APPENDIX G. MITIGATION PROGRAMS

Appendix G-1: 2025 Kern County Subbasin Well Mitigation Program (Version 2)

June 2025

KERN COUNTY SUBBASIN MITIGATION PROGRAM

VERSION 2.0

PRODUCED FOR

Kern County Subbasin KCS Groundwater Sustainability Agencies

PRODUCED BY

INTERA rincon K·S·C KAHN, SOARES & CONWAY, LLP ATTORNEYS AT LAW

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Attention

If you have experienced a loss of drinking water, please contact **Self-Help Enterprises** at **(559) 802-1685**. Self-Help Enterprises is available to assist with accessing emergency drinking water and interim drinking water supplies.

For applications regarding drinking water wells (including agricultural wells used for drinking water purposes), please fill out the online intake form on Self-Help Enterprises' website:
https://www.selfhelpenterprises.org/programs/emergency-services/water-sustainability/

Atención

Si experencia pérdida de agua potable, comuníquese con **Self-Help Enterprises** al **(559) 802-1685**. Self-Help Enterprises está disponible para ayudarle con el acceso a agua potable de emergencia y suministros provisionales de agua potable.

Para reclamos relacionados con pozos de agua potable (incluidos los pozos agrícolas utilizados para fines de agua potable), complete el formulario de admisión en línea en el sitio web de Self-Help Enterprises:
https://www.selfhelpenterprises.org/programs/emergency-services/water-sustainability/

Section 1: Introduction

On September 16, 2014, Governor Jerry Brown signed into law a three-bill legislative package, composed of Assembly Bill 1739 (Dickinson), Senate Bill 1168 (Pavley), and Senate Bill 1319 (Pavley), collectively known as the Sustainable Groundwater Management Act (SGMA), which is codified in Section 10720 et seq. of the California Water Code. In his signing statement, Governor Brown emphasized that "groundwater management in California is best accomplished locally." This legislation created a statutory framework for groundwater management that can be sustained during the planning and implementation horizon without causing undesirable results.

SGMA requires high and medium priority basins to achieve sustainability by avoiding undesirable results. These basins should reach sustainability within 20 years of implementing their sustainability plans. For critically over-drafted basins, such as the Kern County Subbasin (Kern Subbasin), the deadline for achieving sustainability is 2040.

The Kern Subbasin is comprised of 20 Groundwater Sustainability Agencies (GSAs) working together to achieve groundwater sustainability (**Figure 1**). To comply with SGMA Regulations, the Kern Subbasin prepared a coordinated Groundwater Sustainability Plan (2025 Plan) to achieve sustainability by 2040. The Well Mitigation Program is considered part of the 2025 Plan.

In general, the Kern Subbasin will fund administration, outreach, analyses, technical assistance and mitigation services necessary to restore drinking water for households that have lost access to safe drinking water due to groundwater management activities associated with implementation of the 2025 Plan. While households may lose access to their water supply for many reasons, the purpose of this Well Mitigation Program is to avoid or address impacts caused by groundwater management activities undertaken by the Kern Subbasin GSAs after January 1, 2015. The Kern Subbasin has partnered with Self-Help Enterprises, a local expert in providing solutions for households losing access to drinking water described in Section 2. Separate from this Well Mitigation Program, Self-Help Enterprises also administers services for households losing access to their water supply due to causes other than the Kern Subbasin GSAs' groundwater management activities. This collaboration between the Kern Subbasin and Self-Help Enterprises with respect to loss of access to safe drinking water allows Self-Help Enterprises to serve as a single point of contact for households in the Kern Subbasin losing access to drinking water.

Version 2.0 Well Mitigation Program Updates

As part of Version 2.0, the Kern Subbasin has established a dedicated program track to address degraded water quality. This Degraded Water Quality Mitigation Track is distinct from the Dry Well Mitigation Track. For future revisions to the Well Mitigation Program, the Kern Subbasin GSAs are considering development of a funding assistance track for state small systems (i.e., 5 to 14 connections and less than 25 residents) to address dry wells, or wells at risk of becoming dry, due to groundwater management activities. Potential funding assistance is anticipated to be separate from technical assistance and the Kern Subbasin GSAs are evaluating such assistance preliminarily up to $100,00.

The Kern Subbasin has committed to implement this Well Mitigation Program within the Plan Area to provide emergency and interim drinking water, as well as long-term solutions, for households that rely on

domestic and multi-use domestic wells[1] and have lost access to drinking water due to groundwater management activities occurring after January 1, 2015. In addition, the Well Mitigation Program provides alternative drinking water supplies to domestic well users that experience water quality degradation due to groundwater management activities.

The Well Mitigation Program document explains the application process, funding mechanisms, and the roles and responsibilities of the Kern Subbasin and Self-Help Enterprises to implement the Well Mitigation Program and the three tracks within the Well Mitigation Program. The Well Mitigation Program document also explains how the Kern Subbasin will determine if applications are eligible for assistance.

[1] The term domestic well as used in the Degraded Water Quality sections of this appendix means domestic wells that serve up to four service connections.

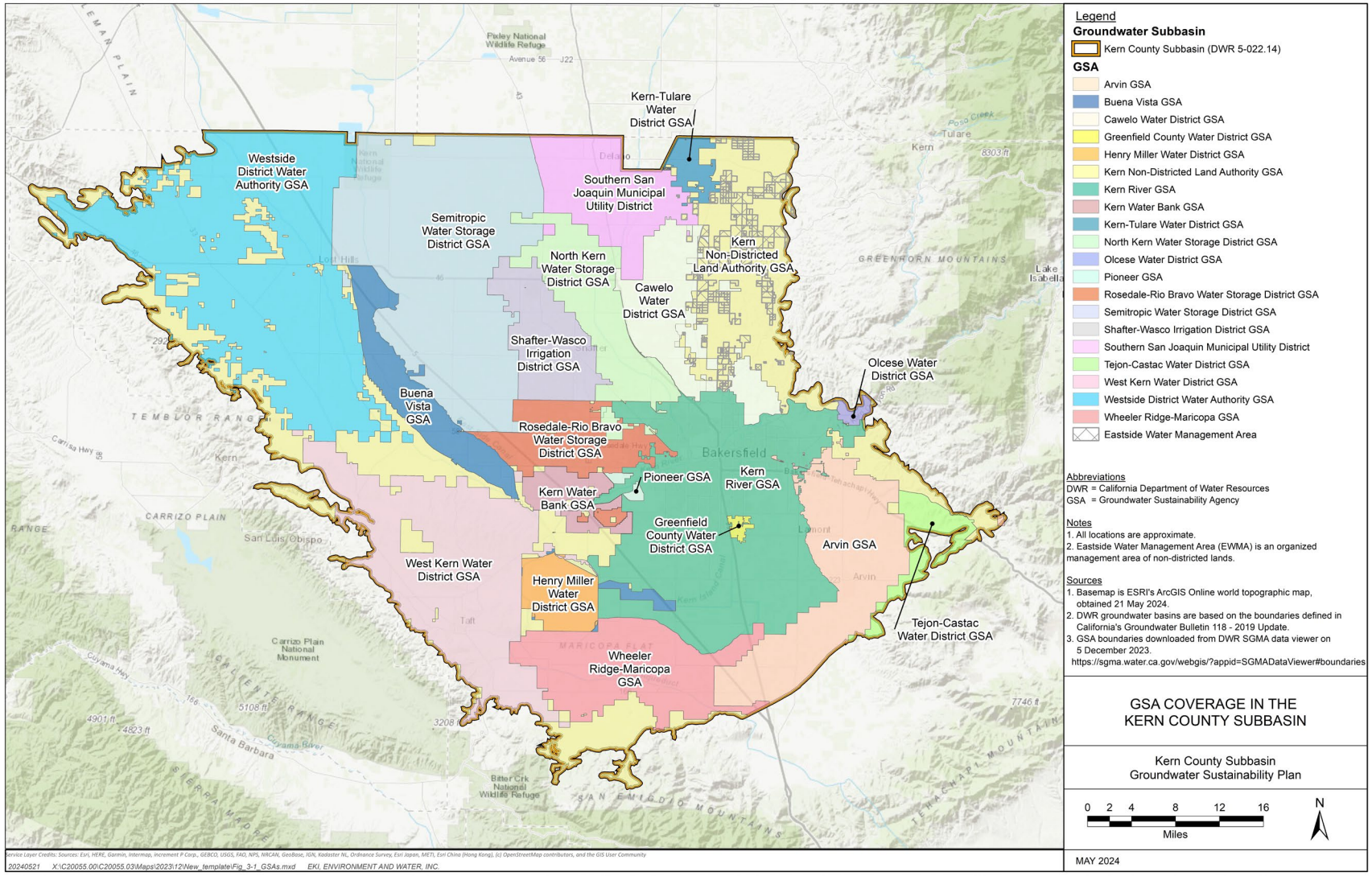

Figure 1. Kern Subbasin

Section 2: Program Overview

The Well Mitigation Program (or "Program") provides mitigation for impacts to domestic wells and technical assistance for public supply wells that are also community water systems and state small water systems demonstrated to have been adversely affected by declining groundwater levels due to groundwater management activities occurring after January 1, 2015. The Well Mitigation Program also addresses impacts to domestic wells adversely affected by groundwater quality degradation resulting from groundwater management activities occurring after January 1, 2015.

Mitigation and technical assistance under this Program are not available for impacts that were the subject of a prior domestic well impact application that was settled and mitigated under another well mitigation plan or program. To be eligible for consideration under this Program, an application for mitigation must be presented no later than two years after adoption of this Program for an impact occurring between January 1, 2015, and the date of adoption of the Program, and no later than two years after the date of the impact for all other applications.

The Well Mitigation Program may be revised as lessons are learned, data gaps are resolved, new analytical tools are available, and mitigation and administrative costs evolve. As with the 2025 Plan, the Well Mitigation Program is designed as an iterative document with adaptive management at the forefront.

Program Need

The Kern Subbasin is collaboratively managing water supplies within the Plan Area to achieve sustainability by 2040 through implementation of the 2025 Plan, which includes actions established in the exceedance policies detailed in Appendix K.

However, groundwater levels in parts of the Kern Subbasin may decline and land subsidence may occur while the Kern Subbasin implements projects and management actions (P/MAs) through the planning and implementation horizon. Declining groundwater levels created by groundwater management activities during the implementation phase of the 2025 Plan may also induce unintended groundwater quality impacts. The Kern Subbasin recognizes the potential impacts that may occur and identified the need for establishing this Well Mitigation Program to be more protective of beneficial uses and users within the Plan Area.

Self-Help Enterprises

The Kern Subbasin is collaborating with Self-Help Enterprises to administer emergency drinking water supplies, interim drinking water supplies, long-term mitigation support, and well stewardship educational resources for qualifying applications for those experiencing a loss in access to drinking water supplies. Self-Help Enterprises' Emergency Services team are local experts in well mitigation, administering these same services for low-income households across the San Joaquin Valley. This Well Mitigation Program expands Self-Help Enterprises' existing program to support households regardless of income-limitation and addresses the Kern Subbasin's local approach to mitigating potential undesirable results as defined in the 2025 Plan.

The Kern Subbasin has entered into agreements with Self-Help Enterprises to provide financial support for their implementation services of the Well Mitigation Program as it relates to dry wells and loss of access to drinking water. The agreement between the Kern Subbasin and Self-Help Enterprises provides that the Kern Subbasin will reimburse Self-Help Enterprises for costs associated with program administration, groundwater quality sampling, interim drinking water supplies, and long-term mitigation measures for

applications qualifying for mitigation under this Well Mitigation Program as it relates to the Dry Well Mitigation Track.

Self-Help Enterprises will continue to serve as a contract mediator and lender for applicants to arrange mitigation with well drillers to perform the long-term physical mitigation.

As agreed on by the Kern Subbasin and Self-Help Enterprises, the Kern Subbasin is responsible for reimbursing Self-Help Enterprises for costs related to dry wells or loss of access to drinking water to mitigate impacts caused by groundwater management activities after January 1, 2015 (see **Section 5: Dry Well Mitigation Track Application Process** starting on Page 11 for more information on the steps to evaluate application qualification). Where a well is impaired for reasons other than groundwater management activities, Self-Help Enterprises may offer emergency drinking water assistance and mitigation through alternative programs. It is important to the Kern Subbasin and Self-Help Enterprises to lessen the burden on households experiencing drinking water issues, where possible. The Self-Help Enterprises collaboration is intended to create a "one-stop-shop" for emergency drinking water supplies and mitigation and allows the financial exchanges to be handled by the Kern Subbasin and Self-Help Enterprises administrative teams.

For the Degraded Water Quality Mitigation Track, the Kern Subbasin is committed to engage qualified professionals or an appropriate contractor/entity (e.g., Self-Help Enterprises) for implementation of the Degraded Water Quality Mitigation Track. The Kern Subbasin is committed to providing financial support for implementation of services such as providing short-term alternative water supplies and implementing long-term solutions for eligible domestic well owners. In the case of nitrate, the Kern Subbasin will seek to work with the Kern Water Collaborative to address interim and long-term solutions for nitrate impacts, as determined appropriate.

Evolving Program

As the Kern Subbasin collects more data and gains insights from demand management changes, project implementation, improved analytical tools and well registration, opportunities to refine the Well Mitigation Program are expected to emerge. In addition to improved data and analytics, lessons will be learned through the implementation of the Well Mitigation Program. Costs to mitigate wells, provide interim supplies, and administration may also evolve over time. The Kern Subbasin intends the Well Mitigation Program to be iterative and evolve as new information, funding, and efficiencies are understood.

Section 3: Well Mitigation Program Tracks

The Well Mitigation Program has three tracks: (1) Dry Well Mitigation Track; (2) Dry Well Technical Assistance Track; and (3) Degraded Water Quality Mitigation Track. **Figure 2** summarizes who qualifies for each track. More detail on the application process for each track is described under their respective sections of this Program (starting on Page 11 for the Dry Well Mitigation Track, Page 16 for the Dry Well Technical Assistance Track, and Page 22 for the Degraded Water Quality Mitigation Track).

Dry Well Mitigation Track

The Dry Well Mitigation Track offers emergency drinking water supplies within 24-hours of notification to Self-Help Enterprises, interim drinking water supplies (hauled tank water) within 72-hours, and long-term mitigation solutions for domestic wells and multi-use domestic wells that have been impacted and meet the qualification criteria explained starting on Page 8. Multi-use domestic wells are agricultural wells that are also used to supply drinking water to at least one household. Agricultural wells used solely for agricultural purposes are not eligible for assistance under the Program.

Under this Well Mitigation Program, domestic wells and multi-use domestic wells are defined as having at maximum 4 service connections to 4 separate households.

More information on the application process for the Dry Well Mitigation Track starts on Page 11.

Dry Well Technical Assistance Track

The Dry Well Technical Assistance Track offers up to $50,000 in funding to support technical assistance in the form of grant development, feasibility planning, or other mechanisms useful to support state small systems and public water systems that are also community water systems (including small community water systems)[2] that have been impacted and meet the qualification criteria explained in the section below.

More information on the application process for the Technical Assistance Track starts on Page 16.

Degraded Water Quality Mitigation Track

The Degraded Water Quality Mitigation Track offers alternative drinking water for users that rely on domestic wells and multi-use domestic wells. Alternative drinking water may consist of supplying bottled water on an interim basis until a long-term solution is identified or until the water no longer exceeds primary maximum contaminant levels (MCLs). Long-term solutions will vary and may consist of installation of point of use or point of entry treatment systems within the home or at the well – depending on the circumstances. Domestic wells are those wells serving no more than four connections. Multi-use domestic wells are agricultural wells that are also used to supply drinking water to at least one household. Agricultural wells used solely for agricultural purposes are not eligible for assistance under the Program.

More information on the application process for the Degraded Water Quality Mitigation Track starts on Page 22.

[2] The terms state small systems, community water systems and small community water systems as used in this Appendix mean the same as defined in Health and Safety Code, § 116275.

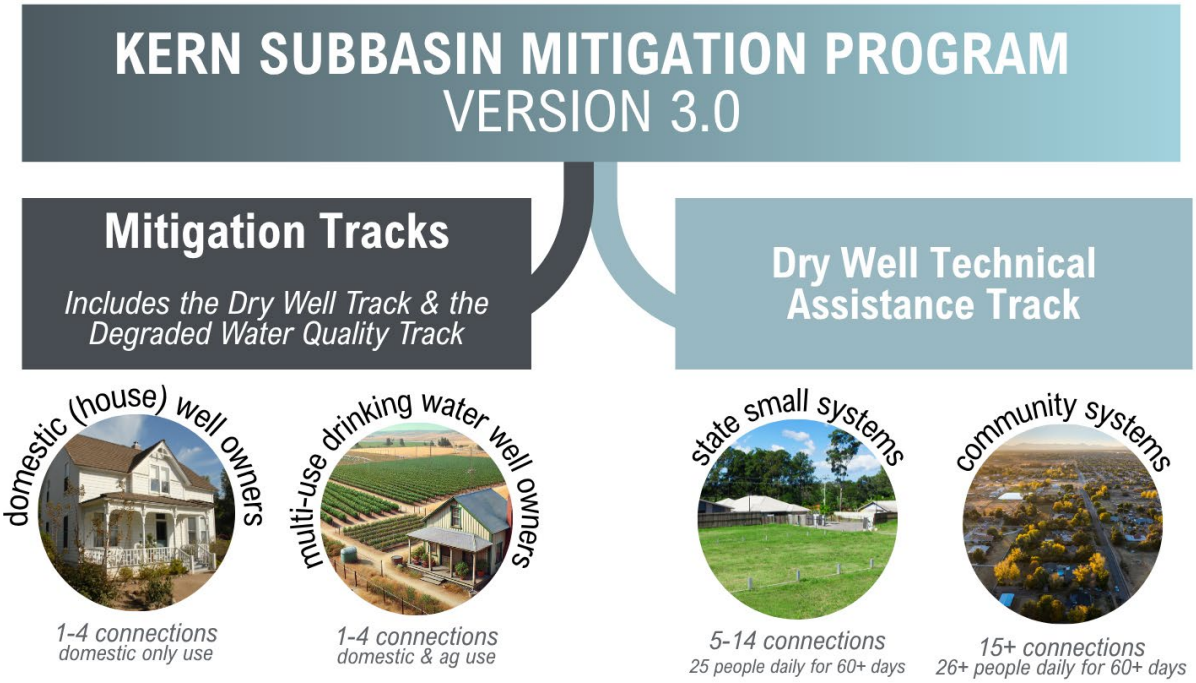

Figure 2. Mitigation Program Tracks

Section 4: Application Qualification Criteria

Application Qualification Criteria for Dry Well Tracks

Not all impacts to wells qualify for mitigation under the Well Mitigation Program's Dry Well Tracks. For example, a well's electrical or mechanical failure may be due to reasons independent of groundwater management activities. Therefore, criteria were established to determine if an application qualifies for assistance under the Well Mitigation Program tracks. The Dry Well Mitigation Program's qualification criteria are shown in **Figure 3**. The same criteria apply for both the Dry Well Mitigation Track and the Dry Well Technical Assistance Track.

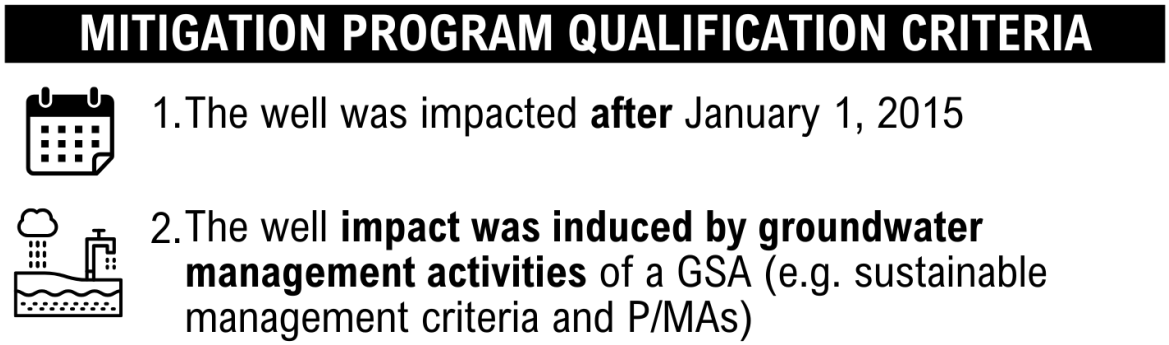

Figure 3. Application Qualification Criteria

Applicants are encouraged to submit applications immediately upon impact. Reimbursement for impacts already mitigated is not available under this Program. Applications for impacts older than 1-year without comprehensive documentation of the impact may not qualify. Documentation that is relevant to the application are photos of the well, photos and descriptions of site conditions, recorded groundwater level measurements, and groundwater quality data. The documentation is necessary because the current well conditions would be unrepresentative of conditions during the time of impact, hindering an effective desktop and field evaluation to assess qualification criteria.

The Well Mitigation Program launched in January 2025. In January 2027 (or two-years from Program adoption), applications for impacts older than 2-years will not be eligible for consideration. This is because 2-year-old well conditions would be unrepresentative of current conditions, making it unfeasible to perform a site-assessment. The first 2 years of implementation offers an exemption from this criterion, as the Well Mitigation Program is new, and it will require several months for the general public to be made aware of the resources available to them, and relevant timelines, through ongoing public engagement and outreach initiatives.

Evaluating Application Eligibility for Dry Well Tracks

Application eligibility will be evaluated on a case-by-case basis. The application processes, described for the Dry Well Mitigation Track on Page 11 and for the Dry Well Technical Assistance Track on Page 16, detail how an application is processed, including evaluations of eligibility based on the qualification criteria identified in the Section above and **Figure 3**. The evaluation of eligibility will occur in two stages:

Stage 1 – Initial Screening: A Qualified Professional (e.g., PG, PE, CHG) will perform a technical evaluation determining if the impact (1) occurred after January 1, 2015 and was (2) induced by groundwater management activities. The qualified professional will evaluate available data and information, such as that listed in **Attachment A**, and consider the context of well vulnerability described in **Section 10: Criteria for Determining if the Impact is within the Scope of Responsibility of the Kern Subbasin GSAs** (starting on Page 28).

Stage 2 – KMEC Eligibility Evaluation: The Kern Subbasin Mitigation Evaluation Committee (KMEC) is a three-seat committee intended to minimize bias in the recommendation process, as shown in **Figure 4**. The KMEC will provide an intermediate evaluation between the technical evaluation performed by the Qualified Professional and the GSA's final determination. The KMEC's evaluation will include both technical considerations and locally relevant stakeholder input.

Application Qualification Criteria for Degraded Water Quality Track

Not all wells will qualify for mitigation under the Well Mitigation Program's Degraded Water Quality Mitigation Track. For example, a well that was already degraded for the constituent of concern (COC) prior to January 1, 2015 will not qualify. Wells impacted by degraded water quality will only qualify for mitigation under this program if the degradation is due to groundwater management activities. Wells affected by other, unrelated factors will not be eligible for mitigation through this program.

Degraded Water Quality for the purposes of eligibility under this Well Mitigation Program track will be evaluated on a case-by-case basis. For some, initial eligibility may be pre-determined through the Minimum Threshold (MT) exceedance investigation process set forth in the Exceedance Policy (Appendix K) whereby domestic well owners with an *assumed* water quality impact due to GSA projects and management activities receive notice with respect to potential Degraded Water Quality Mitigation and information on the application process for seeking mitigation. For others, their application will be subject to a case-by-case evaluation as part of the application process that considers readily available data and information and consideration of factors similar to those considered as part of an MT Exceedance investigation, as applicable. To ensure transparency and clarity, the application review steps for the Degraded Water Quality Mitigation Track are set forth for two distinct scenarios:

Scenario 1: In accordance with the Exceedance Policy, a domestic well owner *assumed* to be impacted due to GSA projects and management actions will receive a notice related to degraded water quality, along with instructions for submitting an application (see Appendix K).

Scenario 2: Receipt of an application by the Kern Subbasin's single point contact unrelated to notice provided per the Exceedance Policy. In this scenario, it is unknown if a well is impacted by GSA projects and management actions.

While the scenarios and their associated steps are generally similar to each other—and to those in the Dry Well Mitigation Track—there are some key differences. These distinctions are explained as follows:

Evaluating Application Eligibility for Degraded Water Quality

The Kern Subbasin anticipates that applications for mitigation of Degraded Water Quality will be received by a single point of contact. The applications will be screened as follows:

Stage 1 – Initial Screening : Wells *assumed* to be impacted due to groundwater management activities pursuant to the Exceedance Policy will receive direct and specific notice of their potential eligibility for mitigation—subject to additional confirmation—and notice regarding the application process.

For applications received under Scenario 2, initial screening and evaluation will be conducted by an independent qualified professional as part of the case-by-case evaluation of the application after it has been submitted to the Kern Subbasin appointed single point of contact.

For both scenarios, domestic well sampling and analysis for the Kern Subbasin COC will also be part of the initial screening process to determine if the well associated with the application exceeds one or more primary MCLs and if an exceeded primary MCL is related to GSA projects and management activities. The Kern Subbasin anticipates that the contractor/entity selected for implementation of the Degraded Water Quality Program Mitigation Track will also perform well sampling and analysis as part of their agreement with the Kern Subbasin.

Stage 2 – **Domestic Well Eligibility Evaluation**: Depending on the result(s) for the well sample, Stage 2 will either consist of (1) no further action necessary and the domestic well owner of record will be notified of such; or (2) be eligible for further evaluation to determine eligibility for mitigation. No further action will be necessary if the well test results indicate that there are no exceedances for primary MCLs tested. The Kern Subbasin is mindful of sharing only factual information and not making false claims regarding the safety of someone's drinking water overall. Notices will be developed in a thoughtful and mindful manner to avoid implying that their well is safe to drink in light of the number of emerging contaminants for which testing may not yet occur.

If there are primary MCL exceedances for the COC, application eligibility will be further evaluated in the same manner as applications for dry wells.

(A) A Qualified Professional (e.g., PG, PE, CHG) will perform a technical evaluation of the initial assessment performed, including the proposed mitigation solution in the initial assessment. As part of the technical evaluation, the Qualified Professional will also further evaluate the individual domestic well in question, its location, and potential causes for degradation to determine if degraded water quality is due to groundwater management activities. The Qualified Professional may review the MT Exceedance investigation, if available, using the case-by-case evaluation factors identified in the Exceedance Policy and other factors as determined appropriate by the Qualified Professional.

(B) The Kern Subbasin Mitigation Evaluation Committee (KMEC) will conduct its evaluation. The KMEC is a three-seat committee intended to minimize bias in the recommendation process, as shown in **Figure 4**. The KMEC will provide an intermediate evaluation between the technical evaluation performed by the Qualified Professional and the GSA's final determination. The KMEC's evaluation will include both technical considerations and locally relevant stakeholder input.

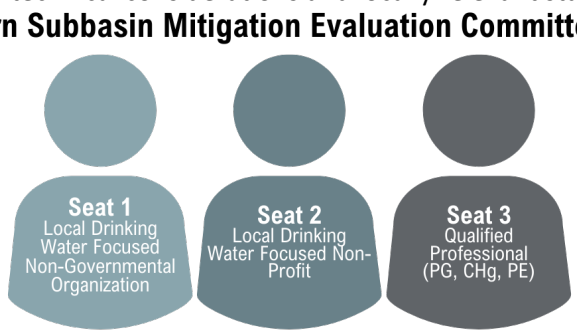

Figure 4. Kern Subbasin Mitigation Evaluation Committee (KMEC)

Section 5: Dry Well Mitigation Track Application Process

The Well Mitigation Program includes two tracks specifically applicable to dry wells or wells experiencing a loss of access to drinking water, based on the type of well and forms of mitigation or assistance available (**Figure 2**). This section describes the Dry Well Mitigation Track, which includes emergency supplies, interim supplies, and long-term solutions for domestic wells and multi-use domestic wells impacted by groundwater management activities that occurred after January 1, 2015. The application process for the Dry Well Mitigation Track is explained below and in **Figure 5**.

Who can apply under the Mitigation Track?

Private Domestic Well Owners[3]

In the Kern Subbasin, private residences in some unincorporated and unconsolidated small communities and rural portions of the County rely on private wells to meet their domestic water supply needs. Households relying on individual domestic wells for their water supply may apply for assistance under the Dry Well Mitigation Track. For purposes of this Well Mitigation Program, domestic wells are defined as wells with at maximum 4 household connections for drinking water purposes.

Multi-Use Drinking Water Wells (Agricultural Well Owners Using Agricultural Wells for Domestic Supply)

Some private well owners use their wells for both domestic potable supply to a residence and irrigation. Households relying on these wells for drinking water supply may apply for assistance under the Dry Well Mitigation Track. For purposes of this Well Mitigation Program, multi-use drinking water wells are defined as wells used for both agricultural and domestic household purposes with a maximum of 4 service connections.

Dry Well Mitigation Track Application Process

Step 1. Stakeholder Outreach

Public participation and communication are critical to implementing an effective Well Mitigation Program. Stakeholder outreach is organized into three phases: (1) Program development, (2) initial notification, and (3) ongoing outreach.

Phase 1: Program Development. During development of the Well Mitigation Program, the Kern Subbasin conducted a virtual workshop with attendance from various local drinking water advocacy groups to gather

[3] Wells used for drinking water purposes that have four or less connections are considered 'domestic' wells in this program. Wells with more than four connections used for drinking water purposes are considered state small systems or community water systems (depending on the connection count), consistent with the terms as defined in Health and Safety Code § 116275.

and incorporate feedback. This workshop summarized the key components of the Well Mitigation Program, including application process, qualification criteria, who can submit an application, and the basis for the budget and funding feasibility. In addition to the Workshop, the Kern Subbasin GSAs, tasked with leading the development of the Well Mitigation Program, engaged in several small group meetings and discussions with Workshop participants to discuss the development of the Well Mitigation Program.

Phase 2: Initial Notification. Following adoption of the Well Mitigation Program, the Kern Subbasin will conduct an outreach campaign to notify Kern Subbasin residents of this new program. Outreach activities include: (1) an email blast to all landowners and participants on the GSAs' interested parties lists and (2) flyers posted in community spaces across the Kern Subbasin. Community spaces include school district buildings, libraries, community centers, and other public locations. The flyers can be made available in English and Spanish, as needed.

Phase 3: Ongoing Outreach. The Kern Subbasin will maintain public awareness of this Well Mitigation Program through postings on GSA websites, agenda items at GSA Board Meetings and stakeholder meetings and events and coordinating with Self-Help Enterprises' outreach initiatives in the Kern Subbasin. This ongoing outreach includes coordination with Kern Water Collaborative, in which it will publicize the Well Mitigation Program as part of the Memorandum of Understanding between the Kern Subbasin and the Kern Water Collaborative. All ongoing outreach can be made available in English and Spanish, as needed.

Step 2. Identify Need for Mitigation

Applicants who have lost access to drinking water must contact Self-Help Enterprises to initiate the mitigation application process. Due to existing laws limiting site access, applications must be submitted by landowners on whose property the adversely impacted well is located; however, in the event a tenant is experiencing loss of access to drinking water, the tenant well user is encouraged to contact the GSA, and the GSA will work with Self-Help Enterprises to notify the well owner of how to apply for mitigation and the benefits of the Well Mitigation Program.

For questions on the applications process or tenant questions on advocating for mitigation support with a landlord(s), a tenant well user should contact the local GSA (**Table 1**) and/or Self-Help Enterprises.

Self-Help Enterprises

(559) 802-1685

8445 W Elowin Ct

Visalia, CA 93291

An online intake form is available on Self-Help Enterprises' website:
https://www.selfhelpenterprises.org/programs/emergency-services/water-sustainability/

Translation services are available via phone or in-person.

Step 3. Emergency Water and Interim Supplies

After an application for mitigation is submitted, Self-Help Enterprises will arrange temporary emergency drinking water supplies within 24 hours in the form of bottled water to applicants. Interim supplies, which may include water tanks with delivered supplies, or other appropriate interim measures will be arranged for these households within 72 hours. The Kern Subbasin will fund and/or reimburse Self-Help Enterprises for administering and supplying emergency and interim water supplies for qualifying applications (see Step 8). Emergency water and interim supplies will continue until the application for assistance is resolved.

Step 4. Mitigation Need Assessment

Self-Help Enterprises' field staff will perform an initial assessment, including a site visit and discussions with the landowner and/or tenants. Translation services for Spanish and Punjabi can be made available by Self-Help Enterprises, as needed. Following the assessment, Self-Help Enterprises will provide the documentation and findings to the GSA in which the impacted well is located and the GSA-arranged qualified professional (who will be performing the evaluation in Step 5).

Step 5. Funding Qualification Assessment

A GSA-designated qualified professional (e.g., PG, CHg, PE) will perform a technical evaluation of the information from Self-Help Enterprises on the well, historical groundwater conditions, and land use data to determine if the application qualifies for mitigation under the Well Mitigation Program's qualification criteria and make a recommendation regarding mitigation. The evaluation, findings, and recommendation will be documented and shared with the GSA in which the impacted well is located and the KMEC (Step 6).

In instances in which the application does not qualify for mitigation based on the evaluation from the qualified professional, this information and the supporting documentation will be shared with the applicant by the GSA. The KMEC may reevaluate the determination of disqualification in Step 6 and override the recommendation for disqualification made by the qualified professional.

See **Attachment A** and the **Section 10: Criteria for Determining if the Impact is within the Scope of Responsibility of the Kern Subbasin GSAs** for more information on the type of data and information to be considered and assessed during this step.

Step 6. Mitigation Measure Selection Agreement

Where the application is determined to be qualified for mitigation in Step 5, the KMEC evaluates the findings and recommendation of mitigation measure(s). The KMEC prepares an agreed upon recommendation of (1) proposed mitigation measure(s) and (2) estimated costs associated with administration, assessment, interim supplies, and physical mitigation to be shared with the Board of Directors of the GSA in which the impacted well is located to consider for funding approval in Step 7.

The KMEC's recommendation for long-term mitigation may include, but is not limited to:

- Deepen the well
- Construct a new well
- Modify pump equipment, including lowering the pump
- Consolidation with an existing water system in the vicinity
- Establishment of a new small public water system

- With the consent of the applicant and Self-Help Enterprises, providing other acceptable means of mitigation

Self-Help Enterprises and the staff of the GSA in which the impacted well is located will consider each application on a case-by-case basis to identify the most effective long-term mitigation measure(s).

In instances in which the application was disqualified in Step 5, the KMEC will evaluate the basis for that determination. The KMEC has authority to override this determination and recommend mitigation to the GSA Board of Directors in Step 7.

In cases where the application does not meet the qualification criteria as determined by the qualified professional and the KMEC, the applicant may qualify for mitigation support via other programs that Self-Help Enterprises administers. Self-Help Enterprises will work directly with those applicants to identify options.

Step 7. GSA Board Approval for Funding

Where an application qualifies for mitigation reimbursement, as determined by the KMEC, the qualified professional from Steps 5 and 6 will present to the Board of Directors of the GSA in which the impacted well is located the findings from Step 5 and the KMEC's recommendation on (1) mitigation qualification, (2) proposed mitigation measure to be financially reimbursed, and (3) costs associated with the reimbursement.

The Board of Directors of the GSA in which the impacted well is located will consider approval of mitigation funding reimbursement.

The Well Mitigation Program includes an Appeal Process in the event the applicant disagrees with the determination of the qualified professional, KMEC, or respective GSA Board of Directors. More information is available in the **Section 8: Appeal Process** on Page 27.

Step 8. Funding Transaction

Following completion of an agreement and all other necessary documentation, Self-Help Enterprises will advance funding to implement the agreed upon mitigation measure(s). The applicant must complete all of Self-Help Enterprises required legal agreements before the funding transaction between Self-Help Enterprises and the Kern Subbasin is administered. Self-Help Enterprises does not carry out the mitigation measure(s) but acts as a contract coordinator and funding source between the driller/pump contractor and the applicant. The GSA in which the impacted well is located will reimburse Self-Help Enterprises for the funding for all qualifying mitigation support services, including emergency and interim supplies, and Well Mitigation Program administration. Self-Help Enterprises and the Kern Subbasin will establish a funding protocol, including the necessary documentation, for advancing funds, and may agree to deposits to maintain sustainable cashflow for Self-Help Enterprises' administration of the Well Mitigation Program. While the Kern Subbasin funds well mitigation, neither the GSA, member agencies of the GSA, nor Self-Help Enterprises will be liable or responsible for any work performed by contractors.

Step 9. Well Stewardship Education

After the physical mitigation services have commenced, Self-Help Enterprises will administer a Well Stewardship Education training to empower the applicant to maintain the mitigated well. The Well Stewardship Education training involves well and water system filtration maintenance training and financial planning guidance to save for long-term well maintenance.

STEP 1

Public Outreach & Engagement

GSAs notify Kern Subbasin well users of the new resources available to them and their community.

STEP 2

Applicant Applies for Assistance

Well owner (Applicant) applies for assistance through Self-Help Enterprises' website, phone call, or office visit.

STEP 3

Emergency & Interim Drinking Water Supplies

Self-Help Enterprises provides the household with emergency (bottled water) water and interim (hauled tank water) supplies.

STEP 4

Site Visit & Evaluation

Self-Help Enterprises field staff meet with the Applicant and perform a site evaluation. Findings are shared with the qualified technical professional in Step 5.

STEP 5

Qualified Professional Performs Technical Evaluation

Objective is to determine if the impact (1) occurred after January 1, 2015 and (2) was induced by groundwater management activities of a GSA undertaken pursuant to its adopted GSP, including projects and management actions, to manage groundwater sustainability.

STEP 6

KMEC Evaluation & Recommendation for GSA

Kern Subbasin Mitigation Evaluation Committee (KMEC) evaluates if the application is eligible and provides recommendation to GSA Board based on the findings of Step 4, Step 5, and any additional and pertinent information.

STEP 7

GSA Board Considers KMEC's Recommendation for Application Approval

This occurs at a public GSA Board Meeting in which the consideration is included on the Agenda.

STEP 8

Instances in which the Application is approved

Self-Help Enterprises Administers Long-Term Solution and GSA Reimburses Self-Help Enterprises

STEP 9

Applicant Attends a Well Stewardship Education Program Hosted by Self-Help Enterprises

The educational program is intended to empower well owners on well maintenance 101 and financial planning for well maintenance.

Figure 5. Mitigation Track Application Process (Domestic Wells)

Section 6: Dry Well Technical Assistance Track Application Process

The Well Mitigation Program includes a Dry Well Technical Assistance Track for community water system wells (including small community water systems and state small systems) that have been impacted by groundwater management activities after January 1, 2015. The Dry Well Technical Assistance Track includes up to $50,000 reimbursement funding for grant application development, contingency planning, feasibility study, or well design.[4] The application process for the Dry Well Technical Assistance Track is described below and in **Figure 7**.

Who can apply for the Technical Assistance Track?

Community Water Systems

Most drinking water users in the Kern Subbasin receive their drinking water supplies from public water systems. For purposes of this Well Mitigation Program, community water systems are defined as a public water system that serves at least 15 service connections used by yearlong residents or regularly serves at least 25 yearlong residents of the area served by the system. Owners of wells that are part of a community water system may submit an application for technical assistance. Public water system wells used exclusively for non-drinking water purposes, such as to irrigate golf courses, landscaping, parks, etc. do not qualify for technical assistance.

State Small Systems

In the Kern Subbasin, some private residences in unincorporated communities (outside of City service area limits) receive their drinking water supplies via a consolidated system of a single or multiple wells. For this Well Mitigation Program, state small systems are defined as wells or system of wells that serve at least 5, but no more than 14, service connections and does not regularly serve drinking water to more than an average of 25 individuals daily for more than 60 days out of the year.

[4] In addition to being eligible for technical assistance, the Kern Subbasin GSAs are currently looking to develop a funding assistance track for state small systems that may potentially provide state small systems up to approximately $100,000 to address a dry well, or wells at risk of becoming dry, due to groundwater management activities. It was not possible to develop a state small system funding assistance track prior to publication of the Final Plan. In the meantime, the Kern Subbasin GSAs will consider providing assistance to state small systems for dry wells on a case by case basis.

Technical Assistance Application Process

Step 1. Stakeholder Outreach

Stakeholder outreach for the Dry Well Technical Assistance Track is consistent with the stakeholder outreach outlined in the Dry Well Mitigation Track's **Step 1. Stakeholder Outreach**.

Step 2. Identify Need for Technical Assistance

Applicants must submit a complete Technical Assistance Application (**Attachment B**), and email, mail, or hand deliver the completed application to the GSA in which the impacted well is located. Contact information for each GSA is available in **Table 1**.

To identify the GSA where the well is located, see **Figure 1** for a map of the GSAs in the Kern Subbasin. For an interactive map of GSAs and location, see the SGMA Data viewer (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer) and turn on the reference layers for 2018 Bulletin 118 Basins and Groundwater Sustainability Agencies (see **Figure 6**).

For support filling out the Technical Assistance Application, the applicant should contact the appropriate GSA. If you are having trouble identifying your GSA or would prefer to identify your GSA via coordination with Kern Subbasin staff, please send an email to comments@kerngsp.com and someone will get back to you in a timely manner.

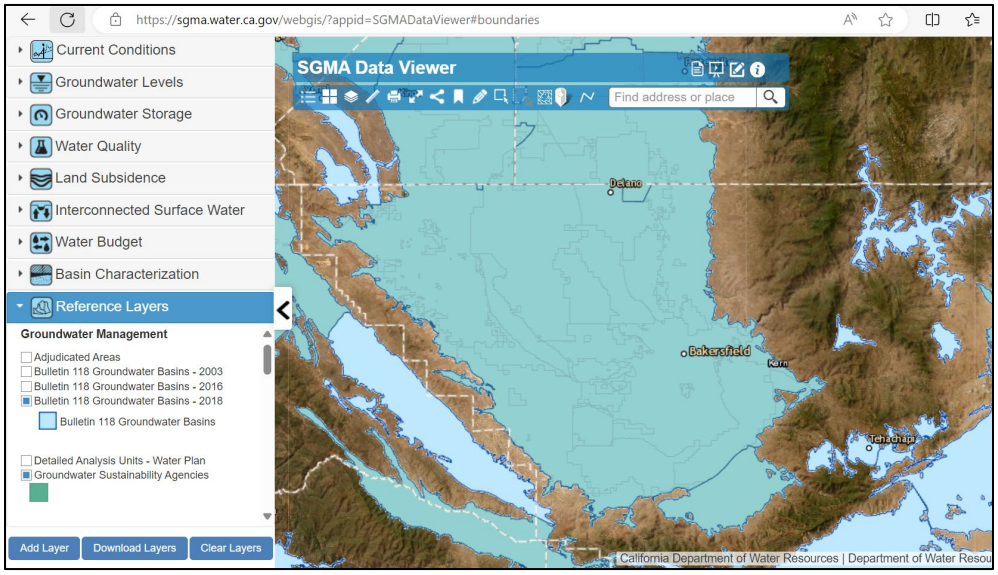

Figure 6. Guidance on Identifying GSA Identification via SGMA Data Viewer

The in-house administrative, financial, and technical resources available to state small and small community systems are often more limited than that for larger community water systems. This can hinder the ability to administer proactive measures to avoid impacts before they occur. Therefore, small community systems and state small systems may submit a proactive application to get a head-start on administering assistance in advance of a potential impact. Small community wells and state small systems who may submit a proactive application can identify if their well is at-risk via the State Water Resources Control Board's Risk Assessment Tool Dashboard : https://gispublic.waterboards.ca.gov/portal/apps/dashboards/4f7795ba4349464f9883827ad2e6b67a
The proactive application involves the same application in **Attachment B** and held to the same qualification criteria as other applications (with the revision of the highly probable impact occurring after January 1, 2015 and it being induced by groundwater management activities).

Table 1. GSA Contact Information

GSA	Address	GSA Manager and E-mail	Phone
Arvin GSA www.aewsd.org	20401 E. Bear Mountain Blvd. PO Box 175 Arvin, CA 93203	Jeevan Muhar Engineer-Manager jmuhar@aewsd.org	661-854-5573
Buena Vista GSA www.bvh2o.com	525 North Main Street PO Box 756 Buttonwillow, CA 93206	Tim Ashlock Engineer-Manager tim@BVH2O.com	661-764-2901
Cawelo Water District GSA www.cawelowd.org	17207 Industrial Farm Road Bakersfield, CA 93308	David Halopoff Assistant General Manager dhalopoff@cawelowd.org	661-393-6072
Greenfield County Water District GSA	551 Taft Highway Bakersfield, CA 93307	Nick Cooper ncooper@greenfieldcwd.org	661-831-0989
Henry Miller Water District GSA	101 W. Walnut Street Pasadena, CA 91103	Jeof Wyrick President / Chairman jwyrick@jgboswell.com	626-583-3000
Kern Non-Districted Land Authority GSA[5] (formerly Kern Groundwater Authority GSA) www.kerngwa.com	1518 Mill Rock Way, Suite 100 Bakersfield, CA 93311	Jenny Holtermann[3] Executive Director jenny@kndla.org	(661) 616-5900
Kern River GSA www.kernrivergsa.org	1000 Buena Vista Road Bakersfield, CA 93311	Daniel Maldonado Assistant Director drmaldonado@bakersfieldcity.us	661-326-3715
Kern Water Bank GSA www.kwb.org	1620 Mill Rock Way, Ste 500 Bakersfield, CA 93311	Jonathan Parker jparker@kwb.org	661-398-4900
Kern-Tulare Water District GSA www.kern-tulare.com	5001 California Ave., Ste 102 Bakersfield, CA 93309	Vanessa Yap Staff Engineer vanessa@kern-tulare.com	661-327-3132
North Kern Water Storage District GSA www.northkernwsd.com	33380 Cawelo Ave. Bakersfield, CA 93308	David Hampton General Manager dhampton@northkernwsd.com	661-393-2696
Olcese Water District GSA	15701 Hwy 178 Bakersfield, CA 93306	Jeff Siemens jsiemens@nfllc.net	661-872-5050
Pioneer GSA www.kcwa.com/	3200 Rio Mirada Drive Bakersfield, CA 93308	Michelle Anderson Geologist manderson@kcwa.com	661-634-1479
Rosedale-Rio Bravo Water Storage District GSA www.rrbwsd.com	849 Allen Road Bakersfield, CA 93314	Dan Bartel Engineer-Manager dbartel@rrbwsd.com	661-589-6045

[5] Eastside Water Management Area https://kernewma.com is covered by Kern Non-Districted Land Authority GSA. Eastside Water Management Area is managed by: Taylor Blakslee TBlakslee@hgcpm.com 661-477-3385.

GSA	Address	GSA Manager and E-mail	Phone
Semitropic Water Storage District GSA www.Semitropic.com	1101 Central Ave. Wasco, CA 93280	Jason Gianquinto General Manager jgianquinto@semitropic.com	661-758-5113
Shafter-Wasco Irrigation District GSA www.swid.org	16294 Central Valley Hwy. Wasco, CA 93280	Kris Lawrence General Manager klawrence@swid.org	661-758-5153
Southern San Joaquin Municipal Utility District GSA	11281 Garzoli Ave. Delano, CA 93215	Roland Gross General Manager/Secretary roland@ssjmud.org	661-725-0610
Tejon-Castac Water District GSA	4436 Lebec Road Lebec, CA 93243	Angelica Martin Water Resources Director amartin@tejonranch.com	661-663-4262
West Kern Water District GSA	800 Kern Street Taft, CA 93268	Greg Hammett General Manager ghammett@wkwd.org	661-763-3151
Westside District Water Authority GSA	21908 7th Standard Road McKittrick, CA 93251	Mark Gilkey General Manager mgilkey@westsidewa.org	661-633-9022
Wheeler Ridge-Maricopa GSA	12109 Highway 166 Bakersfield, CA 93313	Sheridan Nicholas Engineer-Manager snicholas@wrmwsd.com	661-527-6075

Step 3. Meeting with Applicant and GSA Staff

Within 10 days of submittal of the application, staff of the GSA in which the impacted well is located will contact the applicant to schedule a meeting to discuss the impact, additional data and information needed and application review process. Notes and information from this meeting will be shared with the qualified professional in Step 4.

Step 4. Technical Assistance Needs Assessment

A qualified professional (e.g., PG, CHg, PE), arranged by the GSA in which the impacted well is located, will perform a field and desktop assessment to identify the likely cause of impact and identify if the application qualifies for technical assistance under the Well Mitigation Program's qualification criteria. **Attachment A** and the **Section 10: Criteria for Determining if the Impact is within the Scope of Responsibility of the Kern Subbasin GSAs** provides considerations for the assessment.

The findings and recommendations from this evaluation will be documented and shared with the KMEC.

Step 5. Funding Qualification Assessment

The KMEC (**Figure 4**) will meet and prepare a recommendation regarding (1) qualification for technical assistance and (2) the needed technical assistance based on the findings from Step 4.

Options for technical assistance include, but are not limited to:

1. Grant application preparation
2. Well Design
3. Contingency Plan Development
4. Feasibility Plan Development

5. With the consent of the applicant and GSA in which the impacted well is located, an alternative form of technical assistance (in an amount up to $50,000)

These recommendations will be prepared and presented to the GSA Board in Step 6.

Step 6. GSA Board Approval for Funding

The Board of Directors of the GSA in which the impacted well is located will review the recommendations from the KMEC. Where the KMEC and Board of Directors determine the application does not qualify for assistance, that GSA will notify the applicant of the determination and the technical basis for it. Where the application does qualify, the GSA in which the impacted well is located will notify the applicant of the proposed technical assistance amount (i.e., up to $50,000) awarded, which will be reimbursed in Step 8. The GSA in which the impacted well is located may provide funding up-front or contract the reimbursement directly with the qualified professional performing the technical assistance (up to $50,000) instead of the well owner upon a showing of financial hardship by the applicant.

Step 7. Technical Assistance and Indemnification Selection Agreement

Following approval by the GSA in which the impacted well is located, the GSA and applicant will enter into an agreement acknowledging the amount of funding, intent of use, and indemnification for liabilities. This step must be completed prior to funding. A conceptual example of an indemnification agreement is included in **Attachment C** for context purposes. The actual agreement may vary on a case-by-case basis based on the particular situation.

Step 8. Funding Transaction

After the applicant and GSA in which the impacted well is located complete all necessary agreements, the applicant will proceed with the agreed upon technical assistance. The qualifying applicant must submit all invoicing information to be entitled to reimbursement. The GSA in which the impacted well is located will reimburse the agreed upon amount (Step 6 and Step 7) within 45 days of receiving the invoice from the qualifying applicant.

STEP 1

Public Outreach & Engagement

GSAs notify Kern Subbasin well users of the new resources available to them and their community.

STEP 2

Applicant Applies for Technical Assistance

Applicant emails or mails the GSA a filled-out Technical Assistance Application.

**Note: Applicants representing community wells may submit an Application in advance of an impact if the community well is at-risk of going dry as identified by the SWRCB risk assessment tool.*

STEP 3

Meeting with GSA Staff and Applicant

The meeting includes an overview of the qualification criteria, review of the application, and discussion of the impact.

STEP 4

Qualified Professional Performs Technical Evaluation

Objective is to determine if the impact (1) occurred after January 1, 2015 and (2) was induced by groundwater management activities of a GSA undertaken pursuant to its adopted GSP, including projects and management actions, to manage groundwater sustainability. This evaluation may include a site visit and evaluation.

STEP 5

KMEC Evaluation & Recommendation for GSA

Kern Subbasin Mitigation Evaluation Committee (KMEC) evaluates if the application is eligible and provides recommendation to GSA Board based on the findings of Step 4, Step 5, and any additional and pertinent information.

STEP 6

GSA Board Considers KMEC's Recommendation for Application Approval

This occurs at a public GSA Board Meeting in which the consideration is included on the Agenda.

STEP 7

Instances in which the Application is approved

GSA and Approved Applicant Enter an Indemnification Agreement

STEP 8

Instances in which the Application is approved

Approved Applicant sends GSA Invoice for Technical Assistance Services for GSA to Reimburse

Reimbursement is up to $50,000. GSAs have discretion to reimburse directly with a qualified technical professional in instances in which the Applicant represents a Disadvantaged Community.

Figure 7. Technical Assistance Track Application Process (Community and Municipal Wells)

Section 7: Degraded Water Quality Mitigation Track Application Process

The Degraded Water Quality Mitigation Track applies to domestic drinking water wells. This section describes the Degraded Water Quality Mitigation Track, which includes interim supplies, and long-term solutions for domestic wells and multi-use domestic wells impacted by Degraded Water Quality as determined through the Exceedance Policy and/or through this Well Mitigation Program. The application process for the Degraded Water Quality Mitigation Track is explained below and in **Figure 8**.

Who can apply under the Mitigation Track?

Private Domestic Well Owners[6]

In the Kern Subbasin, private residences in some unincorporated and unconsolidated small communities and rural portions of the County rely on private wells to meet their domestic water supply needs. Households relying on individual domestic wells for their water supply may apply for assistance under the Degraded Water Quality Mitigation Track. For purposes of this Well Mitigation Program, domestic wells are defined as wells with at maximum four household connections for drinking water purposes.

Multi-Use Drinking Water Wells (Agricultural Well Owners Using Agricultural Wells for Domestic Supply)

Some private well owners use their wells for both domestic potable supply to a residence and irrigation. Households relying on these wells for drinking water supply may apply for assistance under the Degraded Water Quality Mitigation Track. For purposes of this Well Mitigation Program, multi-use drinking water wells are defined as wells used for both agricultural and domestic household purposes with a maximum of four service connections.

Degraded Water Quality Mitigation Track Application Process

Step 1. Public Outreach & Engagement

Public participation and communication are critical to implementing an effective Well Mitigation Program. Stakeholder outreach is organized into three phases: (1) Program development, (2) initial notification, and (3) ongoing outreach.

Phase 1: Program Development. Stakeholder outreach for the Degraded Water Quality Mitigation Track builds on the stakeholder outreach outlined in the Dry Well Mitigation Track's **Step 1. Stakeholder Outreach**. For the Degraded Water Quality Mitigation Track, the Kern Subbasin intends to conduct

[6] Wells used for drinking water purposes that have four or less connections are considered 'domestic' wells in this program. Wells with more than four connections used for drinking water purposes are considered state small systems or community water systems (depending on the connection count).

additional outreach to local advocacy drinking water groups to explain the program and obtain additional feedback as soon as possible, and prior to September 2025.

Phase 2: Initial Notification. Following adoption of the Version 2.0 Well Mitigation Program that includes the Degraded Water Quality Mitigation Track, the Kern Subbasin will conduct an outreach campaign to notify residents within the Plan Area of this new program. Outreach activities include: (1) an email blast to all landowners and participants on the Kern Subbasin's interested parties lists and (2) flyers posted in community spaces across the Kern Subbasin. Community spaces include school district buildings, libraries, community centers, and other public locations. The flyers can be made available in English and Spanish, as needed.

Phase 3: Ongoing Outreach. The GSAs will maintain public awareness of the Degraded Water Quality Mitigation Track by providing direct notice to domestic well owners of record located generally within a 3-mile radius when a RMW-WQ exceeds a Minimum Threshold for a COC, the Minimum Threshold exceedance is found to be caused by GSA actions during the MT Exceedance Investigation, and the domestic well is *assumed* to also be degraded due to GSA projects and management actions (Appendix K). Further, general notice of the program will be maintained on GSA websites, and will be continually highlighted at stakeholder meetings and events and in coordination with similar outreach initiatives taking place in the Kern Subbasin. This ongoing outreach includes coordination with Kern Water Collaborative, who will publicize the Degraded Water Quality Mitigation Track as part of the existing Memorandum of Understanding between the Kern Subbasin and the Kern Water Collaborative. All ongoing outreach can be made available in English and Spanish, as needed.

Step 2. Applicant Applies for Assistance

Applicants who believe they may have Degraded Water Quality must first submit an application for mitigation to the appointed Single Point of Contact for the Kern Subbasin. The Kern Subbasin will provide information with respect to the process for submitting an application on all relevant websites and in notices to domestic well owners of record per the Exceedance Policy, as applicable. The applicant's submittal of the application will initiate the review process and determination of eligibility.

Due to existing laws limiting site access, applications must be submitted by landowners on whose property the potentially adversely impacted well is located; however, in the event a tenant believes they may have degraded drinking water, the tenant well user is encouraged to contact the Kern Subbasin, and the Kern Subbasin will work with the tenant to notify the well owner of how to apply for mitigation and the benefits of the Degraded Water Quality Mitigation Track.

For questions on the applications process or tenant questions on advocating for mitigation support with a landlord(s), a tenant well user should contact the local GSA (**Table 1**).

Step 3. Domestic Well Assessment

For Step 3, The Kern Subbasin intends to enter into an agreement with an appropriate contractor/entity (e.g., Self-Help Enterprises) to sample and analyze the domestic well, and provide short-term drinking water if necessary. If the domestic well does not exceed primary MCLs for any of the Kern Subbasin COCs, no further steps apply as it relates to the Kern Subbasin's Degraded Water Quality Mitigation Track. However, non-related exceedances of primary MCLs may be eligible for assistance from other, unrelated programs.

As part of Step 3, the contractor/entity engaged to sample and analyze the domestic well will also be engaged to conduct further well evaluation and recommend a potential long-term mitigation measure

for the domestic well, if necessary. This includes conducting a site inspection of the well to evaluate sources of contamination that may be causing degraded water quality (e.g., septic system near domestic well). Translation services for Spanish and Punjabi can be made available, as needed. Following the assessment, the contractor/entity performing the initial assessment would provide the documentation and findings to the Kern Subbasin designated qualified professional for further evaluation and assessment.

Step 4. Qualified Professional Performs Technical Evaluation

The Kern Subbasin will designate a qualified professional (e.g., PG, CHg, PE) (or professionals) to perform a technical evaluation of the information provided from the contractor/entity that performed Step 3 and 4. For this technical evaluation, the qualified professional will evaluate historical groundwater conditions, readily available data and information, and conduct a case-by-case evaluation using the factors identified in the Exceedance Policy for MT exceedance investigations. This evaluation may be more limited if the domestic well is one that has been identified as a well *assumed* to be degraded due to GSA projects and management actions per the Exceedance Policy (Appendix K). The qualified professional will also evaluate the recommended long-term mitigation measure proposed by the contractor/entity. The qualified professional's evaluation, findings, and recommendation will be documented and shared with the GSA in which the impacted well is located and with the KMEC, who will further evaluate recommended long-term mitigation measures (Step 5).

In instances in which the application does not qualify for mitigation based on the evaluation from the qualified professional, this information and the supporting documentation will be shared with the contractor/entity. The KMEC may reevaluate the determination of disqualification in Step 5 and override the recommendation for disqualification made by the qualified professional.

See **Attachment A** and the **Section 10: Criteria for Determining if the Impact is within the Scope of Responsibility of the Kern Subbasin GSAs** for more information on the type of data and information to be considered and assessed during this step.

Step 5. KMEC Evaluation and Recommendation for GSA

Where the application is determined to be qualified for mitigation in Step 5, the KMEC evaluates the findings and recommendations of the qualified professional and the recommended mitigation measure(s). The KMEC prepares an agreed upon recommendation of (1) proposed mitigation measure(s) and (2) estimated costs associated with administration, assessment, interim supplies, and physical mitigation to be shared with the Board of Directors of the GSA in which the impacted well is located to consider for funding approval in Step 7.

The KMEC's recommendation for long-term mitigation may include, but is not limited to:

- Installation of a Point of Use or Point of Entry treatment system – depending on the level and presence of primary MCLs
- Construct a new well
- Consolidation with an existing water system in the vicinity
- With the consent of the applicant, providing other acceptable means of mitigation

The GSA, in coordination with an appropriate qualified professional, in which the impacted well is located will consider each application on a case-by-case basis to identify the most effective interim and long-term mitigation measure(s).

In instances in which the application was disqualified in Step 5, the KMEC will evaluate the basis for that determination. The KMEC has authority to override this determination and recommend mitigation to the GSA Board of Directors in Step 6.

In cases where the application does not meet the qualification criteria as determined by the qualified professional and the KMEC, the applicant may qualify for mitigation support via other programs administered by Self-Help Enterprises or others.

Step 6. GSA Board Considers KMEC's Recommendation for Application Approval

Where an application qualifies for mitigation reimbursement, as determined by the KMEC, the qualified professional from Steps 4 and 5 will present to the Board of Directors of the GSA in which the impacted well is located the findings from Step 4, and the KMEC's recommendation on (1) mitigation qualification, (2) proposed mitigation measure to be financially reimbursed, and (3) costs associated with the reimbursement.

The Board of Directors of the GSA, in which the impacted well is located, will consider the approval of mitigation funding reimbursement.

The Well Mitigation Program includes an Appeal Process in the event the applicant disagrees with the determination of the qualified professional, KMEC, or respective GSA Board of Directors. More information is available in the **Section 8: Appeal Process** on Page 27.

Step 7. Funding Transaction

To implement all or parts of the Degraded Water Quality Mitigation Track, the Kern Subbasin intends to enter into an agreement with a contractor/entity (e.g., Self-Help Enterprises) that will address funding processes to implement the agreed upon mitigation measure(s). Such agreement or agreements may include direct financial support for the services to be provided or an agreement to reimburse the contractor/entity that is performing such services, including qualifying mitigation support services like emergency and interim supplies, and Well Mitigation Program administration.

Step 8. Well Stewardship Education

After physical mitigation services have commenced, the contractor/entity may be asked to offer Well Stewardship Education training, as applicable, to empower the applicant to maintain the mitigated well or maintain treatment systems that may be installed at the well or in the home. The Well Stewardship Education training may include well and water system filtration maintenance training and financial planning guidance to save for long-term well maintenance. As applicable, mitigation awarded for groundwater quality may include providing the applicant with 3-years of filters to ease the initial financial burden of the treatment system's stewardship.

STEP 1

Public Outreach & Engagement

GSAs notify Kern Subbasin well users of the new resources available to them and their community.

STEP 2

Applicant Applies for Assistance

Well owner (Applicant) applies for assistance through the single point of contact for the Kern county subbasin

STEP 3

Domestic Well Assessment

Applicant enters agreement with contractor to sample/analyze well water and provide short-term drinking water supplies (if necessary). If there is no primary MCL exceedance, then no further action is needed. If a primary MCL is exceeded, then a field assessment is also included in documentation that isprovided to the qualified progressional in Step 4.

STEP 4

Qualified Professional Performs Technical Evaluation

Objective is to determine if the impact (1) occurred after January 1, 2015 and (2) was induced by groundwater management activities of a GSA undertaken pursuant to its adopted GSP, including projects and management actions, to manage groundwater sustainability.

STEP 5

KMEC Evaluation & Recommendation for GSA

Kern Subbasin Mitigation Evaluation Committee (KMEC) evaluates if the application is eligible and provides recommendation to GSA Board based on the findings of Step 4, Step 5, and any additional and pertinent information.

STEP 6

GSA Board Considers KMEC's Recommendation for Application Approval

This occurs at a public GSA Board Meeting in which the consideration is included on the Agenda.

STEP 7

Instances in which the Application is approved

Funding Transaction

STEP 8

Well Stewardship Education Program

Applicant is required to attend an educational program is intended to empower well owners on well maintenance 101 and financial planning for well maintenance.

Figure 8. Degraded Water Quality Mitigation Track Application Process (Domestic Wells)

Section 8: Appeal Process

If an applicant disagrees with the mitigation proposed by a GSA, the applicant may submit a request for appeal to the GSA's Board of Directors. This can be arranged by contacting the GSA in which the application was processed and requesting the appeal be placed on an agenda for an upcoming GSA's Board of Directors meeting. The applicant must provide sufficient technical documentation to support the appeal. 'Sufficient technical documentation' means enough data and information for the qualified professional and KMEC to effectively evaluate the application. This includes:

(1) well construction information such as well depth, perforated intervals, casing size, inclusion of a compression sleeve;

(2) well sampling data and information that may be available;

(2) well operation information such as well maintenance and electrical records;

(3) site information such as specific well location, septic location (if relevant), and any additional pertinent land use information; and

(4) photos and access to the site for an in-person assessment.

Because the Kern Subbasin funded a similar, robust technical analysis performed by a qualified technical professional (PG, CHg, or PE) in the application process evaluation phase, it is the applicant's responsibility to fund any additional technical analyses necessary to support the applicant's appeal.

The appeal must be submitted within 30 days of the GSA's Board of Directors determination (Step 7 in the Dry Well and Degraded Water Quality Mitigation Tracks and Step 6 in the Dry Well Technical Assistance Track). The GSA's Board of Directors must include the appeal for consideration at the next regularly scheduled Board meeting or within 45 days of being notified by the applicant of an appeal, whichever is sooner.

During the GSA Board meeting when the appeal is heard, the applicant (or a representative for the applicant) must present the technical basis for the appeal. The GSA Board shall either (1) agree to qualify the application or (2) refer the application and appeal documentation to the KMEC for further evaluation. The KMEC's recommendation based on the appeal documentation and initial application will be provided to the Board of Directors of the GSA to consider at an upcoming GSA Board meeting.

When the appeal is referred to the KMEC, the KMEC may revise its recommendation or affirm its existing recommendation and shall document the technical components explaining the evaluation for its determination.

The KMEC's recommendation following evaluation of the appeal will be documented and submitted to the GSA Board of Directors for reconsideration at the next Board meeting.

As with all elements of the Well Mitigation Program, the appeal (and dispute resolution) protocols are subject to revision as lessons are learned through Well Mitigation Program implementation.

Section 9: Application Privacy

Once an application and subsequent information is provided to a GSA, it becomes subject to the California Public Records Act, which may require public disclosure of the information on request. If an

applicant is concerned about sensitive information requested in the application process, the applicant should contact the GSA to discuss data and information-sharing confidentiality solutions.

Section 10: Criteria for Determining if the Impact is within the Scope of Responsibility of the Kern Subbasin GSAs

Not all impacts to wells fall within the scope of responsibility for GSA mitigation. For example, a well experiencing an electrical or mechanical failure may be due to reasons independent of groundwater management activities. Therefore, qualification criteria were established to determine if an application falls within GSA responsibility. The qualification criteria under this Well Mitigation Program are explained in **Figure 3**.

This section describes the technical considerations to be made during the qualified professional's evaluation in Step 4 of the three Program tracks' application processes.

Groundwater Level Impacts

Groundwater pumping in overdraft results in systemic, long-term lowering of groundwater levels. In a water well, if the groundwater levels decline such that a pump in the well is no longer adequately submerged, the pump may not operate correctly. Further lowering of groundwater levels below the pump's intake will render the pump inoperable. If there is no room to further lower the pump in the well, the well is considered dry (**Figure 9**). DWR released a guidance document in March 2023 detailing additional considerations to identify adverse impacts to drinking water wells, which has informed this Well Mitigation Program.[7]

During the funding qualification assessment step of the application process, groundwater pumping in overdraft will need to be distinguished from seasonal and longer-term precipitation patterns (e.g., drought, non-chronic lowering of groundwater levels). These differences can be distinguished through an analysis of groundwater level hydrographs for representative monitoring wells in the vicinity of the application of impact.

The total well depths across the Kern Subbasin for different well types (domestic, small community, M&I) are depicted in **Figure 10**, **Figure 11**, and **Figure 12**.

It is important to note that the Kern Subbasin has protocols to address instances of Representative Monitoring Site exceedances of minimum thresholds. Those exceedance protocols initiate actions to avoid significant and unreasonable impacts and notify nearby households of the exceedance. These are detailed in Appendix K of the 2025 GSP.

[7] DWR. March 2023. Considerations for Identifying and Addressing Drinking Water Well Impacts. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Files/Considerations-for-Identifying-and-Addressing-Drinking-Water-Well-Impacts_FINAL.pdf

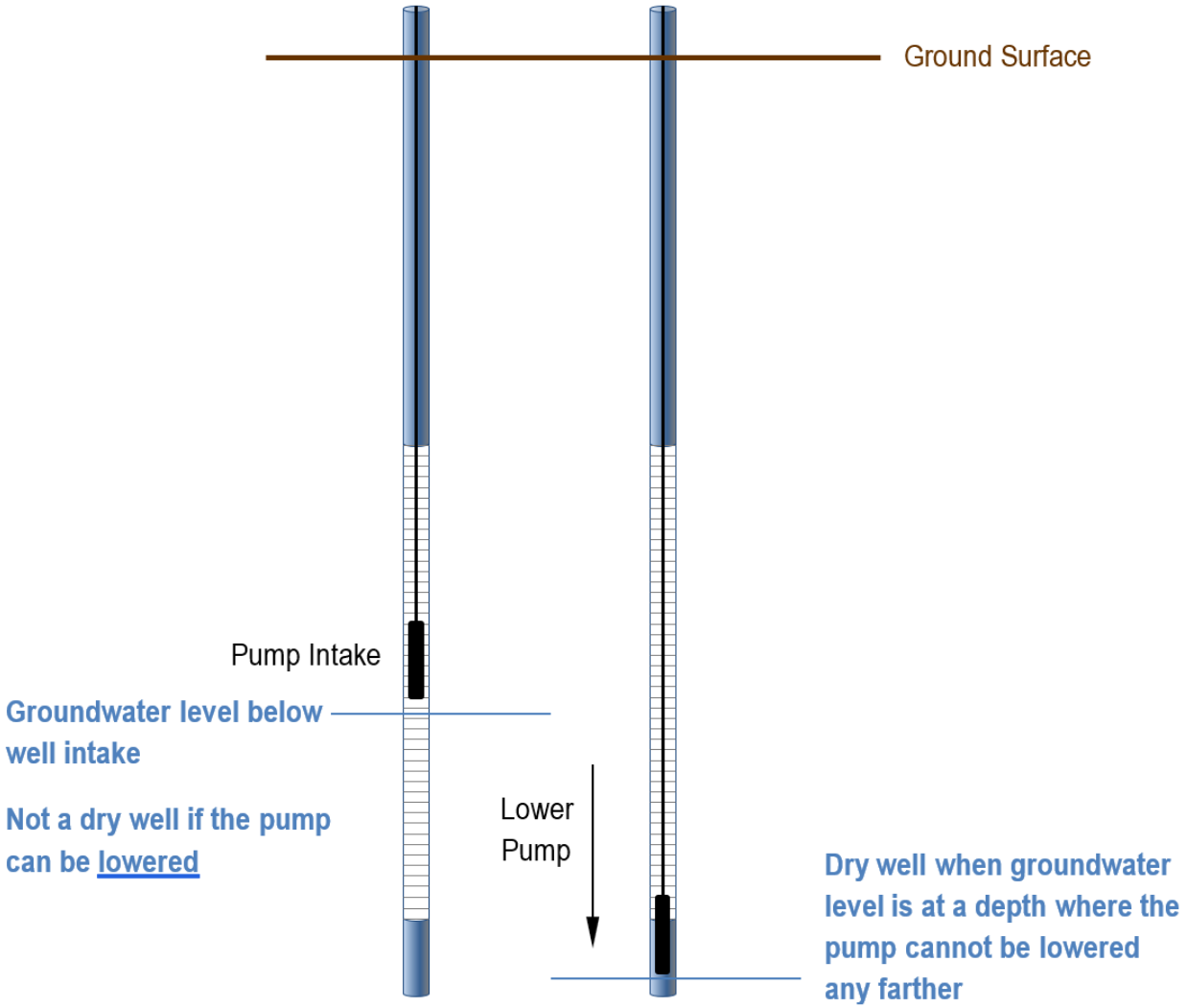

Figure 9. Groundwater Levels Relative to Pump Intake and Bottom of Well

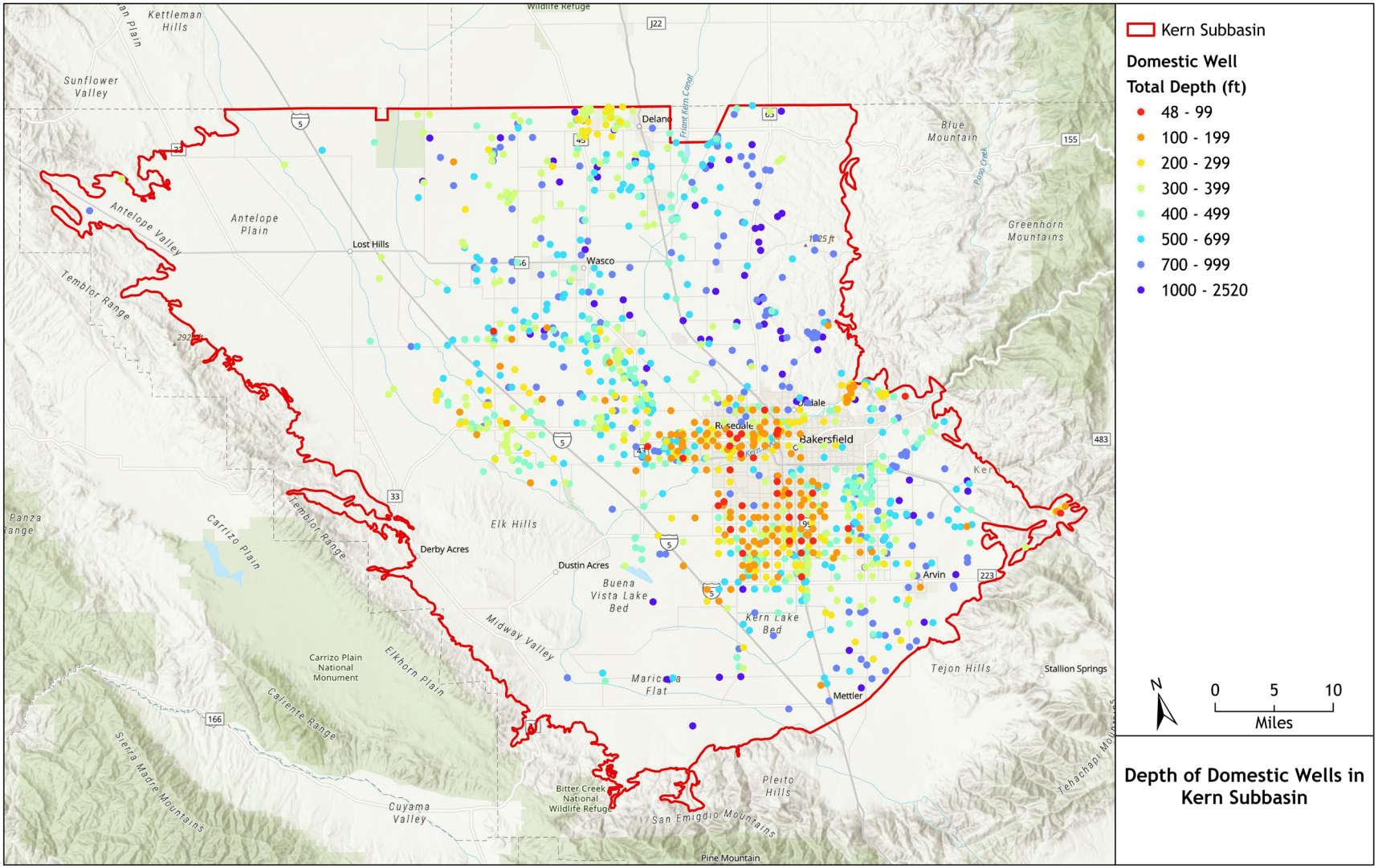

Figure 10. Domestic Well Depths in the Kern Subbasin (as of November 2024)

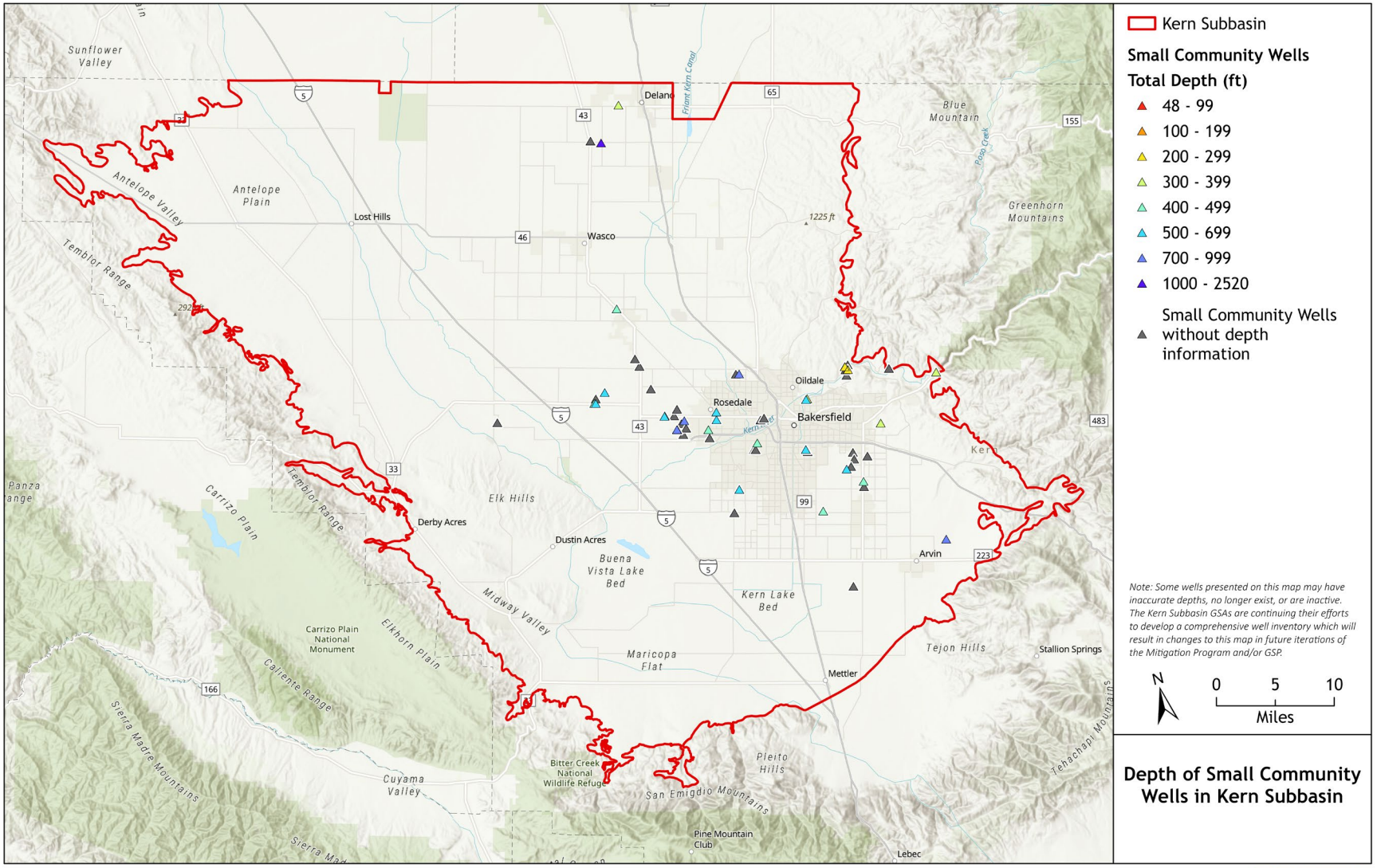

Figure 11. Small Community Well Depths in the Kern Subbasin (as of November 2024)

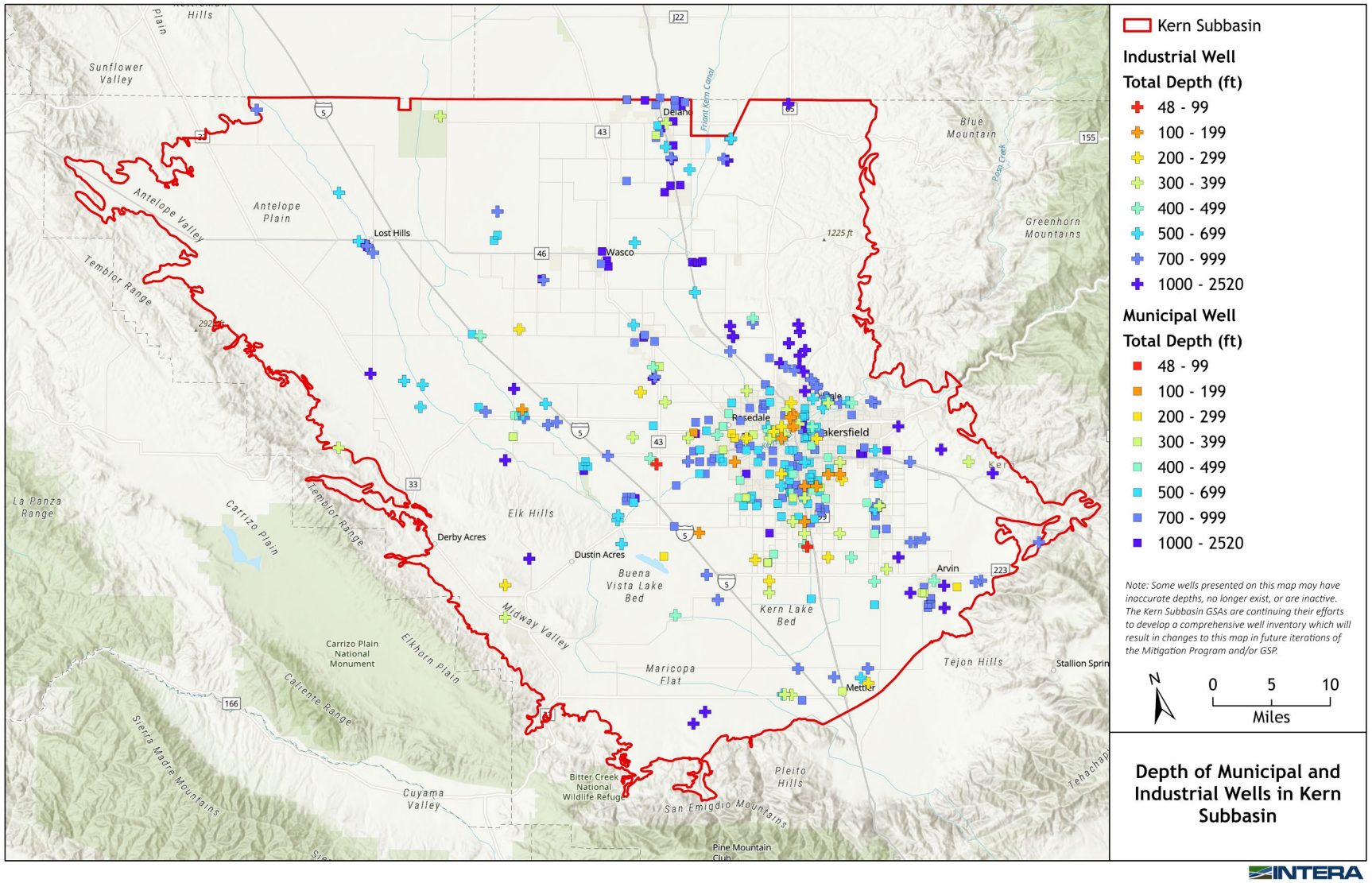

Figure 12. Municipal & Industrial Well Depths in the Kern Subbasin (as of November 2024)

Subsidence Impacts

Land subsidence has been documented within the San Joaquin Valley over both historical and recent timeframes, with the greatest documented subsidence within the Kern Subbasin occurring in the northern portion of the Subbasin (**Figure 13**).

Land subsidence rates within the Kern Subbasin range from 0 to 0.3 feet per year resulting in a cumulative land subsidence of 0 to 2.41 feet since 2015, as of 2023. The risk to wells related to land subsidence is well collapse or physical failure (**Figure 14**). Many irrigation and municipal wells within subsidence-prone regions of the San Joaquin Valley include a compression sleeve. The compression sleeve can withstand 9 to 12 feet of additional subsidence from the point of construction. Therefore, the limited land subsidence in the Kern Subbasin (and projected limited land subsidence) is not expected to result in well failures due to land subsidence.

It is important to note that the Kern Subbasin has protocols to address instances of Representative Monitoring Site exceedances of minimum thresholds. Those exceedance protocols initiate actions to avoid significant and unreasonable impacts. These are detailed in Appendix K (Attachment K-1) of the 2025 Plan.

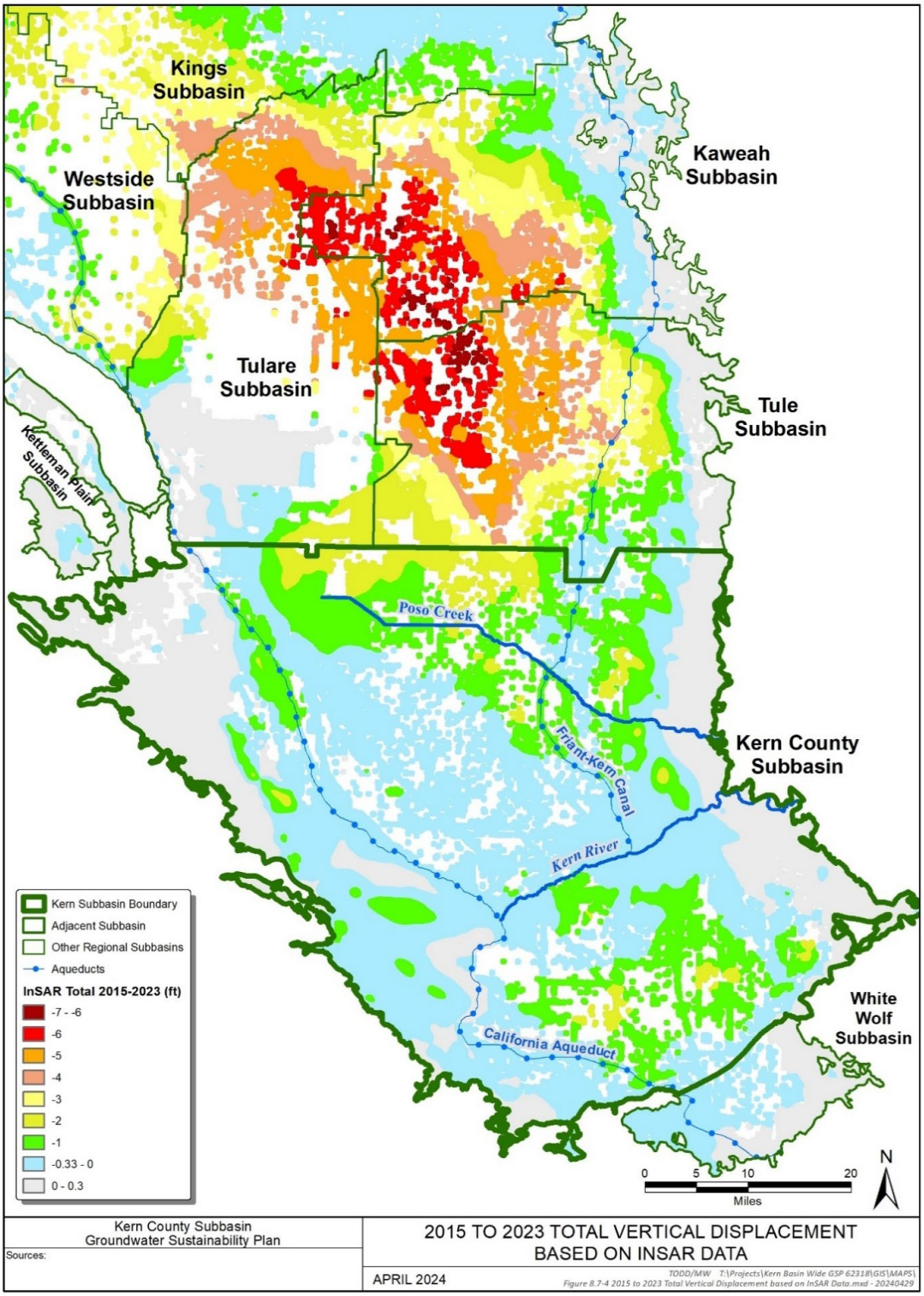

Figure 13. Cumulative Subsidence between 2015 – 2023 (ft) based on InSAR data

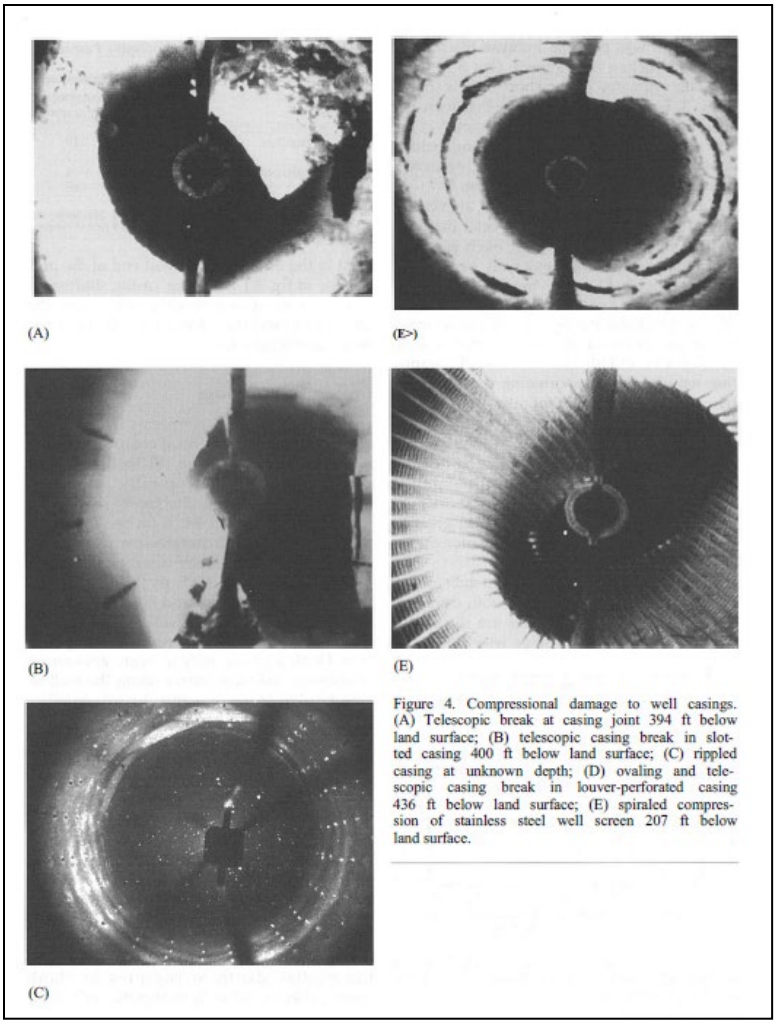

Figure 14. Well Damage Attributed to Subsidence (Borchers et al., 1998)

Groundwater Quality Impacts

Groundwater level changes have been shown in some cases to degrade groundwater quality. While most groundwater meets drinking water standards, some groundwater can contain high concentrations of arsenic, nitrate, nitrite, and 1,2,3-Trichloropropane (1,2,3-TCP), which are all have associated primary MCLs.[8] In addition to these constituents, the Kern Subbasin also includes uranium as a COC. . Note, the application must meet the qualification criteria of the impact having occurred after January 1, 2015, and degraded water quality in the domestic well must be due to groundwater management activities, as determined through implementation of the Minimum Thresholds Exceedance Policy or as part of the Well Mitigation Program's determination of eligibility.

The Degraded Water Quality Mitigation Track is intended to mitigate or provide technical assistance for adverse impacts associated with groundwater management activities; therefore, groundwater quality issues must be related to chronic lowering of groundwater levels, degradation caused by localized recharge and banking activities, or other groundwater management activity that results in increases in concentrations of COC in groundwater to be considered for mitigation qualification, as determined through implementation of the Minimum Thresholds Exceedance Policy (Appendix K), or through the technical evaluation performed under Step 5 of the Degraded Water Quality Mitigation Track.[9] Ultimately, determinations of Degraded Water Quality will need to be a case-by-case evaluation considering a number of factors.

Essential factors for consideration include, but are not limited to:

(1) An exceedance [or exceedances] of a Minimum Threshold at a Representative Monitoring Well for Water Quality (RMW-WQ) as set forth in the 2025 GSP;

(2) The COC is a primary MCL – not a secondary MCL;

(3) Location of the domestic well(s) in relationship to the RMW-WQ and location in relationship to GSA projects and management activities;

(4) Baseline water quality conditions that existed or may have existed prior to January 1, 2015, to determine if degradation occurred prior to January 1, 2015, for the COC;

(5) Whether groundwater management activities are related to ongoing, standard basin operations that are consistent with operations taking place prior to 2015; or,

(6) If the presence of the constituents/contaminants in the aquifer are due to the actions of others that are likely responsible parties.

Degraded groundwater quality may be related to groundwater management activities if the changes in groundwater levels has a direct correlation with introduction of a new COC or significant increase in concentration of a COC from 2015 or earlier conditions. The causation and correlations of changes in groundwater quality are to be considered during the mitigation need assessment and funding qualification assessment phases of the mitigation application process. Groundwater quality increasing

[8] Descriptions of constituents of concern as described in the Kern Subbasin GSP.
[9] Potential causes of Undesirable Results for degraded groundwater quality are listed in the Kern Subbasin Groundwater Sustainability Plan.

and decreasing trends since pre-2015 conditions can be assessed using trend analyses such as the Mann-Kendall Trend test.

With respect to groundwater quality conditions, the Kern Subbasin will also coordinate with other state and local agencies that have some level of regulatory oversight, control, or involvement with ensuring that drinking water in the Kern Subbasin meets appropriate drinking water standards. These coordination efforts are explained in the Degraded Water Quality Implementation Provisions and are not repeated here (Appendix K-2). Moreover, the Kern Subbasin is actively coordinating with the Kern Water Collaborative, a nonprofit organization focused on nitrate issues within the Kern Subbasin. The Kern Water Collaborative and Kern Subbasin have entered a Memorandum of Understanding to further establish their complementary roles in managing groundwater resources and domestic well protections in the Kern Subbasin. For example, the Kern Water Collaborative offers free nitrate testing for domestic wells within Priority 2 management zone areas, which can support a domestic well owner in identifying the need for mitigation via this Well Mitigation Program. Additionally, data from these domestic wells can be useful in Kern Subbasin groundwater management analyses and decision-making.

Notably, the Kern Subbasin has protocols to address instances of Representative Monitoring Site exceedances of minimum thresholds. Those exceedance protocols initiate actions to avoid significant and unreasonable impacts and notify nearby domestic well owners of record of the exceedance. These notice procedures are detailed in the Exceedance Policy (Appendix K) and explained in the Degraded Water Quality Implementation Provisions (Appendix K-2).

Section 11: Mitigation Funding and Anticipated Costs

The Well Mitigation Program budget for the Kern Subbasin is up to an aggregate of $3.5 million for the combined first two years of implementation. This cost estimate includes mitigation of qualifying dry wells, reverse-osmosis systems for qualifying groundwater quality-based applications (including filter replacement for three years), technical assistance for other drinking water well types, uncertainty buffers[10], GSA administration of the Well Mitigation Program, as well as Self-Help Enterprises' administration of the Dry Well Mitigation and Dry Well Technical Assistance Tracks of the Well Mitigation Program.

The mitigation cost and budget will be reevaluated every 2 years (or more frequently, if necessary) by the Kern Subbasin.

The Kern Subbasin's mitigation budget is informed by cost estimates generated by the Kern Subbasin's Dry Well Susceptibility Analysis.[11] The Dry Well Susceptibility Analysis identified potentially at-risk wells by use type across the Kern Subbasin. All potentially at-risk domestic wells were assumed to receive mitigation of $90,000 per well (well replacement with all associated emergency/interim supply and administrative costs included). Potentially at-risk other drinking water well types were assumed to receive the maximum technical assistance award of $50,000 per well.

Note, the $3.5 million mitigation budget includes funding for uncertainty in the analysis, inflation, and climate change as well as funding for program administration, application evaluation, and mitigation for groundwater quality impacts as well as the funding for mitigation and technical assistance for dry wells.

The funding mechanism for each GSA comes from its existing fee and GSA funding structures. All participating GSAs have mitigation funding as appropriate for their GSA to meet the $3.5 million Kern Subbasin budget requirement.

The Kern Subbasin will use an impact-attribution based funding structure once the development of the attribution-based analytical tool(s) is complete. Once the tool is developed, it will be used to "true-up" mitigation funding provided under this mitigation program prior to the completion of the tool development. This will require the GSA responsible for the impact to fund the mitigation. More information on this impact-attribution based structure will be provided in future versions of this Well Mitigation Program, as the analytical tools required to perform the attribution analyses become available.

The Kern Subbasin will continue to explore grant funding at the State and federal levels to support program funding opportunities. The State of California has many existing grant programs for community water systems and well construction funding; however, the State's Safe and Affordable Funding for Equity and Resilience (SAFER) Program funding will not be relied upon by the Kern Subbasin for mitigation of domestic well impacts due to groundwater management activities. County, State, and Federal assistance may be needed to best maximize the Well Mitigation Program in conjunction with programs that are developed to address similar issues (i.e. degraded water quality) to SGMA, such as

[10] An uncertainty buffer refers to monies reserved for uncertainty in available data, information, and analytical tools used to develop the cost estimates which informed the Mitigation Program budget. This uncertainty includes consideration for external factors, such as climate change and changes in state and federal policies affecting surface water allocations.
[11] Appendix Q of the Kern Subbasin Groundwater Sustainability Plan

CV-SALTS. The Kern Subbasin will also work with local non-governmental organizations that may be able to aid or seek grant monies to assist Well Mitigation Program implementation.

Attachment A

Application Process – Technical Evaluation Considerations

Application Process – Technical Evaluation Considerations

The Technical Evaluation Consideration is intended to determine if the impacted well is within the scope of the Kern Subbasin responsibility for funding, or if the impact was induced by activities outside of the scope of SGMA and therefore shall be mitigated via existing alternative programs. Self-Help Enterprises administers mitigation services for wells qualifying for Kern Subbasin GSA's Well Mitigation Program and alternative programs.

TECHNICAL IMPACT ASSESSMENT

GSA's Assigned Qualified Technician to Perform Desktop Assessment:

Applications related to chronic lowering of groundwater levels

GSA to review:
Historical static groundwater levels.
Historical pumping groundwater levels.
Well operation and maintenance history.
Well construction history.
Historical monthly production volume.
Potential for consolidation to public water system.
Nearby historical land and water use.
Depth to bedrock.
Nearby conjunctive use activity.
Well depth, perforated intervals, pump depth.

Applications related to degraded water quality

GSA to review:
Historical groundwater quality at well.
Historical groundwater quality at nearby wells.
Historical static groundwater levels.
Historical pumping groundwater levels.
Well operation and maintenance history
Well construction history.
Historical monthly production volume.
Potential for consolidation.
Nearby historical land and water use.
Depth to bedrock.
Nearby conjunctive use activity.
Well depth, perforated intervals, pump depth.

Applications related to land subsidence

GSA to review:
Historical InSAR data.
Historical static groundwater levels.
Historical pumping groundwater levels.
Operation and maintenance history.
Construction history.
Historical monthly capacity.
Potential for consolidation.
Nearby historical land and water use.
Depth to clay or usable water.
Nearby conjunctive use activity.
Well depth, perforated intervals, pump depth.
Photos of physical damage.
Original well/infrastructure survey/design.

GSA's Assigned Qualified Technician to Perform Field Assessment:

GSA may perform the following:
(1) Pull pump and measure pump intake depth, well bottom, static water level.
(2) Modify wellhead to install sounding port to measure static and pumping level.
(3) Modify wellhead to install flowmeter(3) Modify wellhead to install flowmeter.
(4) Conduct video log.
(5) Investigate site to inform estimated water demand.
(6) Investigate nearby land and water use(6) Investigate nearby land and water use.
(7) Investigate site for consolidation feasibility.

GSA may perform the following:
(1) Pull pump and measure pump intake depth, well bottom, static water level.
(2) Modify wellhead to install sounding port to measure static and pumping level.
(3) Modify wellhead to install flowmeter.
(4) Conduct video log.
(5) Collect water quality samples at Applicant's well.
(6) Collect water quality samples at wells nearby impacted well.
7) investigate site for consolidation feasibility.
8) Investigate site and nearby land use for source of water quality impact.

GSA to assess:
(1) Evidence of ground fissures consistent with subsidence.
(2) Visible casing collapse, damage, or protrusion attributable to subsidence.

For well Applications, the GSA may perform the following:
(1) Pull pump and measure pump intake depth, well bottom, static water level.
(2) Modify wellhead to install sounding port to measure static and pumping level.
(3) Modify wellhead to install flowmeter.
(4) Conduct video log.

GSA may request additional data and information. GSA may reach out to original driller or design engineer to confirm information provided.

Mitigation Application proceeds to Qualification phase.

Attachment B

Technical Assistance Track Application

Kern Subbasin
Technical Assistance Application

See the "Technical Assistance Application Process" Section of the Well Mitigation Program for information on how to identify the GSA in which the impacted well is located and for GSA contact information. If you are unsure of how to answer any questions, please leave blank and this can be further discussed during a meeting with GSA staff. Once all known information is filled out, please email, mail, or hand-deliver this filled-out application to the GSA in which the well was impacted to start the application process.

For applications pertaining to domestic wells or agricultural wells used for domestic purposes, please do not fill out this application. Instead, contact **Self-Help Enterprises** at **(559) 802-1685**. Self-Help Enterprises is available to assist with accessing emergency drinking water and interim drinking water supplies.

Please write which GSA your impact application applies:

_____

Applicant Name: _____

Applicant Preferred Contact Information: _____

Are you the landowner of the property in which this application applies?

Yes No

If no, please provide the name and contact information of the landowner and the GSA shall contact the landowner to notify of the need for their participation in the application process.

Landowner Name: _____

Landowner Contact Information: _____

As the applicant, will you allow physical access to the adversely impacted well for authorized qualified professional(s) to perform a field assessment?

Yes No

Please attach available documentation for the well (for example the State Department of Water Resources Driller's Log, other well construction information, pump depth, groundwater level, or other information).

Please describe your well impact:

_____

_____

_____

Applicant information:

Date: _____

First Name: _____ Last Name: _____ Middle Initial: ___

Address: _____ City: _____ Zip: _____

Mailing Address: _____

Phone # Home: _____ Cell: _____

Email: _____ Text Ok? Yes No

Accessors Parcel Number: _____

Has the impacted well support access to safe drinking water within the last 60-days? Yes No

If no, explain: _____

Kern Subbasin Technical Assistance Application
Impacted Well Information

Please circle response:

Impacted Well's Use	Community	State	
Well Water Source:	Aquifer	Small Spring	Other _____

Please provide as much of the following documentation as is available:
Provide all the information that you have. Ask neighbors and family or well pump repair companies that might know. More information helps the Applications process and not information might stall or disqualify the Application.

- Well completion report (well drillers log)
- Well design documentation
- Water level records
- Water quality records and/or laboratory/test reports
- Photographs
- Well maintenance records
- Well driller name and contact information
- Well pump contractor and contact information
- Documentation from neighboring wells' construction, operations, and maintenance

Please fill out the following information to the best to your ability. Additional information may be requested and/or a site visit may be requested by the GSA:

How many connections are associated with this well?	
When was the well drilled?	
When was water first pumped from the well?	
When did the pump stop working?	
Depth of well	
Depth and length of well screen	
Size of pump (horsepower (HP)	
Depth of pump in well	
Can the pump be fixed?	
Has the pump been removed from the well?	
When was the well last worked on by a pump contractor? What did they work on?	

Has the well been abandoned? If so, why?	
Does the well have a pump saver? *A pump saver is a PVC sleeve with slots on the lower end to allow water to enter while keeping sand particulate out*.	
How much water should this well be pumping?	
How much water has the well been pumping recently? (note units including daily or monthly)	
Has the well experienced water quality issues? Describe the issue and when it started	
Have neighboring wells experienced water quality issues? Describe the issue and when it started.	
Is the well located near septic tanks? If so, please provide the distance between well and septic tank and/or leaching field.	

Well Site Map Sketch

Include in sketch:

- Property boundaries
- Structures
- Cross Streets/Roads
- Fences/Gates
- Access
- North Arrow
- Pools/Ponds
- Septic Tank/Leach Lines
- Driveways
- Trees
- Power Poles/Lines
- Existing Wells
- Neighboring Homes/Properties (left, right, across)
- Distance of Connection(s) if known
- Dogs/Animals on the Property

Annotated photos or aerial images of the property may be used in place of a sketch.
Please also attach photos of the impacted well and pump.
Mark the well impacted and any other wells on the property.

Attachment C

Conceptual Indemnification Agreement Example for Technical Assistance Track Applications

EXAMPLE INDEMNIFICATION AGREEMENT FOR TECHNICAL ASSISTANCE APPLICATIONS

The undersigned ("the Applicant") having been awarded funding to support technical assistance by _____ Groundwater Sustainability Agency of the Kern Subbasin ("the GSA") hereby agrees as follows:

1. The Applicant will indemnify and hold harmless the GSA, its Board of Directors, Staff, Consultant Staff, Committee Members, Offices, Third-Party Facilitators from any and all applications, suits, actions, and liability of any character arising or alleged to arise, out of injuries or damages sustained by any person, persons, or property on account of the Applicant's act or omission, neglect, or misconduct, or in violation of any law, ordinance, or regulation, which was caused to occur during the Applicant's mitigation development or implementation.
2. The GSA shall not be liable to the Applicant's staff or guests for any injury incurred while on the property in which mitigation will take place.
3. The Applicant is responsible for paying all taxes owed for income or property value the Applicant receives as a result of the mitigation measure.
4. The GSA is awarding the Applicant funding for the following technical assistance activities:

_____

_____

_____

_____

_____

Name of Applicant

_____

Signature of Applicant ` Date

_____ _____

Name of GSA General Manager

_____

Signature of GSA General Manager Date

_____ _____

Appendix G-2: Friant-Kern Canal Lower Reach Subsidence Mitigation Studies and Agreements

This appendix includes the following documents:

- Preliminary Friant-Kern Canal Lower Reach Capacity Correction Project Assessment/Cost
- Groundwater Sustainability Agency Cost Sharing Agreement
- Kern County Subbasin Subsidence Mitigation Cost Analysis for the Friant-Kern Canal – One-dimensional (1D) models and Critical Head Estimates

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TECHNICAL MEMORANDUM

To:	Kern County Subbasin Groundwater Sustainability Agency
From:	Trey Driscoll, PG, CHG, Abhishek Singh, PhD, PE, John Ellis
Subject:	Preliminary Friant-Kern Canal Lower Reach Capacity Correction Project Assessment/Cost
Date:	June 12, 2025
cc:	Kern Subbasin Technical Working Group (TWG) and Managers Group

This proposed Project and Management Action (PMA) to include in the updated Groundwater Sustainability Plan for the Kern County Subbasin (Kern Subbasin) has been developed for the Friant-Kern Canal (FKC) to address deficiencies[1] identified by the California Department of Water Racecourses (DWR).

The FKC facilities include the Friant Dam (Millerton Reservoir) completed in 1944, and the 152-mile FKC completed in 1951. On average, the canals deliver 1.2 million acre-feet of irrigation water annually to more than 15,000 farms on over one million acres of the most productive farmland in the world (FWA, 2020). The Friant Division was designed and is operated as a conjunctive use project to convey surface water for direct beneficial uses, such as irrigation and municipal supplies, and to recharge groundwater basins in the southern San Joaquin Valley. The ability to move significant water through the Friant Division's canals in wetter years to store in groundwater recharge basins is critically important for the project to work as intended. These operations sustain the primary source of drinking water for nearly all cities, towns, and rural communities on the Valley's East side (FWA, 2020).

Within Kern County, the FKC extends from approximately mile post (MP) 122 at the County line and flows south for approximately 30 miles to MP 152 near Bakersfield, California. Figure 1 displays the location of the FKC within Kern County, cumulative vertical surface deformation in feet from June 2015 to October 2023 as measured by Interferometric Synthetic Aperture Radar (InSAR) satellite data within the Kern Subbasin and corresponding cumulative subsidence in feet along the profile of the FKC for select years from 2017 to 2023 (TRE ALTAMIRA 2023). The maximum amount of measured subsidence in the Kern Subbasin from 2015 to 2023 is 2.4 feet with the greater amount of subsidence in the northern part of the basin in a depression along the County boundary with Tulare County.

Along the FKC profile, the maximum subsidence from 2015 to 2023 is about 0.9 feet between MP133.43 and MP 135.45 (Figure 1).

[1] "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" (Deficiency #3, Inadequate Determination, pg. 52); and "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" (Deficiency #3, Inadequate Determination, pg. 54)

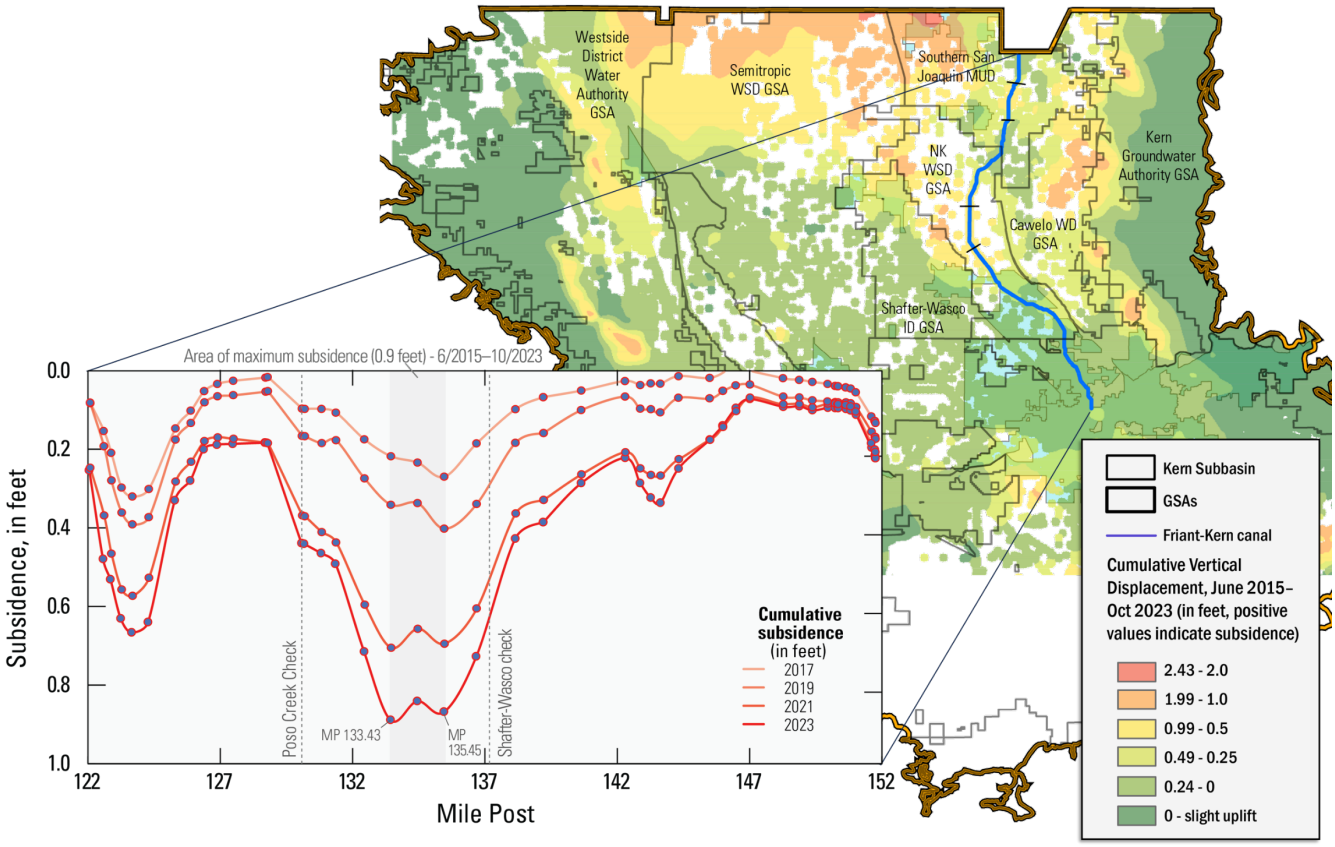


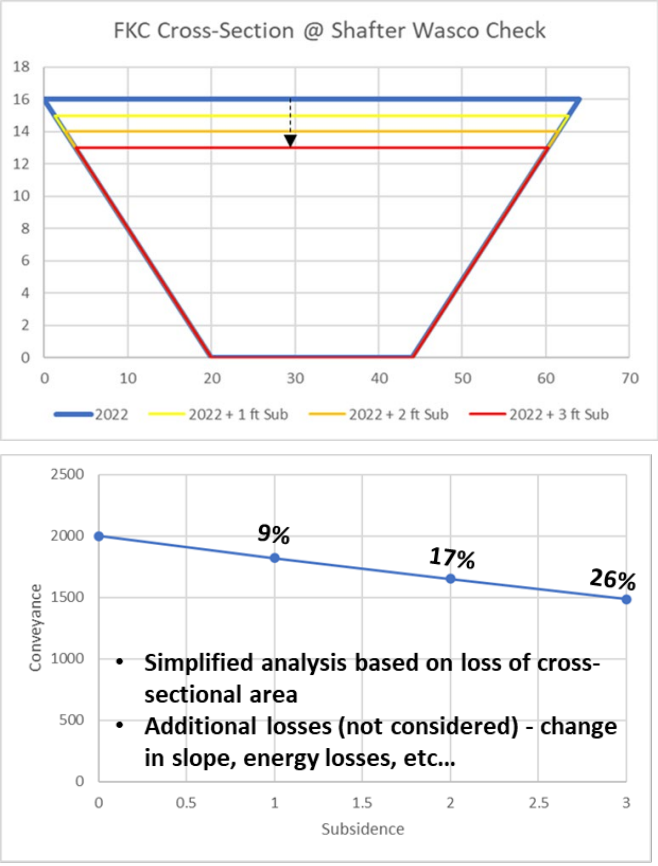
Figure 1. Kern Subbasin Cumulative Subsidence 2015 to 2023 and FKC Subsidence Profile

The Friant Water Authority (FWA) is currently in the process of performing a Lower Reach Capacity Correction analysis to evaluate the design, improvements, and costs to upgrade the FKC to achieve the maximum design capacity of 2,500 cubic feet per second (cfs)[2]. The FWA has identified four primary factors that affect the capacity of the FKC to convey flow (FWA 2022):

1. Original design assumption for the roughness coefficient (Manning's "n" coefficient) of the FKC was underestimated that resulted in never achieving the maximum design capacity of 2,500 cfs
2. Age (increase in roughness coefficient) and vegetation within canal sections has reduced conveyance capacity
3. Historical subsidence has reduced the conveyance capacity
4. Future subsidence will further reduce the conveyance capacity

[2] FWA is also evaluating the design, improvements, and costs of other design capacities less than the maximum design capacity of 2,500 cfs; however, this memo refers only to the maximum design capacity correction.

The FWA position regarding subsidence along the FKC is that "any unmitigated conveyance loss due to subsidence beyond 2020 would lead to undesirable results". The proposed minimum threshold for the FKC is a 5-year annual average rate of 0.1 feet per year (ft/yr) with a maximum 3 feet of cumulative subsidence from 2015 to 2040. Beyond 2040, subsidence is to be minimized with zero average inelastic subsidence. A maximum of approximately 0.4 feet of subsidence was observed along the FKC from 2015 to 2020. If the proposed minimum threshold is reached, up to an additional 2.6 feet of cumulative subsidence post-2020 could occur along the FKC. This could result in a loss in conveyance capacity of up to 26% as illustrated in the simplified FKC cross-sectional Figures 2a and 2b.



Figures 2a and 2b. FKC Approximate Cross-Section and Simplified Capacity Loss Based on Loss of Cross-sectional Area

Mitigation would consist of raising the concrete liner by 3 to 6 feet and upgrading associated facilities/infrastructure such as bridge crossings, check structures, wasteways, turnouts, inlet drains, siphons/underdrains, power and telephone and various size pipelines.

To evaluate future subsidence along the FKC, the historical subsidence rate from 2015 to 2023 was forecast to 2040 using linear regression to provide a conservative estimate of future subsidence. Figure 3 displays subsidence at MP 133.43 extrapolated to 2040 and indicates a total cumulative displacement of 2.7 feet.

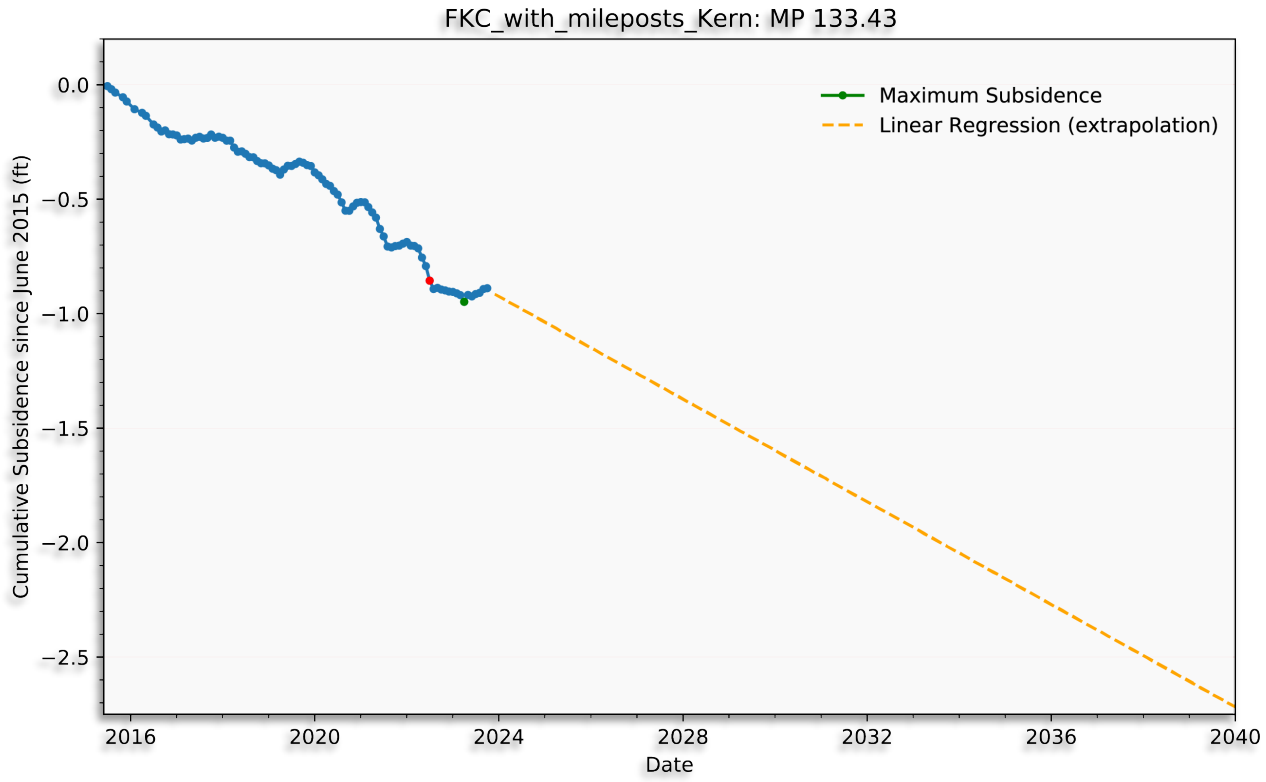


Figure 3. FKC Mile Post 133.43 Extrapolated Subsidence to 2040 (Based on 2015 to 2023 InSAR data)

To further evaluate potential future subsidence along the FKC, a profile was developed using the historical InSAR subsidence data from 2015 to 2023 extrapolated to 2040 as shown in Figure 4. The subsidence forecast assumes that future subsidence occurs in areas of historical subsidence. It provides a general understanding of sections of the FKC that may require a liner raise and exceed subsidence thresholds that trigger the need for additional infrastructure improvements such as bridge replacement (e.g., 1.25 feet of subsidence triggers the need for bridge replacement).

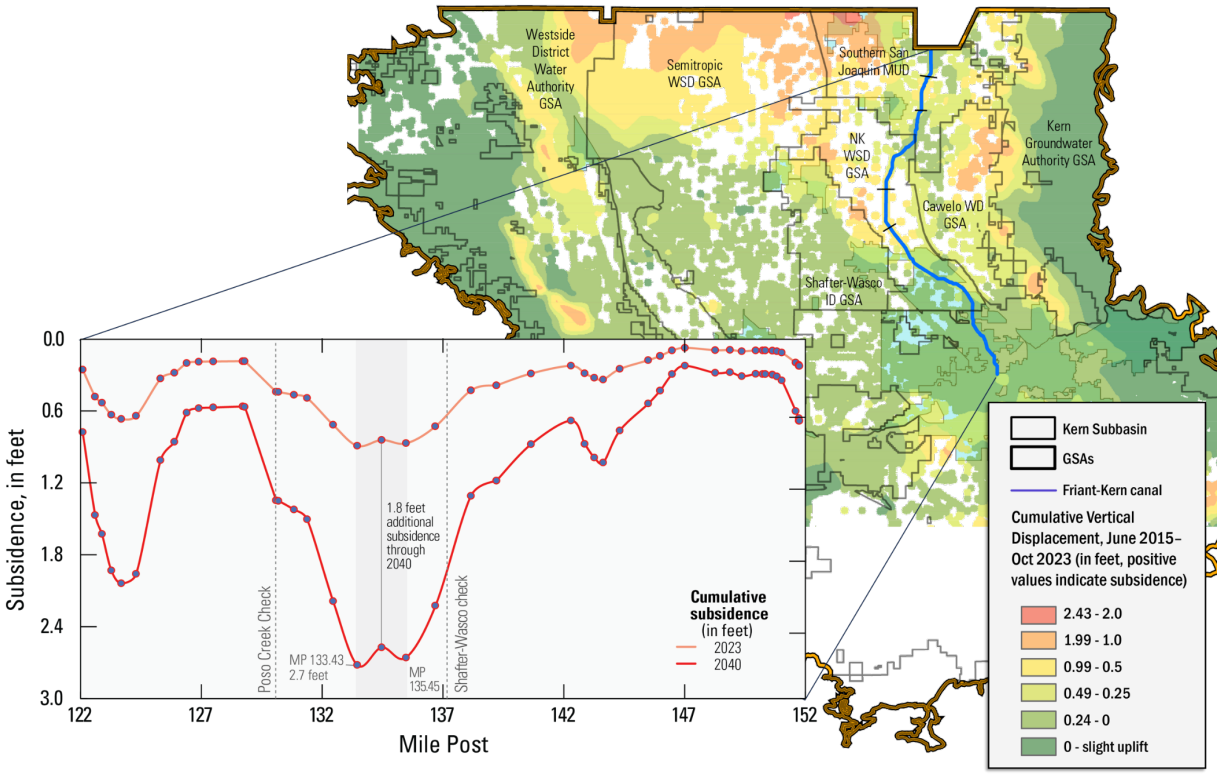


Figure 4. Kern Subbasin Cumulative Subsidence 2015 to 2023 and FKC Subsidence Profile Extrapolated to 2040

INTERA used the output from the FWA's FKC HEC-RAS model to perform preliminary evaluation of sections of the Lower Reach impacted by post-2020 subsidence. For this analysis, the 2018 top of liner elevation and 2018 water surface elevation (from FWA's HEC-RAS model) were used to be representative of 2020 canal conditions[3]. Based on this analysis, the following sections of the FKC with subsidence impacts resulting in loss of conveyance capacity beyond 2020 conditions were identified:

- MP 122.85 to MP125.29 (Poso Creek Pool): 2.44 miles (12,883 ft)
- MP 130.05 to MP 137.2 (Shafter Wasco Pool): 7.15 miles (37,752 ft)

Based on preliminary analysis, about 10 miles of liner raise and associated infrastructure improvements could be attributable to post-2020 subsidence. This analysis is preliminary and will be refined as additional subsidence and surveying data becomes available.

The FWA has developed a Class 5 level cost estimate[4] for the Lower Reach to achieve the maximum design capacity of 2,500 cfs. The total project cost and project cost by pool are presented in Table 1.

[3] 2020 water surface and liner elevations were not available at the time of this analysis.
[4] The uncertainty range of Class 5 estimate range between -50 percent and +100 percent from the most probable estimate (FWA 2022).

Table 1. FWA's Class 5 Cost Estimate for the Lower Reach Capacity Correction to 2,500 cfs Design Capacity

Pool	Mile Posts	Total Project Costs Per Mile	Total Project Costs by Pool
Poso Creek	121.5 – 130.1	$14.4M	$124M
Shafter Wasco	130.1 – 137.2	$9.7M	$69M
Kern River	137.2 – 151.8	$7.6M	$111M
Total Lower Reach Capacity Correction			**$304M***

Notes: *Preliminary Working Draft Lower Reach Capacity Correction Cost
Source: Pers. Comm. Perez, Evan (Stantec), February 1, 2024.

This analysis of post-2020 subsidence impacts is based on evaluating the freeboard, which is the minimum distance required from the top of the canal lining to the water surface elevation to convey flow as documented in FWA's FKC HEC-RAS model and shown schematically in Figure 5. The required minimum freeboard varies along the FKC profile. The sections of the FKC that have been identified to potentially be impacted by post-2020 subsidence will not have sufficient remaining freeboard to convey flows are shown conceptually in Figures 6 through 8.

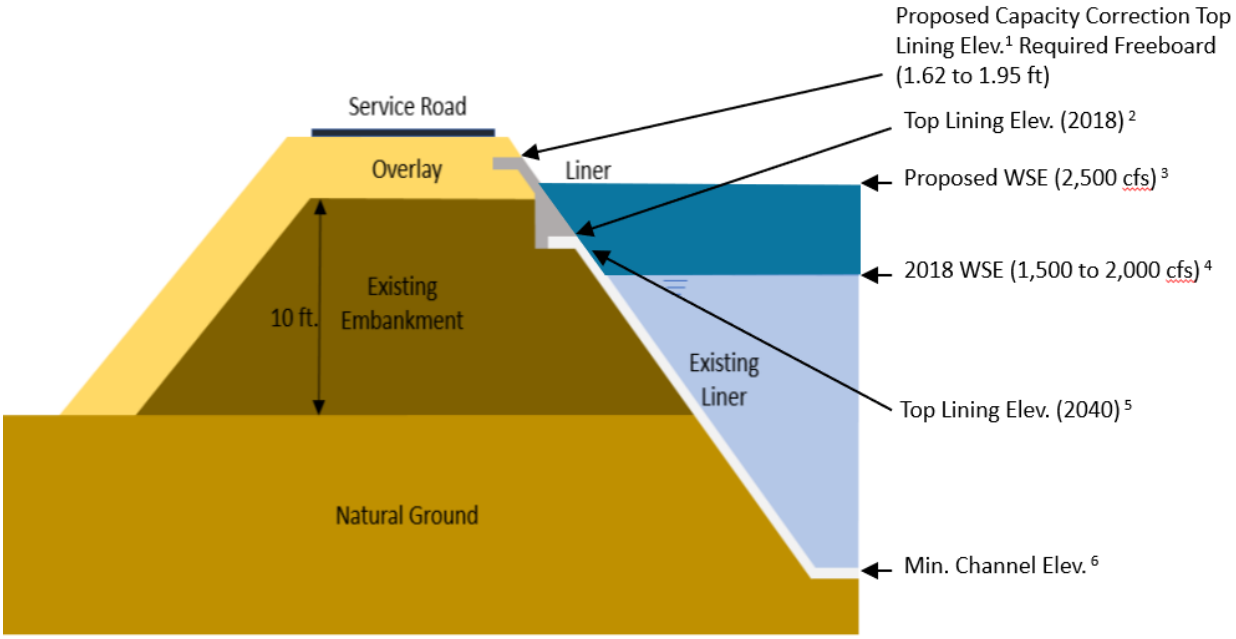


Figure 5. FKC Typical Detail for Embankment Liner Raise (Modified from FWA 2022)

Notes: Data Sources:

1. Capacity Correction Top of Lining = Calculated as 2,500 cfs WSE (Stantec, 2024) plus freeboard from HEC-RAS output (FWA 2022)
2. Top of Lining Elevation (2018) = HEC-RAS output (FWA 2022)
3. Proposed WSE (2,500 cfs) = Evan Perez, Stantec 2/1/2024
4. 2018 WSE = HEC-RAS output (FWA 2022)
5. Top of Lining Elevation (2040) = Calculated as Top of Lining Elevation (2018) – Extrapolated Subsidence 2023-2040 from 2015 to 2023 based on historical rates of subsidence using InSAR data (TRE ALTAMIRA, 2023 and INTERA Unpublished [see slide 13]).
6. Minimum Channel Elevation = HEC-RAS output (FWA 2022)

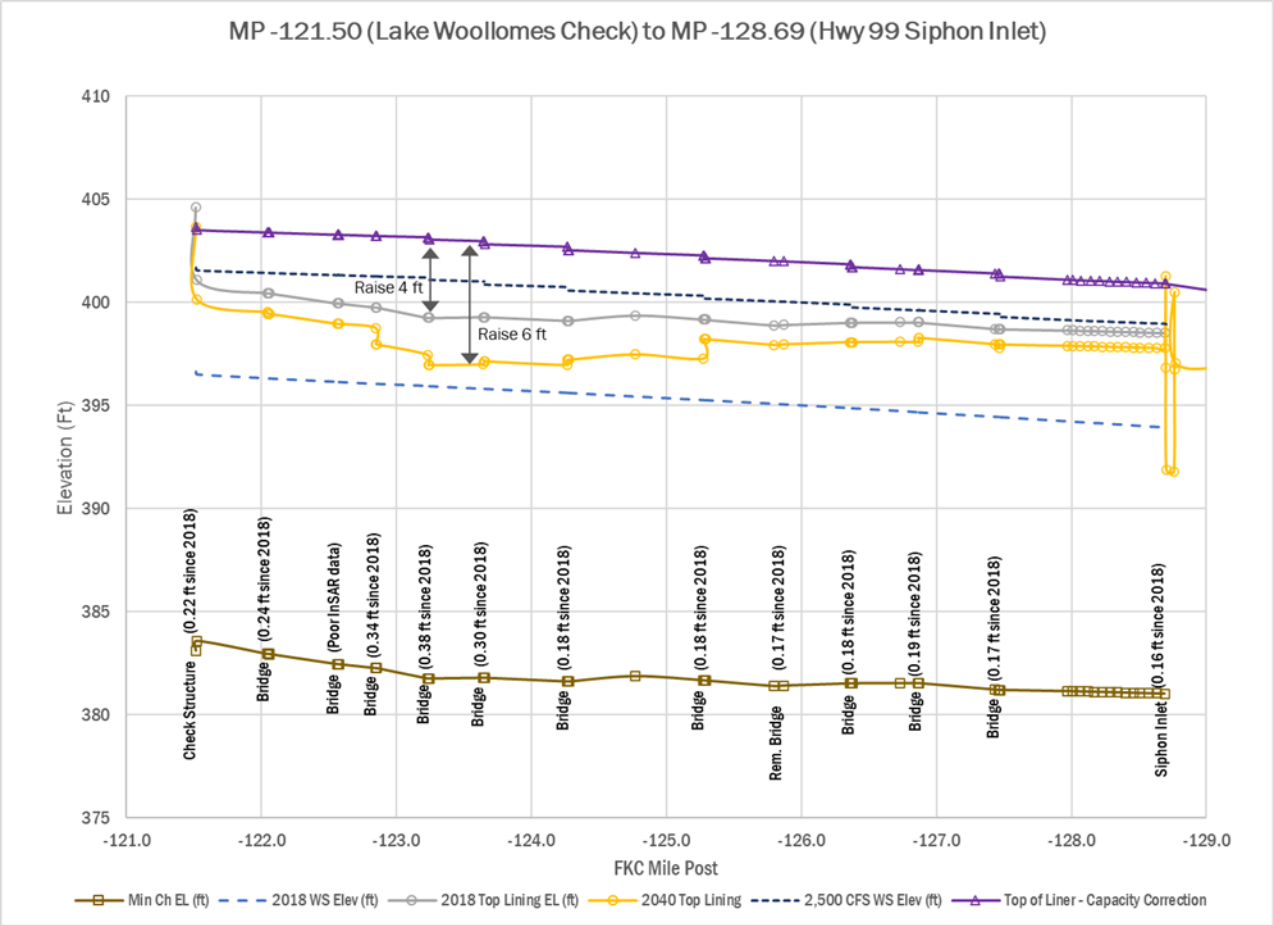


Figure 6. FKC—MP 121.51 (Lake Woollomes Check) to MP 128.69 (Hwy 99 Siphon Inlet)

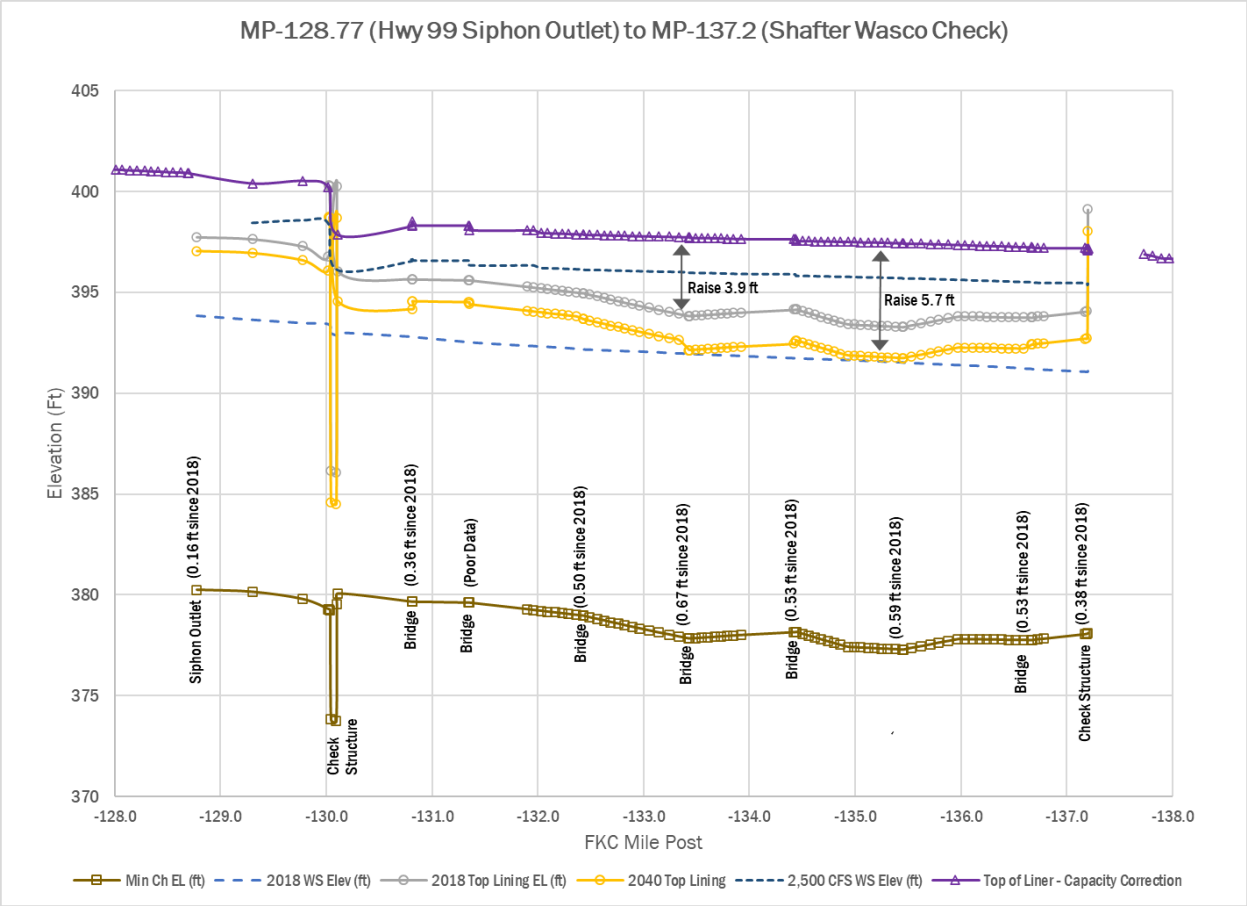


Figure 7. FKC– MP-128.77 (Hwy 99 Siphon Outlet) to MP-137.2 (Shafter Wasco Check)

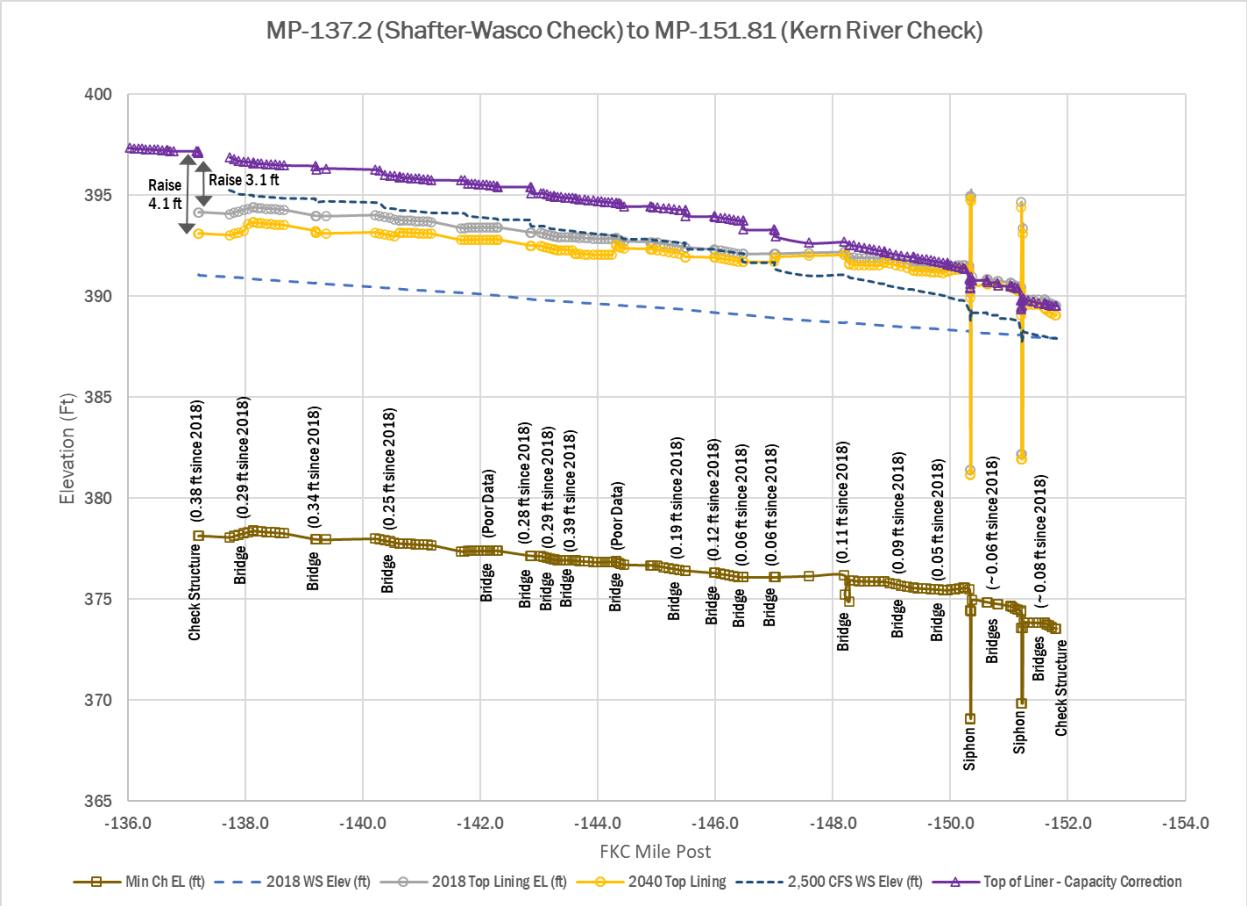


Figure 8. FKC– MP-128.77 (Hwy 99 Siphon Outlet) to MP-137.2 (Shafter Wasco Check)

A preliminary rough order of magnitude capacity correction cost analysis due to subsidence at the proposed 2040 minimum threshold (MT) using the 2018 water surface elevation for the FKC Lower Reach is provided in Table 2. This cost analysis assumes that approximately 40% of the total subsidence (since the construction of the FKC) could occur between 2020 and 2040 and would be attributable to GSA activities. The 40% is based on a linear extrapolation of the 2015 to 2024 subsidence rates (Figure 3) through 2040 compared with the total subsidence from the time of FKC construction to the 2040 extrapolated subsidence. Note, this analysis is approximate and conservative since it assumes that 1) future subsidence linearly continues up to the 2040 subsidence MT extent, whereas the Kern Subbasin is actively managing future subsidence and groundwater levels to avoid the 2040 MT subsidence extent; and 2) the 2018 WSE and liner are representative of 2020 conditions. As mentioned before, a more detailed cost estimate for the mitigation cost will be developed based on the best available data and tools and in close collaboration with the FWA.

Table 2. Lower Reach Rough Order Capacity Correction Cost Due to Subsidence at 2040 MT (2018 WSE)

Pool	Total Project Costs	Freeboard Analysis with 2018 WSE	Total Project Costs by Pool	Post-2020 Subsidence Impacts	Subsidence Costs by Pool
	Millions Per Mile	Miles	Millions	Percent	Millions
Poso Creek	$14.40	2.44	$35.14	40%	$14.05
Shafter Wasco	$9.70	7.15	$69.36	40%	$27.74
Kern River	$7.60	0	$0.00	40%	$0.00
Total Cost Due to Potential Subsidence @ 2040 MT			**$104.49**		**$41.80**

Notes: Freeboard Analysis with 2018 WSE.

Project and Management Action

Conveyance conditions of the Fraint-Kern Canal (FKC) have been impacted by historical subsidence and will potentially be impacted by future subsidence under the proposed implementation of the Kern Subbasin Groundwater Sustainability Plans (GSPs). The Fraint Water Authority (FWA) position regarding subsidence along the FKC is that "any amount of unmitigated subsidence beyond 2020 would lead to undesirable results". Sustainable management criteria (SMCs) have been proposed for the FKC that limit subsidence to a 5-year annual average rate of 0.1 feet per year (ft/yr) with a maximum 3 feet of cumulative subsidence from 2015 to 2040. Beyond 2040, subsidence is to be minimized with zero average inelastic subsidence (including residual subsidence) attributable to groundwater pumping under GSA jurisdiction. To address post-2020 subsidence along the FKC, a mitigation program consisting of raising the sides (liner) of the canal and upgrading associated facilities/infrastructure such as bridge crossings, check structures, wasteways, turnouts, inlet drains, siphons/underdrains, power and telephone and various size pipelines is proposed. The mitigation program will be partially funded by GSAs within the Kern Subbasin, based on the relative impact of post-2020 pumping and groundwater overdraft on inelastic subsidence along the FKC. FWA is evaluating several Lower Reach Capacity Correction alternatives including achieving the original design conveyance capacity of 2,500 cubic feet per second (cfs). FWA has performed their own forecast of future subsidence in a reconnaissance-level study (Note: the FWA future subsidence forecast is less than historical rate from 2015 to 2023 used to develop the FKC subsidence minimum threshold and assumes groundwater levels stabilizing quickly during implementation of the GSPs). FWA's position is that the Kern Subbasin GSA's should minimize and mitigate for lost conveyance capacity post-2020 due to ongoing subsidence attributable to groundwater pumping under GSA jurisdiction.

As part of this project and management action (PMA), the Kern Subbasin would implement the following: 1) participate in a program that monitors and tracks ongoing subsidence regionally within the Kern Subbasin and locally along the FKC, 2) compare observed rates of subsidence to established SMCs along the FKC and take action such as pumping reductions should future observed subsidence rates exceed interim milestones and the minimum threshold, 3) collaborate with FWA to develop costs

estimates for the Lower Reach Capacity Correction and evaluate the degree of post-2020 lost capacity attributable to subsidence, 4) develop an attribution analysis of post-2020 subsidence impacts using either a numerical model to perform predictive analysis or other suitable tool, 5) participate in developing a value of water analysis in cooperation with FWA and 6) develop and implement a funding mechanism based on the subsidence attribution analysis to pay for post-2020 conveyance impacts on the FKC attributable to subsidence.

Measurable Objectives Addressed 354.44(b)(1)

This mitigation strategy for the FKC will directly address the impacts of land subsidence caused by lowered groundwater levels by providing funding for repair of conveyance impacts on the FKC attributable to subsidence. In addition, this management action includes regional subsidence monitoring which will support annual evaluations of sustainable management criteria effectiveness and if additional management actions are needed to align with the Kern Subbasin's sustainability goal.

Circumstances and Criteria for Implementation 354.44(b)(1)(A)

The FKC's functionality is critical for the Kern Subbasin's economy, water availability, and path towards sustainability. With potential future conveyance capacity compromised due to land subsidence on the canal, the amount of available surface water supplies is reduced, and more groundwater is pumped to offset the loss in surface supplies. This management action is intended to mitigate loss of capacity on the FKC induced by land subsidence via an attribution-analysis basis for funding mechanism. In addition, the GSAs may explore other state, federal, and private funding opportunities to support land subsidence monitoring, physical mitigation, and the attribution analysis.

Process to Provide Notice of Implementation 354.44(b)(1)(B)

All impacted parties, including the FWA and Kern Subbasin growers must be given the opportunity and time to comment on the Program prior to adoption by the GSAs. Each GSA must engage with its stakeholders as detailed in their respective Communications and Engagement Plans.

Estimated Annual Program Benefits 354.44(b)(2) & Evaluation of Benefits 354.44(b)(5)

This management action will directly mitigate impacts on the FKC induced by subsidence, which will provide direct benefit to the beneficial users of the FWA's surface water supplies as well as beneficial users of groundwater in the Kern County Subbasin, including the Disadvantaged Communities, much of which are groundwater dependent. By mitigating conveyance capacity loss induced by subsidence, this prevents excessive use of groundwater pumping to offset the losses in surface water supplies.

The metric for measuring this management action's benefits will be the volume of surface water supplies that may have otherwise been lost to conveyance capacity reductions.

Permitting and Regulatory Requirements 354.44(b)(3)

The GSAs will work with FWA to identify any mitigation efforts that are non-exempt from California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) requirements and will comply with CEQA and NEPA prior to initiation of those activities. The FKC is a federal facility, and activities along the canal are more likely to be subjected to federal environmental planning processes and permits. The GSAs will work with FWA to comply with various permits associated with the environmental planning process that are required for the physical repair of the FKC.

Program Schedule 354.44(b)(4)

The GSAs shall work with the FWA on developing a schedule that meets the urgency of the need while remaining feasible. A detailed schedule shall be provided in the next amended GSP(s) or sooner as part of Annual Reports.

How will the Project be accomplished and what is the water source? 354.44(b)(6)

This management action will be accomplished by an agreement between the Kern County Basin GSAs and the FWA. The funding will likely be generated by GSA via a to-be-determined fee structure informed by an attribution analysis. No new surface water sources are required for this management action.

Legal Authority 354.44(b)(7)

California Water Code Section 10725.2 provides the GSA has the powers and authorities "perform any act necessary or proper" to implement SGMA regulations and allows the GSA to adopt rules, regulations, ordinances, and resolutions necessary for SGMA implementation. Because DWR is required to evaluate whether the GSPs provides a reasonable means to mitigate continued overdraft, a mitigation strategy for subsidence impacts along the FKC is an act necessary or proper to implement SGMA (23 CCR §355.4(b)(6)).

Program Cost 354.44(b)(8)

FWA's Class 5 level cost estimate[5] for the Lower Reach to achieve the maximum design capacity of 2,500 cfs is approximately $304 million. Additional costs may include administration, environmental, legal, technical support for attribution analysis, land subsidence monitoring, GSA coordination, and program maintenance. The Kern Subbasin GSAs would be responsible for a portion of the overall cost due to post-2020 subsidence impacts on the 2020 conveyance capacity. A preliminary and conservative estimate for this cost range is approximately $42 million, based on potential subsidence from 2020 to the 2040 MT subsidence extent for the affected FKC pools. A more detailed cost estimate will be developed using the best available data and tools and in close coordination with the FWA.

Management of Groundwater Extractions and Recharge 354.44(b)(9)

This mitigation program will provide insight into how groundwater extractions and recharge operations have historically affected groundwater levels and subsidence along the FKC through review of empirical data and include development of a predictive analysis using a numerical model to perform the attribution analysis. This will provide crucial insight for decision support in regard to allocation decisions and groundwater recharge needs across the GSAs. To achieve the necessary FKC repairs and prevent continued subsidence, the GSAs must engage in strategic groundwater extraction curtailments via allocations and consider opportunities to implement new groundwater recharge activities in areas where required declines in groundwater extractions may interfere with the resiliency of the local Disadvantaged Community economies.

Level of Uncertainty 354.44(d)

The analyses required to plan, design, and implement this project/management action may be limited by data availability, conceptual-level of construction details, unknown localized nuances in the

[5] The uncertainty range of Class 5 estimate range between -50 percent and +100 percent from the most probable estimate (FWA 2022).

underlying hydrogeology that affect subsidence, the unknown future rate of subsidence, and unknown costs required to complete the Lower Reach Capacity Correction. The GSAs will develop informed assumptions to navigate data gaps and develop rules and regulation changes as additional information and experience is gained through the process. The GSAs will work collaboratively with FWA to minimize the level of uncertainty involved with developing the Lower Reach Capacity Correction PMA.

References

FWA (Friant Water Authority), 2022. Friant-Kern Canal System-Wide Capacity Correction Reconnaissance Study – DRAFT. November, 2022. Attachment C HEC-RAS Modeling Results Planning Level HEC-RAS Output for Existing Conditions. 1.0.2 model: 2022 Existing Conditions Model - Discharge Capacity Limited by USBR FB. Run Date: 8/22/2022

FWA, 2020. Testimony of Jason Phillips, Chief Executive Officer, Friant Water Authority Before the House of Representatives Subcommittee on Energy and Water Development and Related Agencies. March 31, 2020.

Stantec, 2024. Evan Perez, Stantec 2/1/2024. File: FKC_Lower_Reach_2040_DesignMax_WSE.xlsx and Costs per mile by pool in July 2023 dollars from data from our current FKC Systemwide Study.

TRE ALTAMIRA, 2023. InSAR Land Surveying and Mapping Services to DWR supporting SGMA: October 2023 Update Technical Report. October 2023. Available at https://gis.water.ca.gov/arcgisimg/rest/services/SAR

COST SHARING AGREEMENT FOR ADDITIONAL DATA COLLECTION AND MODELING TO SUPPORT SUBSIDENCE MITIGATION COST ANALYSIS FOR THE FRIANT KERN CANAL

This Cost Sharing Agreement ("Agreement") is entered into on **April 1, 2024**, by and among the following Groundwater Sustainability Agencies ("GSAs"), Districts, or Agencies located within the Kern County Groundwater Subbasin, each a “Party” and collectively referred to as the "Parties":

1. Cawelo Water District
2. North Kern Water Storage District
3. Shafter-Wasco Irrigation District
4. Shafter-Wasco Irrigation District 7th Standard Annex
5. Southern San Joaquin Municipal Utility District
6. Arvin-Edison Water Storage District
7. Buena Vista Water Storage District
8. City of Bakersfield
9. Eastside Water Management Area
10. Improvement District No. 4
11. Kern Delta Water District
12. Kern Water Bank GSA
13. Kern-Tulare Water District
14. Pioneer GSA
15. Rosedale-Rio Bravo Water Storage District
16. Semitropic Water Storage District
17. Tejon-Castac Water District
18. West Kern Water District
19. Wheeler Ridge-Maricopa Water Storage District

RECITALS:

WHEREAS, the Parties collectively have a shared interest in developing a model to preliminarily evaluate potential impacts of future groundwater levels and subsidence along the Friant-Kern Canal (FKC) and preliminarily attribute those impacts to Kern Subbasin groundwater management activity for support of potential FKC mitigation and coordinated Groundwater Sustainability Plans (GSPs) to satisfy the requirements of the Sustainable Groundwater Management Act;

WHEREAS, Parties will engage the services of Intera Incorporated (Consultant) to develop the model;

WHEREAS, the cost of Consultant services to develop the model will not exceed $120,000 based on the proposed tasks and cost estimate provided by Consultant dated February 22, 2024 (Proposal) and is attached hereto as Exhibit A;

WHEREAS, the Parties acknowledge that sharing the costs associated with the model development is beneficial and cost-effective;

WHEREAS, the Parties wish to appoint North Kern Water Storage District (NKWSD) as the lead authority and signatory to the Consultant contract for services described in the Proposal and to provide payment for such services on behalf of the Parties to this Agreement;

NOW, THEREFORE, in consideration of the mutual covenants contained herein, the Parties agree as follows:

AGREEMENT TERMS:

1. Cost Sharing: The Parties agree to collectively share the total cost of up to $120,000 for Tasks 1 through 5 as presented in the Proposal, with each Party contributing a share of the total cost as described in Exhibit B. If total final costs are less than $120,000 then each Party will pay their proportionate share.

2. Payment to NKWSD: NKWSD shall invoice the Parties as needed for their respective proportionate cost share in Exhibit B. However, upon completion of the Proposal, NKWSD may also elect to provide a one-time invoice for a Party's total cost share in Exhibit B. Parties only agree to provide payment for services described in the Proposal. Upon receiving an invoice, the Parties agree to provide payment within 45 days.

3. Accounting: NKWSD shall maintain accurate accounting records and other documentation pertaining to all invoices and payments per this Agreement and Consultant contract. Supporting documentation will be provided with invoices for Party's review.

5. Amendments: This Agreement may only be amended in writing and mutually agreed to by all Parties hereto.

6. Governing Law: This Agreement shall be governed by and construed in accordance with the laws of the State of California.

7. Joint Ownership of Work Product: All work product generated pursuant to this Agreement shall be jointly owned by the Parties so that each will have access and ability to review and comment on drafts and otherwise utilize said work product. The work product generated pursuant to this Agreement shall not be binding on any Party.

8. Execution in Parts or Counterparts: This Agreement shall be executed in parts or counterparts, each part or counterpart being an exact duplicate of all other parts or counterparts, and all parts or counterparts shall be considered as constituting one complete original and may be attached together when executed by the Parties hereto. Electronic signatures shall be binding.

EXECUTION:

IN WITNESS WHEREOF, the Parties hereto have executed this Cost Sharing Agreement as of the date written above:

1. Cawelo Water District — DocuSigned by: David Halopoff AADF128C7D204F5...
2. North Kern Water Storage District — DocuSigned by: D4CE6B513ACB4B7...
3. Shafter-Wasco Irrigation District — DocuSigned by: Kris Lawrence C5424311CE0E418...
4. Shafter-Wasco Irrigation District 7th Standard Annex — DocuSigned by: Kris Lawrence C5424311CE0E418...
5. Southern San Joaquin Municipal Utility District — DocuSigned by: Roland Gross CD47AC533A5B40B...
6. Arvin-Edison Water Storage District — DocuSigned by: EBB22BEA39FC497...
7. Buena Vista Water Storage District — DocuSigned by: Tim Ashlock 341D61C8B51642C...
8. City of Bakersfield — DocuSigned by: Kristina Budak 851D96B36CEE4CA...
9. Eastside Water Management Area — DocuSigned by: Chad Hathaway 650F9CA517E54A3...
10. Improvement District No. 4 — DocuSigned by: 61784EAE45FA4B7...
11. Kern Delta Water District — DocuSigned by: D73DA596371B408...
12. Kern-Tulare Water District — DocuSigned by: A98E2F5BB6E84BD...
13. Kern Water Bank GSA — DocuSigned by: Jonathan Parker DB23EAE1F6E14B4...

14. Pioneer Groundwater Sustainability Agency

DocuSigned by:
Lauren Bauer
95F5FDD4863A4D8...

15. Rosedale Rio-Bravo Water Storage District

DocuSigned by:
Dan Bartel
0AFA98D07C50427...

16. Semitropic Water Storage District

DocuSigned by:
Jason Gianquinto
F02BDC8FFAD3431...

17. Tejon-Castac Water District

DocuSigned by:
Angelica Martin
FB7E46CF267E471...

18. West Kern Water District

DocuSigned by:
Greg Hammett
EEAA5AEC18784B5...

19. Wheeler Ridge-Maricopa Water Storage District

DocuSigned by:
Thomas F Nicholas
506013EA1F514A4...

EXHIBIT B

COST SHARING AGREEMENT TABLE:
ADDITIONAL DATA COLLECTION AND MODELING TO SUPPORT SUBSIDENCE MITIGATION COST ANALYSIS FOR THE FRIANT-KERN CANAL

	Participation	Agency	Cost Share Amount	Cost Share %
1	Yes	Cawelo Water District	$7,968.22	6.6%
2	Yes	North Kern Water Storage District	$7,968.22	6.6%
3	Yes	Shafter-Wasco Irrigation District	$7,968.22	6.6%
4	Yes	Shafter-Wasco Irrigation District 7th Standard Annex	$7,968.22	6.6%
5	Yes	Southern San Joaquin Municipal Utility District	$7,968.22	6.6%
6	Yes	Arvin-Edison Water Storage District	$7,968.22	6.6%
7	Yes	Kern-Tulare Water District	$7,968.22	6.6%
8	Yes	Pioneer Groundwater Sustainability Agency	$6,315.79	5.3%
9	Yes	Semitropic Water Storage District	$6,315.79	5.3%
10	Yes	Buena Vista Water Storage District	$5,454.55	4.5%
11	Yes	City of Bakersfield	$5,454.55	4.5%
12	Yes	Eastside Water Management Area	$5,454.55	4.5%
13	Yes	Improvement District No. 4	$5,454.55	4.5%
14	Yes	Kern Delta Water District	$5,454.55	4.5%
15	Yes	Kern Water Bank Authority	$5,454.55	4.5%
16	Yes	Rosedale-Rio Bravo Water Storage District	$5,454.55	4.5%
17	Yes	Tejon-Castac Water District	$5,454.55	4.5%
18	Yes	Wheeler Ridge-Maricopa Water Storage District	$5,454.55	4.5%
19	Yes	West Kern Water District	$2,500.00	2.1%
20	No	Westside District Water Authority	$0	0.0%
21	No	Olcese Water District	$0	0.0%
22	No	Henry Miller Water District	$0	0.0%
		Total	$120,000	100.0%

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Torrance, CA 90503
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INTERA.com

TECHNICAL MEMORANDUM

To:	Kern County Subbasin Groundwater Sustainability Agencies
From:	John Ellis, PG; Leila Saberi, PhD; Wesley Neely, PhD; Marisa Earll; Trey Driscoll, PG, CHG; INTERA Incorporated
Date:	May 21, 2025
Re:	Kern County Subbasin Subsidence Mitigation Cost Analysis for the Friant-Kern Canal – One-dimensional (1D) models and Critical Head Estimates

1 Introduction

Land subsidence (subsidence) due to groundwater extraction is an important issue in the Kern County Subbasin (Subbasin), particularly along the Friant-Kern Canal (FKC). This technical memorandum (TM) presents findings for Tasks 1-3 detailed in our scope of work to Support Subsidence Mitigation Cost Analysis for the FKC dated February 22, 2024. To determine the relationship between subsidence and groundwater level changes, INTERA performed one-dimensional (1D) numerical modeling at selected sites in the Subbasin. The data, methods, and results are described below. Results from these tasks will be used jointly with the updated IWFM-Kern model to explore a range of scenarios for establishing the FKC subsidence mitigation cost-sharing framework as part of future work (Task 4 of the approved scope of work dated February 22, 2024).

2 Background

Groundwater pumping lowers groundwater levels and depressurizes aquifer-system materials below the ground surface, which causes compressible sediment types in the subsurface to compact and the ground surface to subside. Using long-term historical groundwater level and subsidence records, INTERA analyzed the relationship between groundwater level fluctuations and subsidence to help understand the aquifer-system dynamics related to subsidence in the Subbasin in the vicinity of the FKC.

The analysis compiled and integrated subsidence and groundwater level data from: (1) three benchmark sites, (2) publicly available Interferometric Synthetic Aperture Radar (InSAR) time series, and (3) nearby wells whose groundwater level trends were identified as the most representative of the subsidence drivers at those benchmark sites. The long-term subsidence and groundwater level time series from these sites are used to evaluate the interconnection between groundwater levels and subsidence and develop datasets for modeling.

INTERA performed additional data-collection, analysis, and modeling necessary to evaluate future impacts on groundwater levels and subsidence along the FKC from groundwater pumping in different Groundwater Sustainability Agencies (GSAs) within the Subbasin. Unmitigated conveyance loss due to subsidence along the FKC has been deemed an “undesirable result” under Sustainable Groundwater

Management Act (SGMA) by the Friant Water Authority (FWA). Hence, mitigation alternatives to raise the liner (and associated infrastructure) along the subsiding sections of the canal are under evaluation.

3 Task 1. Recover and survey elevations at selected benchmarks

To determine long-term subsidence along the FKC, INTERA identified eight potential benchmark sites to provide time series from 1901 through 2024. INTERA's subconsultant, Provost & Pritchard Consulting Group, successfully located and surveyed three of these benchmark sites (**Figure 1**, **Table 1**) on April 25 and 26, 2024. The other five benchmark sites were not located and are presumed to be destroyed. Provost & Pritchard collected static Global Positioning System (GPS) data for each benchmark site suitable for static observations with overlapping static GPS observations lasting at least four hours in duration. Provost & Pritchard processed the static GPS data using the National Geodetic Survey (NGS) Online Positioning User Service (OPUS) Projects software, incorporating data from five continuously operating reference stations and two stations within Leica's Smartnet real-time network. Surveys also employed Real-time Kinematic (RTK) GPS to collect data at additional benchmarks, using both a local base station broadcasting with Ultra High Frequency (UHF) radio and the Leica Smartnet real-time network. The static GPS survey results helped provide the base station coordinates. Several benchmarks are mounted vertically in the side of concrete bridge pillars and were surveyed by setting two temporary control points nearby using RTK GPS and then using conventional survey equipment to measure the elevation.

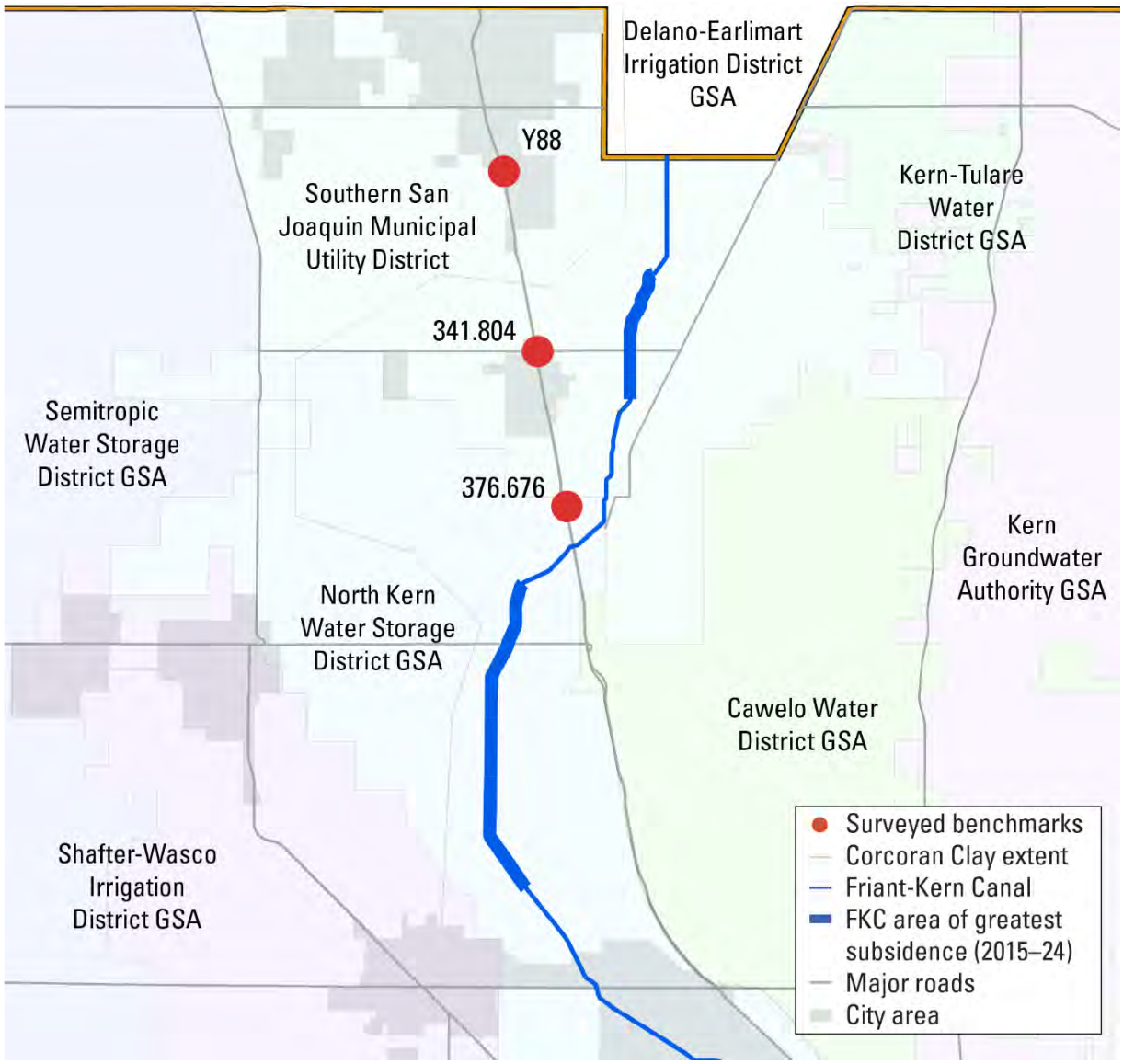


Figure 1. Location of benchmark sites used for groundwater modeling in the Kern Subbasin.

Table 1. Location and elevations of recovered benchmarks surveyed to obtain 2024 elevations.

Station	Northing	Easting	Elevation	Latitude	Longitude
K 1206	2439405.80	6196548.38	346.63	35.689201	-119.229447
HPGN D CA 06 GK	2439377.40	6196734.85	373.71	35.689129	-119.228818
381.380 USBR	2423427.47	6198104.25	382.01	35.645364	-119.223554
Y 1205	2423544.05	6199398.63	386.45	35.645728	-119.219203
Q 454	2421032.35	6199908.52	389.17	35.638845	-119.217385
T 453 USBR	2418129.65	6200152.83	401.56	35.630880	-119.216444
FAMOSO	2407494.28	6202403.91	420.05	35.601741	-119.208440
FRANK	2407574.25	6193152.14	398.87	35.601651	-119.239560
7 (CALTRANS)	2407642.14	6193049.57	401.73	35.601834	-119.239908
A 1207	2391698.02	6205118.67	450.63	35.558440	-119.198676
Z 1206	2395365.67	6204544.53	444.52	35.568496	-119.200753

Notes: Northings and Eastings are in the California Coordinate System of 1983, Zone 5, US Survey feet. Latitude and Longitude are NAD83 (2011), epoch 2010.00. Elevations are NAVD88, computed using Geoid18.

4 Task 2. Analyze and prepare long-term groundwater level and subsidence time series data and figures

4.1 Techniques

We integrated leveling and InSAR observations to estimate cumulative subsidence from 1901 through 2024, and paired these subsidence estimates with groundwater level data. The subsidence measurement techniques and groundwater level data used for the analysis are described in the following subsections.

4.1.1 Leveled Elevations at Benchmarks

Leveling is the oldest method used to precisely measure elevation and, in California, was commonly performed along linear infrastructure—including roads, railroad tracks, and canals—as part of initial construction or ongoing maintenance. The U.S. Geological Survey (USGS) first installed (or "monumented") benchmarks in California's Central Valley in 1901 and 1924, followed by the U.S. Coast and Geodetic Survey in 1931 (predecessor agency of NGS). The leveling technique allows the surveyor to carry an elevation from a known reference point (such as a benchmark) to other points using a precisely leveled telescope and a graduated rod resting vertically on a benchmark. Repeated surveys of the same benchmarks over time yield a series of elevations used to calculate elevation changes.

The three recovered benchmarks were located along State Route 99 between Delano Municipal Airport and Slater, ranging from ~1-3 miles away from the Friant-Kern Canal. These benchmarks have elevations obtained across many leveling projects (where a "leveling project" is a survey campaign in a specific

timeframe that includes a number of leveling lines across which a record of height differences from one vertical control mark to another are obtained). Benchmark selection was based on the following criteria: (1) a long history of leveling to alleviate the issue of "floating lines" that are routinely encountered with leveled elevations in the 1950s to 1970s, (2) proximity to more recent benchmarks with leveled elevations during the 1980s to present, (3) proximity to a sufficient number of wells with many years of groundwater level data, and (4) successful benchmark recoveries at nearby benchmarks with leveled elevations available in the NGS OPUS shared solutions database.

We obtained historical leveled elevations from 1901 through 1989 by using an NGS leveling adjustment tool whereby elevation differences between leveling projects extend the time series of the leveled elevations from the NGS-adjusted datasheets. This utility compares a baseline project (baseline) against other projects from the starting benchmark on each leveling line to the end of the leveling line. The comparison begins by finding the first common benchmark that each project shares with the baseline. For each project, the first common benchmark is considered equivalent to the elevation of the baseline. Therefore, the first common benchmark has a comparative height difference of zero. Each common benchmark progressing down the length of the leveling line is compared by way of differencing their heights relative to the first common benchmark. We tabulated the height differences in line order by height difference in millimeters and discarded marks not found in common to each line. The utility also reports closure and allowable misclosure of the section in common (where a "section" is a subdivision of a leveling line). If the allowable misclosure is exceeded for the order and class of the survey, the section is flagged.

The NGS leveling and OPUS databases provided elevations from 1990 to 2024. The OPUS database contains survey-grade GPS data submitted by users and provides accurate geodetic positions within the National Spatial Reference System. By leveraging OPUS, users can efficiently obtain high-accuracy positioning without maintaining their own reference stations, which ensures consistency with national geodetic standards. The OPUS database also provided ellipsoid heights for each benchmark used in the analysis, and we determined an equivalent orthometric height using the GEOID18 geoid model (where the orthometric height is the difference of the ellipsoid and GEOID18 values).

INTERA selected benchmarks at each site to extend the time series of data to present-day based on one of two conditions: (1) if a tie could be made to the historical subsidence time series (such as if the historical time series ended in 1970, and the more recent time series at another benchmark began the same year); or (2) if the older benchmark and more recent benchmark had a leveled or OPUS elevation taken during the same period (such as if the older benchmark was resurveyed in 2020, and the recent benchmark had a survey in the same year). Several benchmark sites required a recovery using RTK GPS techniques to establish a cumulative subsidence time series through 2024 (described in Section 3 Task 1). These recoveries are included in the OPUS database and are available online.

4.1.2 InSAR Data

InSAR is a remote sensing technique which uses satellite or airborne platforms and is capable of detecting ground-surface deformation at centimeter- to millimeter-scale across large areas. It estimates relative surface displacements by repeatedly collecting synthetic aperture radar (SAR) data. During each visit, the sensor transmits an electromagnetic signal toward the Earth's surface and records the phase and amplitude of the reflected energy. The phase component of the signal is proportional to the line-of-sight

distance between the ground and the satellite (range) and is used to measure land-surface displacement, such as subsidence or uplift. Ground motion away from the satellite (subsidence) reflects a more distal phase portion of the waveform and a more proximal phase portion when the ground moves closer (uplift). The difference in signal phase between two acquisitions, known as an interferogram, can help to estimate the relative motion of the ground surface. A collection of interferograms can help to estimate the displacement time series at each image pixel.

Interferometric methods have existed since the 1970s, but InSAR became widely used for displacement monitoring in the 1990s with the launch of the European Space Agency's (ESA's) ERS-1/2 missions. Satellite radar enables large-scale displacement observations (spanning tens to hundreds of miles) at spatial resolutions of tens of feet, often with near-global coverage. Revisit intervals vary by mission, typically ranging from 12 to 46 days. As interferograms represent relative displacement observations, these data are often calibrated with external data sources, such as GPS data, to link interferograms together and force InSAR results into an absolute reference frame. Where external displacement data are unavailable, data gaps in InSAR time series may lead to the loss of displacement information.

4.1.3 Groundwater Level and Lithologic Data

Reliably forecasting the magnitude and time scales of subsidence using 1D subsidence modeling requires an understanding of past and current hydrogeological conditions. The stress history of an aquifer system influences the potential for and rate of future subsidence, making it key information for accurate subsidence forecasting. The extent of compaction largely depends on the characteristics and arrangement of the fine-grained units, specifically clays, and the magnitude, duration, and history of the groundwater level declines.

Knowing the critical head is important to determining when groundwater level declines will result in permanent subsidence. Paired analyses of subsidence (and/or compaction) records and groundwater level observations may help to: estimate the critical head, improve our understanding of the aquifer-system response to changing groundwater level, and calculate aquifer-system storage properties. This information is highly beneficial for developing and calibrating groundwater and subsidence models, as well as establishing SMC to prevent further subsidence.

To develop the 1D models, INTERA constructed long-term groundwater level inputs at each of the three benchmark sites. We compiled current and historical groundwater level observations from state, federal, and local sources within a ~3-mile radius of the benchmark site. We developed a Python-based tool to streamline groundwater level data processing and dynamically assess the time series for well completion depth, relative location, long-term trends, and their relationship to subsidence data from the leveling surveys at each benchmark. Though we prioritized continuous long-term data at a single well, these data were not always available. To construct long-term time series where observations were discontinuous, we grouped groundwater levels from multiple wells (typically two to three) by aquifer depth intervals using similar well completion criteria (total depth, and top and bottom perforation depths, where available) and proximity, where each well grouping was within a 3-mile radius of the benchmark and each other. We assessed the data for quality and similarity to construct a long-term time series generally spanning the 1940s to the present.

For each site, we compiled long-term groundwater levels in multiple intervals within the principal aquifer system to capture the aquifer response to aquifer stresses. Pumping often occurs at different depth intervals across an aquifer system. The shallow interval of the principal aquifer may show seasonal effects of recharge and groundwater levels that are generally stable, whereas groundwater levels in the deeper interval may be declining due to deep pumping wells and the presence of a confining unit such as the Corcoran Clay (in northern Kern). Depressurization increases effective stress on the fine-grained unit as the decrease in hydrostatic pressure reduces its ability to support the overburden. This leads to delayed compaction, where thinner, faster-draining fine-grained units compact first, while thicker units drain slowly, resulting in residual subsidence that can persist for many years. To capture these processes in the 1D models, INTERA compiled the lithology of each groundwater well to determine the thickness, depths, and generalized layering of each unit categorized into clay and sand layers. We established the depths and extent of the Corcoran Clay (where present) based on literature and the layer assignment from the Central Valley Hydrologic Model (CVHM) version 2 (Faunt et al., 2024). The 1D models are populated with this site-specific lithology. By incorporating lithology and groundwater levels across multiple aquifer intervals, the 1D models can simulate the changes in critical heads in different aquifer intervals in response to changing groundwater levels and resulting compaction and subsidence.

INTERA also compiled well completion reports for each observation well and reviewed these reports by aquifer intervals, categorizing the general lithology at each depth interval as sand, clay, or sand and clay based on the descriptions in the well logs. The depth and thickness of the Corcoran Clay (only present at site Y88) was based on the USGS digital dataset developed for CVHM (Faunt, 2009). Each interval is defined by specific properties such as thickness, hydraulic conductivity, elastic and inelastic skeletal storage coefficients, porosity, and the number and thickness of interbeds. The Corcoran Clay functions as a regional confining layer (in northern Kern) and plays a significant role in delayed subsidence due to its low vertical hydraulic conductivity and high compressibility. **Figure 2** provides an example representation of the vertical layering used in the MODFLOW 6-CSUB model, showing the position and thickness of the three main intervals and interbed structure.

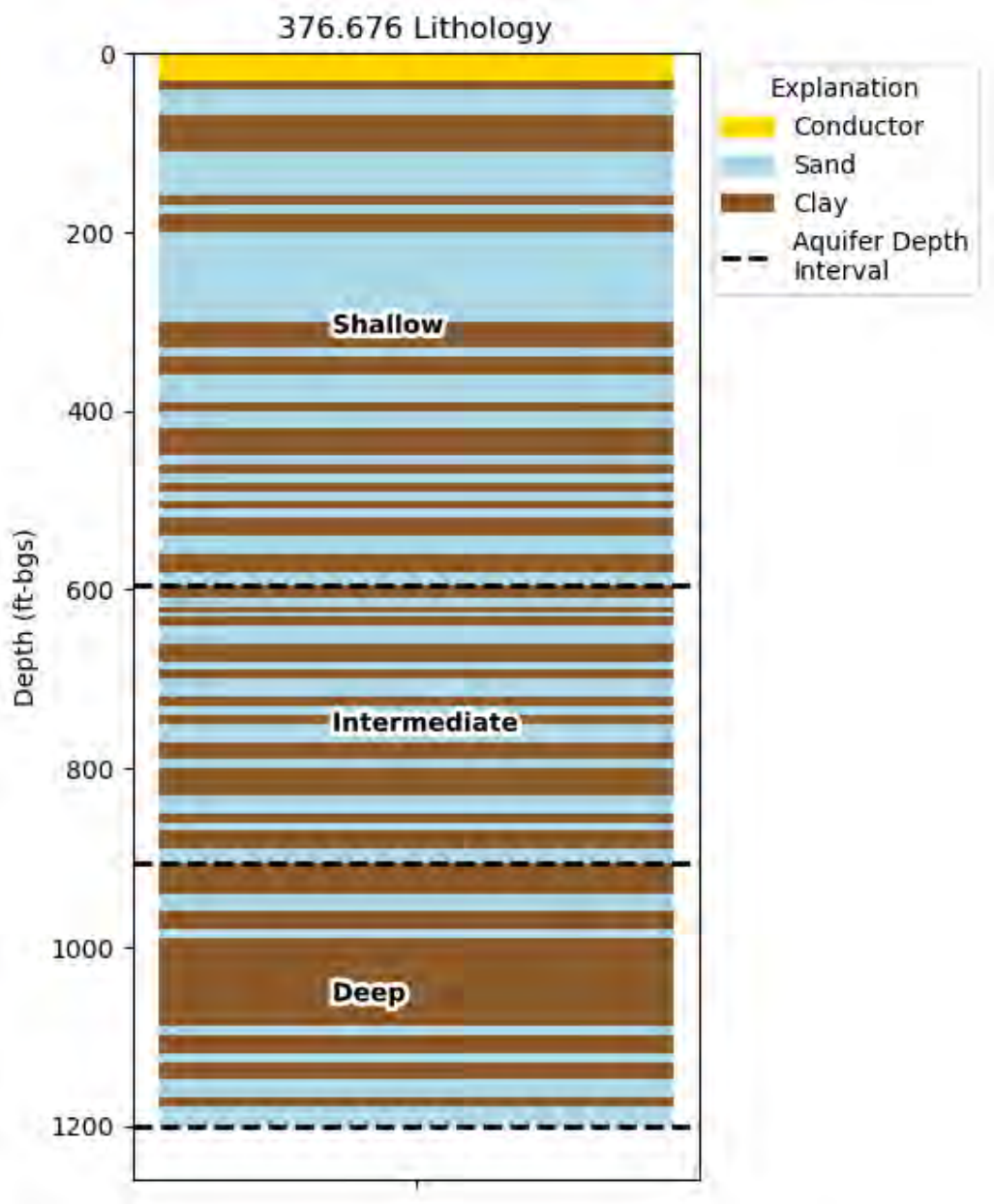


Figure 2. Example vertical discretization of the principal aquifer system used in the 1D MODFLOW 6-CSUB model.

4.2 Cumulative Time Series Construction

INTERA constructed the long-term time series of subsidence data (1901 to 2024) by integrating the leveling and InSAR data for each benchmark site. The 1931 to 1989 leveled elevations were provided by NGS in the National Geodetic Vertical Datum of 1929 (NGVD29). Leveled elevations from the NGS OPUS database were provided in the National American Vertical Datum of 1988 (NAVD88). The OPUS ellipsoid

heights were used to derive the 1990 to 2023 elevations for some benchmarks. Leveled elevations for the 1901 and 1924 USGS benchmarks used a pre-NGVD29 datum approximating sea level and did not include adjustments similar to the NGS leveled elevations. Therefore, uncertainty exists when comparing the 1901 and 1924 leveled elevations to 1931 and later leveled elevations at the same benchmarks. To compare the 1931–1989 NGVD29 elevations to the 1990 and later NAVD88 elevations, we used the NGS VERTCON tool to convert the pre-1990 elevations to NAVD88. After converting the data, we calculated cumulative subsidence at each benchmark by subtracting the first recorded leveled elevation from the elevations measured during each subsequent leveling epoch (i.e. 1931, 1940, 1970) to produce a cumulative subsidence time series of leveling data.

After constructing the cumulative subsidence time series of leveling data for each benchmark site, we registered InSAR data from Sentinel-1 (2015-2024) and Envisat (2003-2010) satellite missions directly to these leveling values or registered to the estimated displacement values of the nearest leveling data point. We reviewed each site for discrepancies and data gaps across different data sources and made adjustments based on known reference points, ideally from leveling data. We addressed gaps in the InSAR datasets by estimating displacement rates or interpolating between known displacement observations to maintain continuity in the subsidence time series.

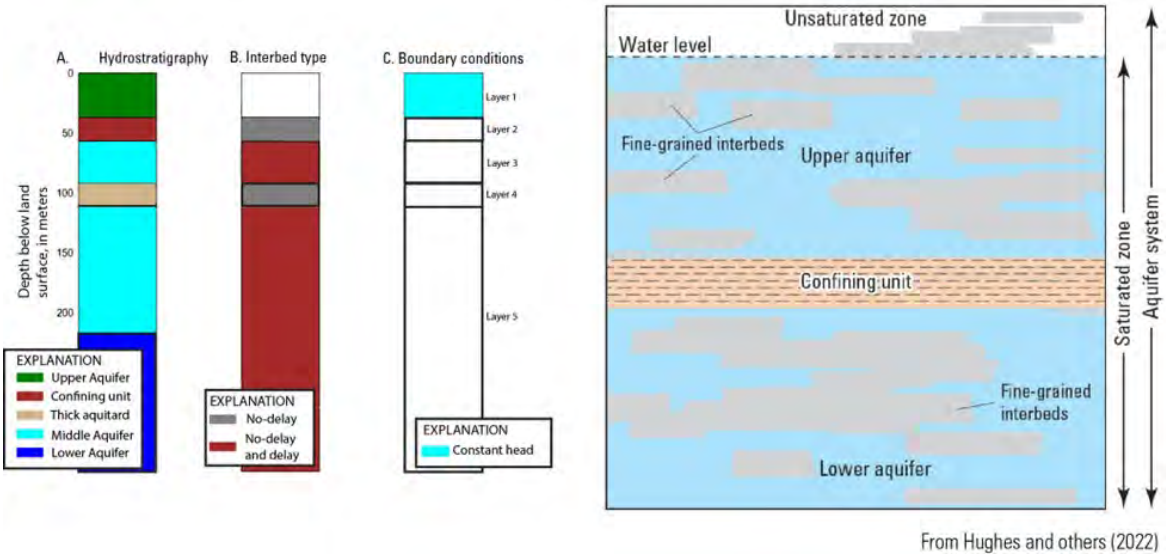
5 Task 3. Subsidence analysis using 1D models

INTERA constructed 1D models using MODFLOW 6-CSUB and calibrated these models using the iterative ensemble smoother (IES) as implemented in the open-source software PESTPP-IES for the three long-term subsidence sites described in Tasks 1 and 2. These models were then used to estimate the present-day critical head and will serve as tools for running predictive groundwater management scenarios.

5.1 One-Dimensional Modeling

A localized 1D model simulates vertical compaction along a single column of the aquifer system (**Figure 3**). In areas where data are only available from a single borehole, 1D models provide a detailed understanding of subsidence at a specific location where subsidence is occurring. A 1D model operates under the assumption that horizontal groundwater flow is negligible compared to storage changes and other water budget components. This simplified approach may be advantageous when the heterogeneity of the aquifer or the lateral groundwater flow are not well understood. 1D modeling can be effective for determining Minimum Thresholds (MTs) based on simulated critical head approximations for sustainable management of subsidence. The availability of nearby subsidence and groundwater level data is important to consider when developing or using 1D models. Selecting a location with ample subsidence data (such as InSAR data, a continuous GPS station, or an extensometer) and continuous groundwater levels measurements is important as it allows for better calibration of the compaction model. The standardization of a 1D modeling workflow across multiple locations makes it effective for managing subsidence across one or multiple GSAs. Models can also assess the impacts of adaptive management strategies such as local recharge projects and pumping reduction. Additionally, 1D modeling offers computational simplicity compared to 3D models, with shorter runtimes enabling faster iterations during calibration, uncertainty analysis, and scenario development. An example of 1D subsidence modeling in MODFLOW 6 using CSUB and delay beds is available in MODFLOW 6 Examples:

One-Dimensional Compaction. Accessed [10,1,2024]. https://modflow6-examples.readthedocs.io/en/master/



From Hughes and others (2022)

Figure 3. Schematic representation of subsidence using the CSUB package (Hughes and others, 2022).

INTERA used MODFLOW 6-CSUB this analysis due to its ability to fully integrate groundwater flow and subsidence processes and compute subsidence dynamically based on changing groundwater levels, track layer-specific compaction, and simulate both instantaneous and time-delayed subsidence. CSUB also offers greater flexibility in defining hydraulic conductivity values, skeletal storage properties, and interbed thicknesses, making it better suited for complex heterogeneous groundwater basins.

5.2 Model Configuration and Stratigraphy

The aquifer system at sites Y88, 341.804, and 376.676 is divided into three vertically discretized hydrostratigraphic intervals: the Shallow, Intermediate, and Deep intervals of the principal aquifer. These divisions are not based on geologic or sediment differences; rather, they reflect discrete zones where the groundwater level data differs from the other zones. Because these zones are modeled as separate layers, the model captures the compaction caused by these differing groundwater levels in depth. The difference in groundwater levels pertains primarily to sites Y88 and 341.804; the groundwater levels at site 376.676 are very similar. However, simulating this site as a single-layer model would have required substantially changing the existing modeling programmatic workflow.

As discussed at the end of Section 4.1.3, INTERA compiled well completion reports, reviewed these by aquifer interval, and categorized the lithology. **Figure 4** provides a schematic representation of the vertical layering used in the MODFLOW 6-CSUB model, showing the position and thickness of the three main units and interbed structure.

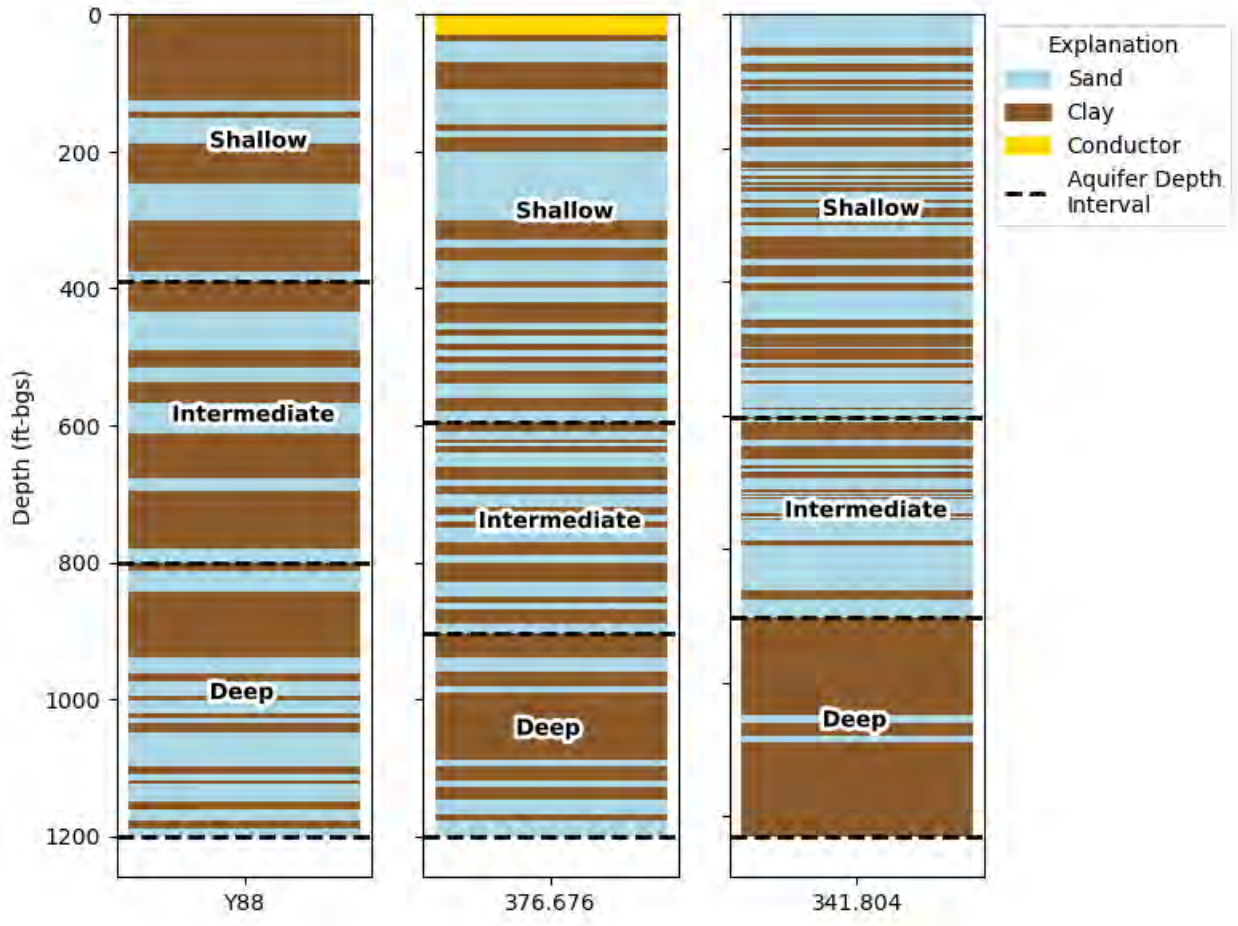


Figure 4. Vertical discretization of the aquifer system at sites Y88, 376.676, and 341.804 used in the 1D MODFLOW 6-CSUB model in feet below ground surface (ft-bgs).

5.3 Calibration and Parameter Estimation

INTERA calibrated the model using long-term subsidence data derived from spirit leveling, GPS, and InSAR data. We used groundwater level data from wells to develop continuous hydrographs for each aquifer interval. Where continuous records were unavailable, we developed composite long-term hydrographs based on well proximity, the depth of screened interval, and similarity in observed trend. Details of the long-term time series construction are discussed in Section 4 Task 2.

A total of 500 ensemble realizations informed the data assimilation process to calibrate the model parameters and assess uncertainties. **Table 2** summarizes the final calibrated parameters for each interval, including vertical hydraulic conductivity (Kv), elastic specific storage (Sse), and inelastic specific storage (Ssv). These values fall within expected ranges based on regional studies and literature sources and reflect the physical heterogeneity across layers.

Table 2. Calibrated aquifer system parameters for each long-term site.

Site	Aquifer Interval	Sse (ft/day)	Ssv (ft/day)	Kv (ft/day)
Y88	Shallow	2.58E-06	7.31E-05	3.59E-06
	Intermediate	1.63E-06	3.26E-04	2.93E-06
	Deep	2.28E-06	2.03E-04	9.91E-08
341.804	Shallow	1.45E-06	9.51E-05	1.91E-06
	Intermediate	2.14E-06	1.15E-04	3.10E-08
	Deep	3.55E-06	1.27E-04	6.36E-06
376.676	Shallow	4.15E-06	4.50E-05	4.00E-08
	Intermediate	3.64E-06	1.77E-04	9.55E-08
	Deep	9.37E-06	3.30E-05	1.85E-05

Figure 5 presents the simulated cumulative subsidence time series (blue line) against observed subsidence from InSAR, leveling, and GPS (black dots). Gray shading reflects the ensemble spread of the simulated subsidence, and red shading shows the noise introduced to subsidence observations which represent uncertainty in the measured data. The ensemble spread narrows during periods of frequent measurements, indicating increased model confidence. The model accurately reproduces historical trends, including periods of rapid subsidence during groundwater drawdown events and reduced rates during recovery phases.

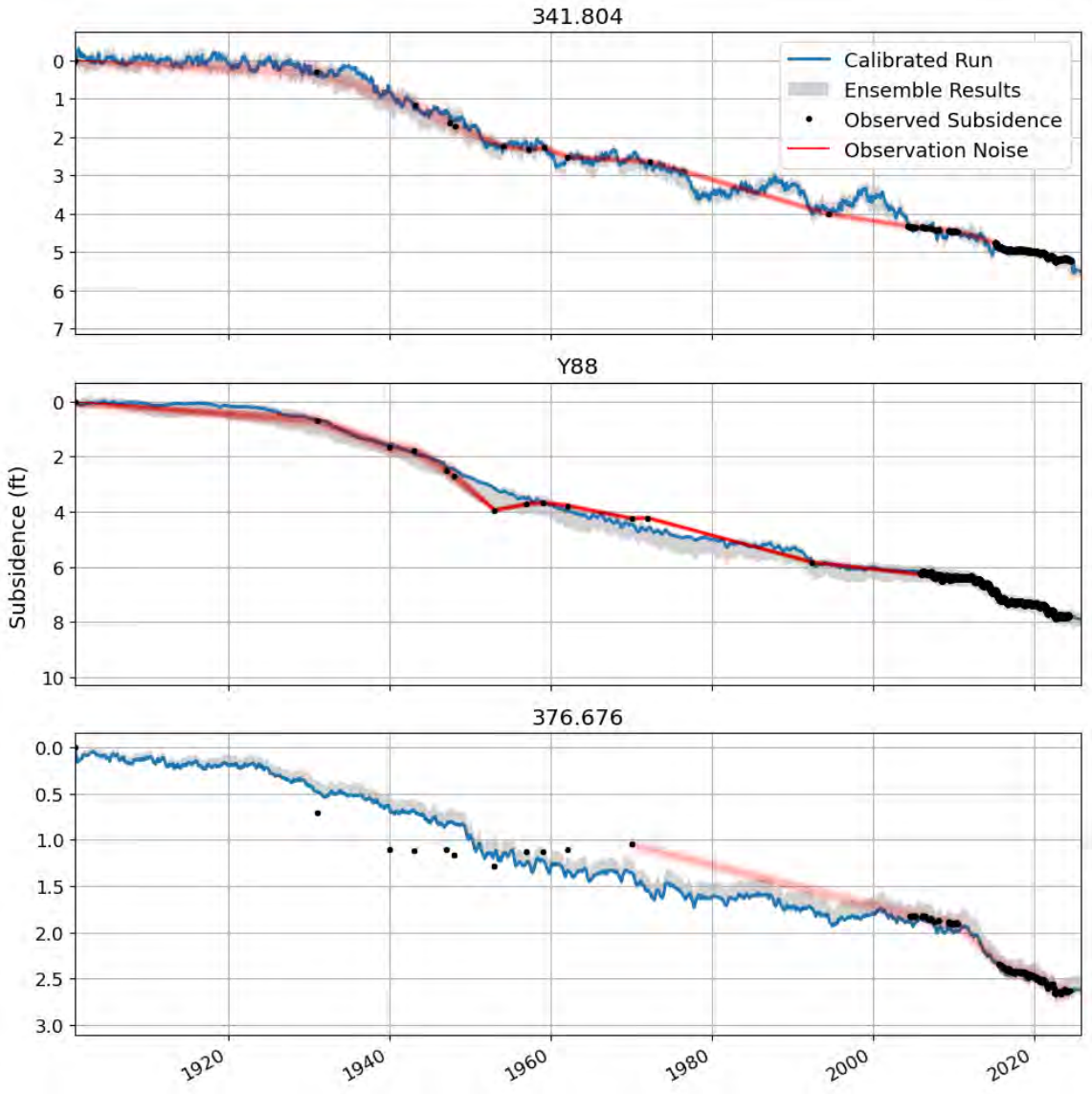


Figure 5. Comparison of simulated and observed subsidence at sites 341.804, Y88, and 376.676.

5.4 Compaction by Layer

Figures 6 A, B, and C show the distribution of simulated compaction across each of the three aquifer layers for sites Y88, 341.804, and 376.676. About 60 to 80% of the compaction occurs in the **Intermediate interval of the Principal Aquifer** in sites Y88 and 376.676, consistent with the pumping distribution across the depth at these sites (Figures 6A and B). At site 341.438, most of the compaction occurs in the **Deep interval of the Principal Aquifer** (Figure 6C), which could be attributed to the higher thickness of clay in layer 3 (Figure 4). The shallow interval of the principal aquifer (layer 1) shows smaller contributions, mainly elastic and seasonal in nature. This depth-specific breakdown is critical for prioritizing monitoring and management efforts and, and at this site specifically highlights the

importance of managing groundwater levels to prevent ongoing compaction in thick, slow-draining interbeds.

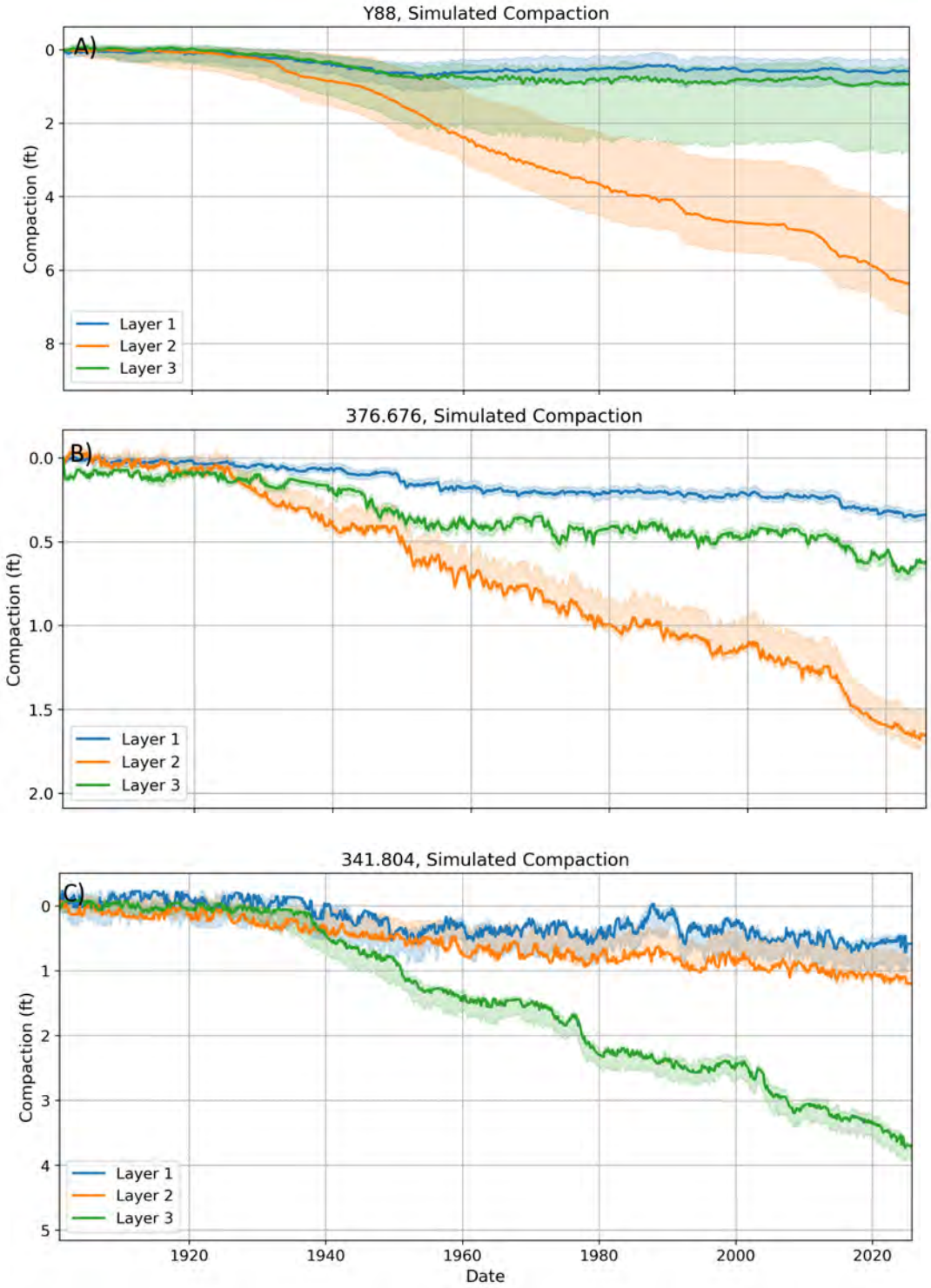


Figure 6 Layer-specific compaction distribution at sites Y88 (A), 376.676 (B), and 341.804 (C)

5.5 Critical Head Estimates

Numerical models are important for estimating critical head because these values cannot easily be directly measured in the field. Instead, they must be inferred through simulation of the stress-strain behavior of interbeds in response to changing groundwater levels over time. The MODFLOW 6-CSUB models used here simulate critical head by resolving both the time-delayed and instantaneous compaction effects across different layers. **Figures 7, 8,** and **9** illustrate these dynamics for all three sites in two panels: Panel A shows measured subsidence (red circles), simulated and measured groundwater levels in the Intermediate or Deep intervals of the principal aquifer (the blue line and circles, respectively), and the ensemble spread of simulated critical head (gray shaded area), with the dark blue dashed line indicating the mean estimate of critical head and the light purple dashed line showing the historical lowest measured groundwater level. Panel B presents the difference between the simulated critical head and the groundwater level in the Intermediate or Deep intervals of the principal aquifer, with red areas marking periods when groundwater levels are lower than the critical head—an important visual cue for understanding when inelastic compaction is expected to occur.

Critical head information is important for establishing or updating subsidence SMCs, as these thresholds define the conditions under which irreversible land subsidence occurs. Managing groundwater levels above the critical head ensures that additional inelastic compaction is minimized. This approach is more protective than managing to the historically lowest observed groundwater level because the critical head is often at a higher level, especially in systems with delayed compaction (Panel A of Figures 7 to 9). Therefore, critical head-based management provides a more accurate framework for preventing further damage to infrastructure from subsidence.

MODFLOW 6-CSUB can provide an approximation of the critical head by extracting the lowest groundwater level in cells containing an interbed in each model layer for each model stress period. For each stress period, the difference between the groundwater level in the model cell and the lowest groundwater level recorded in the interbed represents the amount of groundwater level recovery or decline (in model units) required to reach the critical head value, as illustrated in Figures 7A to 9A.

Preventing groundwater levels from declining below critical head is key to managing inelastic subsidence. Although groundwater levels are typically measured in the coarse-grained sediments, subsidence results from groundwater level declines in the fine-grained sediments (e.g. clays). The critical head is often different from the lowest recorded groundwater level unless sufficient time has elapsed to allow for the equilibration of the fine- and coarse-grained groundwater levels—a process that can take many years (residual subsidence). Therefore, managing to the lowest recorded groundwater level may result in inelastic subsidence because the critical head may be at a greater elevation than the measured groundwater level minimum in the aquifer, as shown in Figures 7A to 9A.

Residual subsidence can still occur when aquifer groundwater levels are above the critical head. In the period from 1994 to 2010, shown in panel B of Figures 7 and 8, the groundwater level in the aquifer rebounded and recovered above the critical head. At the onset of this rebound, subsidence rates decreased due to the rapid and substantial groundwater level recovery that resulted in a faster period of equilibration between the coarse- and fine-grained sediments than a lesser groundwater level recovery. These results demonstrate that models incorporating long-term records of groundwater levels and subsidence can effectively estimate the contributions of both contemporary and residual subsidence processes.

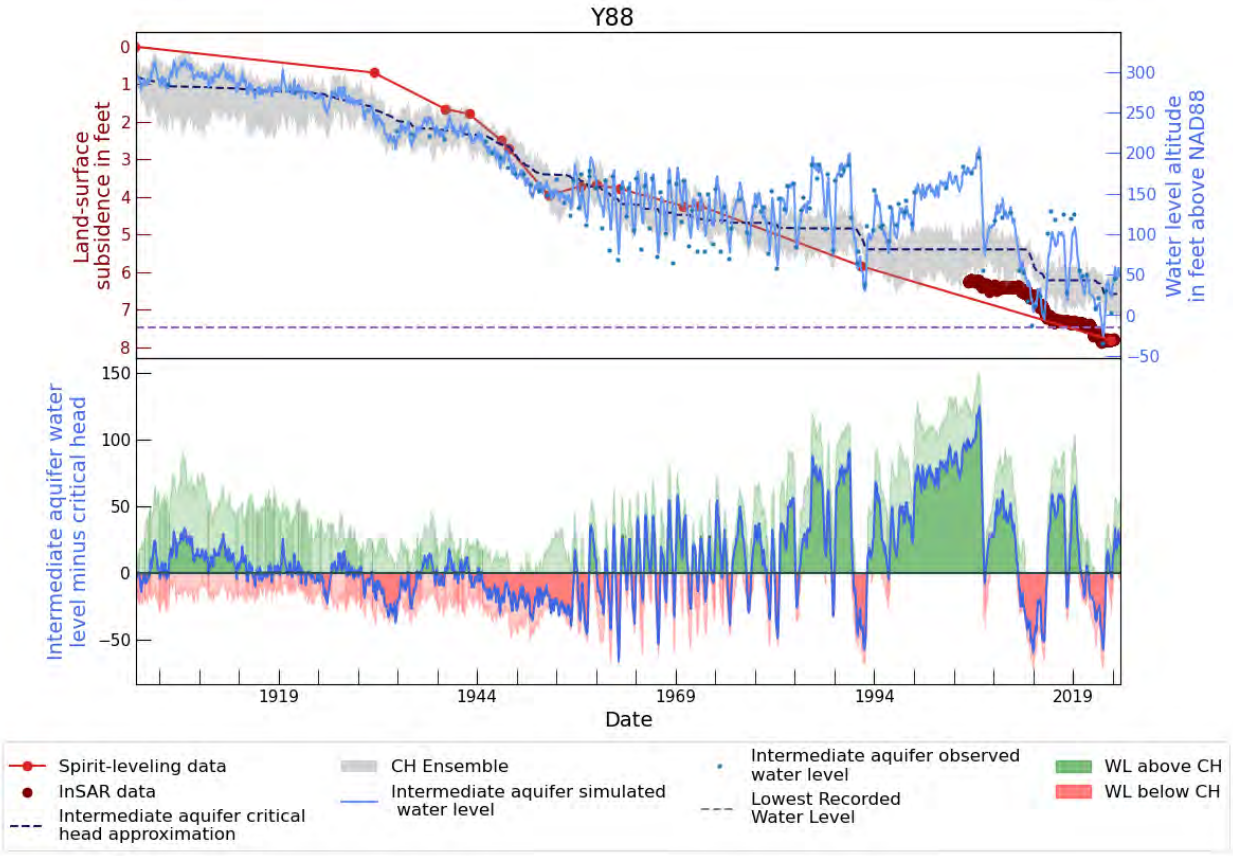


Figure 7. (a) Measured subsidence and simulated and measured groundwater levels and (b) the difference between the aquifer groundwater level and the critical head estimate at Site Y88 (Delano Municipal Airport) at the intermediate interval of the aquifer.

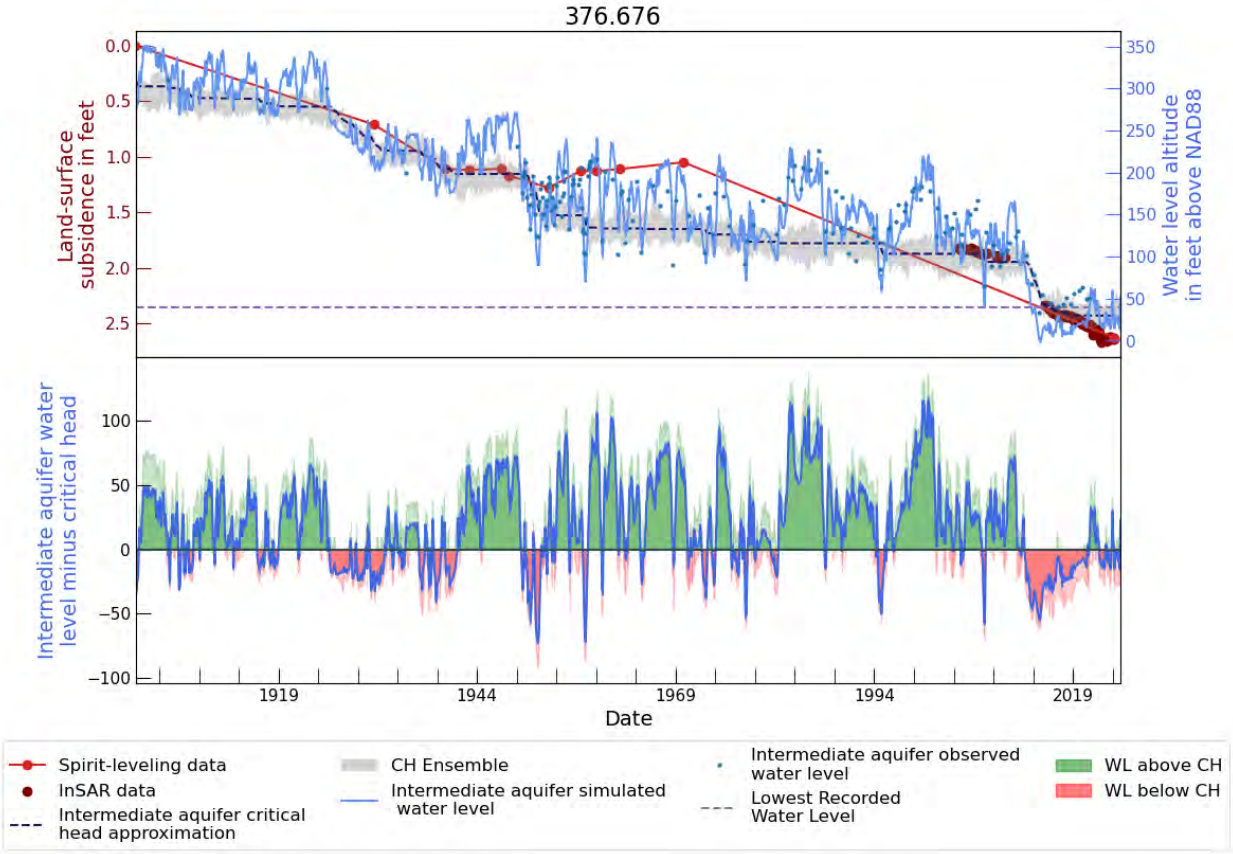


Figure 8. (a) Measured subsidence and simulated and measured groundwater levels and (b) the difference between the aquifer groundwater level and the critical head estimate at Site 376.676 (1 mile north of FKC) at the intermediate interval of the principal aquifer.

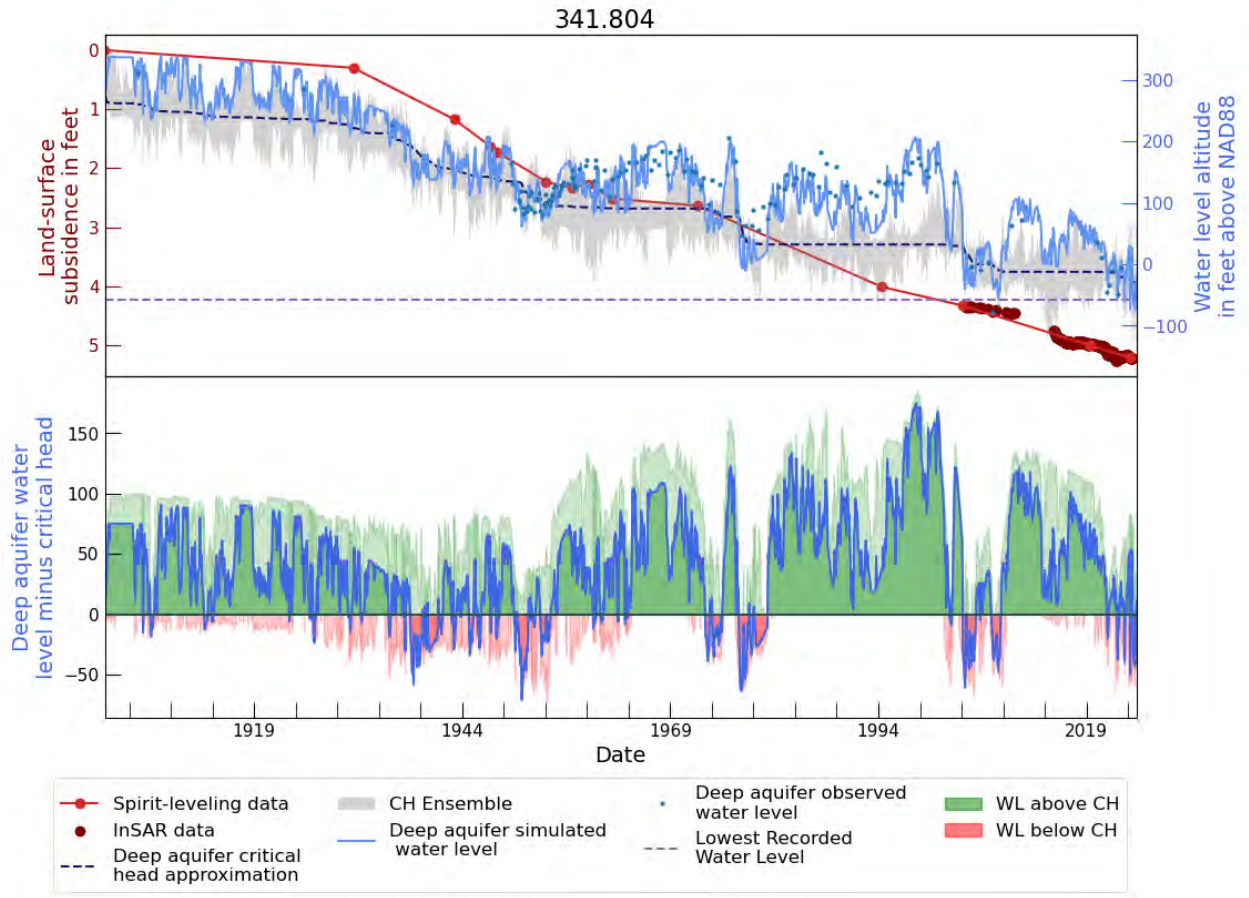


Figure 9. (a) Measured subsidence and simulated and measured groundwater levels and (b) the difference between the aquifer groundwater level and the critical head estimate at Site 341.804 (McFarland) at the deep interval of the principal aquifer.

6 References

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Appendix G-3: Friant Water Authority Letter of Support

854 N. Harvard Ave.
Lindsay, CA 93247
(559) 562-6305

April 30, 2024

Kristin Pittack, MS Kern County Subbasin Plan Manager
Rincon Consultants
4825 J St Ste 200
Sacramento, CA 95819

Subject: Kern Subbasin Progress Report on Friant-Kern Canal Lower Reach Subsidence Mitigation Studies and Request for Letter of Support from Friant Water Authority

Dear Ms. Pittack and Kern Subbasin GSPs:

We are in receipt of your letter dated April 16, 2024. The letter accurately outlined the history of coordination and communication between Kern Subbasin GSAs and Friant Water Authority (FWA) with regards to subsidence along the lower reach of the Friant-Kern Canal (FKC). As the letter stated, numerous meetings have been held with the goal of estimating projected future subsidence and estimating the cost to mitigate that subsidence.

As you recalled, one of the common points made during the meetings between the Kern Subbasin GSAs and FWA was related to FWAs "zero-tolerance absent proper mitigation" position for future subsidence that impacts the carrying capacity of the Friant-Kern Canal. Given the severity of the carrying capacity impacts as well as the harm done to contractors and communities whose livelihoods depend on a fully functioning canal, FWA has no other choice than to rigorously adhere to this policy, by any means necessary.

With that said, we very much appreciate the candor and transparency of those meetings and that the Kern Subbasin GSAs are committed to adhering to FWA's policy. We also understand that more time is needed to further analyze and finalize subsidence projections, finalize cost amounts, and conduct an attribution analysis to ultimately determine a cost allocation between the Kern GSAs. Given the coordination thus far, we have confidence that this additional work will be completed expeditiously and that the GSPs in the Kern Subbasin will properly mitigate impacts to the FKC.

Sincerely,

Jason Phillips, CEO
Friant Water Authority

April 16, 2024

Jason R. Phillips, CEO
Friant Water Authority
856 North Harvard Avenue
Lindsay, CA 93247
Via email: jphillips@friantwater.org

Subject: Kern Subbasin Progress Report on Friant-Kern Canal Lower Reach Subsidence Mitigation Studies and Request for Letter of Support from Friant Water Authority

Dear Mr. Phillips:

As you may be aware, the Kern Subbasin (Subbasin) Groundwater Sustainability Plans (GSPs) were deemed incomplete by the Department of Water Resources (DWR) in 2020 and inadequate in 2022. Since the receipt of the Inadequate Determination, the Subbasin Groundwater Sustainability Agencies (GSAs) have been diligently working to address the DWR-identified deficiencies in the Inadequate Determination, so as to avoid entering probation under the State Water Resources Control Board (SWRCB). At a very high level, the Subbasin GSAs need to address issues related to coordination and consistency of methodologies and set Sustainable Management Criteria that are consistent with SGMA regulations – including subsidence. The Subbasin has been making significant progress in addressing the issues in the Inadequate Determination, and the current schedule indicates the submittal of revised GSPs to the SWRCB in May 2024.

Regarding subsidence, the Subbasin has greatly appreciated the numerous meetings held with the staff and consultants of the Friant Water Authority (FWA). During those meetings, FWA staff has made it very clear that "any unmitigated subsidence beyond 2020 is unacceptable". Analysis has shown that our proposed groundwater level Minimum Thresholds (MTs) will lead to some amount of subsidence in the future along the lower reach of the Friant-Kern Canal (FKC), which is that portion that is covered by Kern Subbasin GSAs. As such, the Subbasin has been conducting analyses hand-in-hand with FWA staff and consultants to estimate the amount of potential future subsidence and estimate the cost to mitigate that potential subsidence. Through that work, the Subbasin has conservatively estimated a potential of up to 3 feet of subsidence along the aforementioned lower reach of the FKC, and a preliminary cost estimate of $40M attributable to Kern County GSAs.

Three tasks need to take place to move forward on this analysis and ultimately begin mitigating subsidence on the FKC:

1. Finalize the estimated amount of future potential subsidence caused by groundwater management in the Subbasin
2. Finalize the cost estimate to mitigate the potential subsidence, and determine how it will interact with the capacity correction projections FWA is currently working on
3. Conduct an attribution analysis to determine how mitigation costs may be split between Kern County GSAs

Unfortunately, none of the three tasks above will be completed prior to the May 2024 submittal of the revised GSPs to the SWRCB.

This letter has two goals: Firstly, the Subbasin GSAs wish to clearly state to FWA that the Subbasin GSAs are committed to working with FWA to expeditiously complete the above three tasks and mitigate post-2020 potential subsidence. Secondly, the Subbasin GSAs are requesting a letter of support from FWA for the Subbasin to include within their GSPs with regards to how the Subbasin is handling potential subsidence along the FKC. Since the above three tasks cannot be completed prior to submitting revised GSPs to the SWRCB, the hope is that the work the Subbasin has done to date with

FWA (several technical meetings, cost estimates, impacts analyses, installation of an extensometer along the FKC at Kimberlina Road) combined with the proposed path forward will be sufficient to assure FWA that post-2020 subsidence along the FKC will be mitigated.

To emphasize the Subbasin's commitment to this process, please find attached a scope of work and a cost-share agreement between most Subbasin GSAs to fund the model calibration necessary to complete tasks 1 and 3 above. The aim is to complete this work in 2024, and the Subbasin GSAs look forward to working with FWA to determine how mitigation will fit into the grand scheme of FKC Capacity Correction projects.

Please don't hesitate to contact Kristin Pittack if you have any questions or concerns.

Sincerely,

Kristin Pittack, MS
Kern County Subbasin Plan Manager/Point-of-Contact
kpittack@rinconconsultants.com
(760) 223-5602

CC:

Johnny Amaral, COO/Chief of External Affairs
jamaral@friantwater.org

Attachments

Attachment 1 INTERA Scope of Work