area plan states that no critical infrastructure is located within the management area and does not define sustainable management criteria.[157]
- The KGA GSP Kern-Tulare Water District management area plan listed roads, wells, and pipelines as infrastructure within the area but were not designated as "critical infrastructure", therefore no undesirable results have been experienced and no sustainable management criteria are established.[158]
- The KGA GSP Westside District Authority management area plan provides a discussion of the Regional Critical Infrastructure but does not provide discussion on Management Area Critical Infrastructure.[159] The plan references a study which indicates that subsidence within the management area is attributable to oilfield activities over which the District has no control.[160]

Examples of GSPs or management area plans that defined Management Area Critical Infrastructure and defined subsidence sustainable management criteria include the following:

- Kern River GSP identifies municipal wells, canals, pipelines, roads, buildings, water treatment facilities, Bakersfield Meadows Field Airport, Highway 99, and Interstate-5 as critical infrastructure[161] within its three management areas (i.e., urban, agricultural, and banking). The minimum thresholds were established using historical water levels or setting the minimum threshold at 20 or 50 feet below the historic water levels. [162]
- KGA GSP Rosedale-Rio Bravo WSD management area plan identifies major transportation routes, pipelines, railroads, and water conveyance facilities as

[156] South of Kern River GSP, Section 13.5.2, p. 423, Section 14.5, p. 450.
[157] KGA GSP Eastside Revised MAP, Section 12.5 and 12.5.2, p. 90.
[158] KGA GSP Kern-Tulare Water District MAP, Sections 3.4.3 and 3.5.3, pp. 73 and 76.
[159] KGA GSP Westside District Water Authority Revised MAP, Section 4.1.2, pp. 144-145.
[160] KGA GSP Westside District Water Authority Revised MAP, Table 2b, p. 362.
[161] Kern River Amended GSP, Section 3.3.5.3, p. 177.
[162] Kern River Amended GSP, Table 5-2a, p. 304.

critical infrastructure.[163] The management area plan defined the subsidence sustainable management criteria for the management area critical infrastructure. A management area exceedance for land subsidence occurs when the average measured subsidence rate exceeds the minimum thresholds over a six-year rolling average. The minimum threshold is set at 0.10 feet per year over a six-year rolling average.[164]

- The South of Kern River Arvin-Edison management area plan does not identify Regional Critical Infrastructure but identifies Management Area Critical Infrastructure and establishes sustainable management criteria. The minimum threshold is defined as the maximum annual rate of subsidence observed between 2014 and 2018 which is equal to 1.5 inches per year. The minimum threshold will be assessed as an average annual rate over a 6-year rolling monitoring period.
- KGA GSP Cawelo Water District management area plan identified the CWD gravity flow components of surface water distribution system, Lerdo Canal, 8-1 Pump Station, and Beardsley Canal as Management Area Critical Infrastructure. The management area establishes groundwater levels as a proxy for land subsidence sustainable management criteria. The minimum threshold is set at 80 feet below the lowest historical low groundwater elevation. The plan states an estimated 0.8 feet of additional subsidence may occur in the management area.[165]
- The Olcese Water District GSP defines its Management Area Critical Infrastructure as the Gravity driven canal to its Rio-Bravo Hydroelectric Plant. The GSP states that because this canal was defined as Management Area Critical Infrastructure, "therefore, sustainable management criteria for land subsidence are defined." The GSP defines its Undesirable Result "in terms of reduction in canal capacity, defined based on the relationship between capacity and slope." The Undesirable Result is defined as a 25% reduction in canal capacity, if found to be "due to land subsidence caused by groundwater extractions." The GSP uses two monitoring locations a known distance apart to calculate a reduction of slope, which can be used to calculate the canal capacity via Manning's equation. The Minimum Threshold for land subsidence is defined as a relative elevation difference of 0.75 feet between the two selected monitoring points, which results in a reduction of canal capacity of 25%. The measurable objective is defined as a relative elevation difference of 0 feet between the two selected monitoring points.[166]

4.3.3 Evaluation

As part of Corrective Action 3, the Department stated that the Plan should define their undesirable results supported by the amount of subsidence that would substantially interfere with the land uses and critical infrastructure in the Subbasin; additionally, plans

[163] KGA GSP Rosedale-Rio Bravo Water Storage District Revised MAP, Section 3.2.5, p. 89.
[164] KGA GSP Rosedale-Rio Bravo Water Storage District Revised MAP, Section 5.5, p. 108.
[165] KGA GSP Cawelo Revised MAP, Section 7.4.3, pp. 210-212.
[166] Olcese Amended GSP, Section 13.5, pp. 151-153, Section 14.5, p. 158, Section 15.5, p. 162.

should identify the rate and extent of subsidence corresponding with substantial interference that will serve as the minimum threshold or should thoroughly demonstrate that another metric can serve as a proxy for that rate and extent. While the Subbasin provided the analysis documented in the two white papers and defined new interim sustainable management criteria for the Subbasin Regional Critical infrastructure, the Plan does not provide supporting evidence that the minimum thresholds, corresponded to a rate of subsidence, would cause substantial interference to these facilities.

Department staff believe that the rates and cumulative amounts of subsidence that are defined for minimum thresholds along the California Aqueduct and Friant-Kern Canal are not consistently analyzed in terms of lasting impacts, but rather from estimates from observed subsidence rates from previous studies. As a result, the Plan does not provide a coordinated, complete analysis of how the respective minimum thresholds could affect the conveyance operations of the California Aqueduct or Friant-Kern Canal. Ultimately, Department staff still cannot determine how the Agencies apparently concluded that the amount of subsidence potentially allowed by the interim minimum thresholds would not substantially interfere with the operations of the California Aqueduct or Friant-Kern Canal.

For example, the Subbasin's undesirable result for the Friant-Kern Canal is in part defined as "when the flow capacity through the Lower Reach is reduced to capacities below historical operational flow capacities over the previous 10 years."[167] However, the Friant-Kern Canal White Paper does not explain how its interim minimum thresholds, which plan to continue historical rates of subsidence, would impact the conveyance capacity of the Friant-Kern Canal. It is not clear whether the minimum thresholds would prevent the flow capacity of the canal from being further reduced to capacities below that of the previous 10 years. Additionally, the Plan does not state if or how the agencies plan to monitor the conveyance capacity of the canal for use in the undesirable result definition. Due to the apparent disconnect between the definition of the undesirable result and the definition of the interim minimum thresholds, Department staff are unable to determine how or whether the Agencies determined the proposed or allowable rates of subsidence under the interim minimum thresholds would avoid substantial interference to the Friant-Kern Canal.

For the California Aqueduct, an undesirable result is defined in part as "the amount of inelastic subsidence…[that] creates a significant and unreasonable impact (requiring either retrofitting or replacement to a point that is economically unfeasible to the beneficial users) to surface land uses or critical infrastructure".[168] However, the Plan does not explain how its minimum thresholds, set at two times the average observed from 2016 to 2022, could impact the Aqueduct.[169] While the California Aqueduct white paper provides the remaining freeboard ranges at the various aqueduct pools, it does not provide an analysis about the effects (e.g., loss of conveyance capacity, increased maintenance

[167] First Amended Kern County Subbasin Coordination Agreement, p. 395.
[168] First Amended Kern County Subbasin Coordination Agreement, pp. 363-364.
[169] First Amended Kern County Subbasin Coordination Agreement, p. 367.

costs, other operational considerations, etc.) of further reducing the freeboard through continued subsidence.[170] Due to the apparent disconnect between the definition of the undesirable result and the definition of the interim minimum thresholds, Department staff are unable to determine how or whether the Agencies determined the proposed rates of subsidence for the interim minimum thresholds would not cause substantial interference to the California Aqueduct.

The Plan also emphasizes that the Subbasin-wide sustainable management criteria will only apply to subsidence caused by "SGMA-related groundwater extractions" from certain beneficial uses and users and that subsidence purportedly caused by other activities will not constitute or contribute to an exceedance of minimum thresholds or measurable objectives; however, the Plan does not describe the process that the Agencies will use to differentiate between possible causes of subsidence.[171]

All of the initial sustainable management criteria definitions relating to Regional Critical Infrastructure emphasize that for subsidence to apply towards a minimum threshold exceedance, it must be caused by "SGMA-related" activities. The KGA GSP, Buena Vista GSP, Henry Miller GSP, and some management area plans contain similar caveats which state that "[p]ermanent loss of freeboard from land subsidence due to other causes including but not limited to oil or gas production, natural compaction of shallow underlying soils beneath or near the Aqueduct, or any other cause that is not within the jurisdiction of a GSA, shall not be considered as a loss of freeboard that contributes to the amount specified for any measurable objective or minimum threshold."[172] However, despite this caveat, the plans lack discussion on how the GSAs would determine whether the subsidence was caused by so-called SGMA-related activities rather than other causes of subsidence.

It is unclear to Department staff whether the Plan has the capability to quantify "SGMA related" subsidence when evaluating its subsidence monitoring which it will be using to monitor the minimum thresholds. The Lawrence Berkeley Study and Earth Consultants International Study imply that they are able to differentiate between oil and gas and SGMA-related subsidence; however, it is unclear if or how the plans will be utilizing these studies to quantify SGMA-related subsidence.[173] Additionally, the Plan does not demonstrate that they will be using consistent methodology to quantify the amount of "SGMA-related" subsidence. For example, some plans state that they do not understand the relationship between subsidence and groundwater extraction at this time. The KGA GSP Semitropic Water Storage District Management Area does not define minimum thresholds for subsidence because of "data gaps" related to a lack of knowledge of the

[170] First Amended Kern County Subbasin Coordination Agreement, Table 1b, p. 366.
[171] First Amended Kern County Subbasin Coordination Agreement, pp. 368-369.
[172] KGA Amended GSP, Section 3.5.3.2, p. 301; Buena Vista Amended GSP, Section 5.7.11, p. 185; Henry Miller GSP, Section 3.3.4, p. 156.
[173] First Amended Kern County Subbasin Coordination Agreement, Lawrence Study, p. 404, Earth Consultants International Study, p. 426.

relationship between groundwater pumping and subsidence.[174] Similarly, the Buena Vista GSP states that sustainable management criteria for subsidence were not defined in part because there is not a clear understanding of how groundwater pumping in different areas of the Subbasin affect subsidence.[175] If there is a way that the studies are differentiating between "SGMA related" and other types of subsidence, this methodology is not part of a coordinated response at the GSP or management area plan level.

Department staff also conclude that outside of the regional infrastructure, the Subbasin still does not have a Subbasin-wide approach for managing subsidence because of the differing data and methodologies used to establish Management Area Critical Infrastructure and corresponding sustainable management criteria. The new subsidence approach is primarily concerned with the Subbasin's Regional Critical Infrastructure (i.e., the California Aqueduct and Friant Kern Canal). However, the GSPs and management area plans were tasked with defining their own Management Area Critical Infrastructure and corresponding sustainable management criteria. As previously described, some plans defined both Management Area Critical Infrastructure and sustainable management criteria; some plans defined Management Area Critical Infrastructure but did not provide sustainable management criteria; and some plans did not define Management Area Critical Infrastructure nor subsidence sustainable management criteria. Due to the variations in the plans' responses, Department staff conclude that the plans did not define "Management Area Critical Infrastructure" consistently and many do not set corresponding sustainable management criteria. The varying approaches to managing Management Area Critical Infrastructure does not clearly demonstrate a coordinated Subbasin-level response to subsidence, as required by Corrective Action 3.

4.3.4 Conclusion

In sum, the Plan made progress in moving towards coordinated Subbasin-wide subsidence management by establishing sustainable management criteria for the Regional Critical Infrastructure and defining Management Area Critical Infrastructure. However, the Plan still lacks a description and discussion of the conditions occurring throughout the Subbasin that would cause undesirable results that the GSAs propose to manage the basin to avoid. The Plan lacks detailed, supporting information describing and demonstrating the understanding of land uses and critical infrastructure (the Management Area Critical Infrastructure in particular) in the Subbasin and the amount of subsidence that would substantially interfere with those uses and critical infrastructure.

[174] KGA GSP Semitropic Water Storage District Revised MAP, Section 3.4.4, p. 231, Section 3.5.2.3, p. 241.
[175] Buena Vista Amended GSP, Section 5.7.1.2, pp. 179-180.

5 STAFF RECOMMENDATION

Department staff conclude that the GSAs did not take sufficient actions to correct the previously identified deficiencies. Department staff recommend the Plan be determined **INADEQUATE**.