Draft Initial Study & Proposed Mitigated Negative Declaration

North Kern Water Storage District

Return Capacity Improvements for Regional Drought Resiliency Project

Prepared for:

North Kern Water Storage District

January 2022

[This page left intentionally blank]

GEI Consultants

Consulting Engineers and Scientists

Draft Initial Study & Proposed Mitigated Negative Declaration

North Kern Water Storage District

Return Capacity Improvements for Regional Drought Resiliency Project

Prepared for:

North Kern Water Storage District
33380 Cawelo Avenue
Bakersfield, CA 93308

Contact:

Mr. David Hampton
General Manager
661-393-2696

Prepared by:

GEI Consultants
5001 California Avenue, Suite 120
Bakersfield, CA 93309

Contact:

Ginger Gillin
Principal Environmental Scientist
503-342-3777

January 2022

Project No. 1804142 Task 4

[This page left intentionally blank]

Table of Contents

List of Tables

List of Figures

List of Appendices

Abbreviations and Acronyms

AF	acre-feet
AFY	acre-feet per year
BMP	best management practices
Caltrans	California Department of Transportation
C.A.R.B.	California Air Resource Boards
C.A.A.Q.S.	California Ambient Air Quality Standards
CCR	California Code of Regulations
CEC	California Energy Commission
CEQA	Californi Environmental Quality Act
cfs	cubic feet per second
CDFW	California Department of Fish and Wildlife
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
C.O.	carbon monoxide
County	Kern County
CVP	Central Valley Project
dBA	A-weighted decibels
District	North Kern Water Storage District
D.O.C.	Department of Conservation
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
FKC	Friant-Kern Canal
GAC	granular activated carbon
GEI	GEI Consultants, Inc.
GHG	greenhouse gas
GSP	Groundwater Sustainability Plan
HCP	Habitat Conservation Plans
IS/MND	Initial Study/Mitigated Negative Declaration
Leq	equivalent continuous sound level in decibels
LRA	Local Responsible Area
MA	Masters of Art
MCL	Maximum Contaminant Level
MLD	Most Likely Descendant
MP	mile post
N.A.A.Q.S.	National Ambient Air Quality Standards
NAHC	Native American Heritage Commission
$N.O._2$.	nitrogen dioxide
N.P.D.E.S.	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
O_3	ozone
PG&E	Pacific Gas and Electric
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in diameter

$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PRC	Public Resources Code
proposed Project / Project	Return Capacity Improvements for Regional Drought Resiliency Project
Reclamation	U.S. Bureau of Reclamation
RPA	registered professional archaeologist
SGMA	Sustainable Groundwater Management Act
S.J.V.A.B	San Joaquin Valley Air Basin
S.J.V.A.P.C.D.	San Joaquin Valley Air Pollution Control District
$S.O._2$.	sulfur dioxide
S.M.A.R.A.	Surface Mining and Reclamation Act of 1975
SPAL	Small Project Analysis Level
SR	State Route
State Water Board	State Water Resource Control Board
SWP	State Water Project
SWPPP	Stormwater Pollution Prevention Plan
TCP	1,2,3-Trichloropropane
U.S.F.W.S.	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

This page intentionally left blank

1.0 Introduction

The North Kern Water Storage District (District) has prepared this Initial Study/proposed Mitigated Negative Declaration (IS/MND) in compliance with the California Environmental Quality Act (CEQA) and Guidelines to address the potentially significant environmental impacts of the proposed Return Capacity Improvements for Regional Drought Resiliency Project (proposed Project or Project) in Kern County, California (County). The District is the lead agency under CEQA.

After the required public review of this document is complete, the District's Board of Directors will consider all IS/MND comments received, the entirety of the administrative record for the Project, whether to adopt the proposed MND and a Mitigation Monitoring and Reporting Program and approve the proposed Project.

1.1 Summary of Findings

Chapter 3 of this document contains the analysis and discussion of potential environmental impacts of the proposed Project. Based on the issues evaluated in that chapter, it was determined that the proposed Project would result in no impacts on the following issue areas:

- Land Use and Planning
- Population and Housing
- Public Services
- Recreation
- Transportation
- Tribal Cultural Resources
- Wildfire

The proposed Project would result in less-than-significant impacts on the following issue areas:

- Aesthetics
- Agriculture and Forestry Resources
- Energy
- Greenhouse Gas Emissions
- Hazards and Hazardous Materials
- Mineral Resources
- Noise
- Utilities and Service System

The proposed Project would result in less-than-significant impacts *after* mitigation implementation on the following issue areas:

- Air Quality

- Biological Resources
- Cultural Resources
- Geology and Soils
- Hydrology and Water Quality

1.2 Other Key Public Agencies Relying on this IS/MND

CEQA requires that state and local governmental agencies consider the environmental effects of projects over which they have discretionary authority before taking action on those projects (Public Resources Code [PRC] Section 21000 et seq.). CEQA also requires that each lead agency avoid or mitigate to less-than-significant levels, wherever feasible, the significant environmental effects of projects it approves or implements. There are no other key public agencies relying on this IS/MND.

1.3 Document Organization

This document contains the information required under CEQA:

Chapter 1, Introduction. This chapter describes the purpose of the IS/MND, summarizes findings, and describes the organization of this IS/MND.

Chapter 2, Project Description. This chapter describes the Project location and background, Project need and objectives, Project characteristics, construction activities, Project operations, and discretionary actions and approvals that may be required.

Chapter 3, Proposed Mitigated Negative Declaration. The proposed MND briefly summarizes the proposed Project, summarizes the environmental conclusions, and identifies that mitigation measures would be implemented in conjunction with the proposed Project.

Chapter 3, Evaluation of Environmental Impacts. This chapter presents an analysis of environmental issues identified in the CEQA environmental checklist and determines whether Project implementation would result in no impact, less-than-significant impact, less-than-significant impact with mitigation incorporated, potentially significant impact, or significant impact on the physical environment in each topic area. Should any impacts be determined to be potentially significant or significant, an Environmental Impact Report (EIR) would be required. For this proposed Project, however, mitigation measures have been incorporated as needed to reduce all potentially significant and significant impacts to a less-than-significant level.

Chapter 4, References. This chapter lists the references used to prepare this IS/MND.

Chapter 5, Report Preparers. This chapter identifies report preparers who contributed to the preparation of this document.

2.0 Project Description

2.1 Project Background

The District is located in Kern County along the eastern side of California's southern San Joaquin Valley (**Figure 2-1**). The District's service area includes approximately 60,000 acres of predominately agricultural land north of the City of Bakersfield, west of State Route (SR) 99, and east of the cities of Shafter and Wasco.

North Kern administers a conjunctive use project that consists of groundwater banking, recovery, and exchange programs to optimize water supplies. Groundwater banking facilities consist of approximately 1,550 acres of spreading ponds/recharge basins with a capacity to recharge up to 300,000 acre-feet per year (AFY). Most of the District's groundwater banking is associated with "in-District" operations; however, the District has maintained active water exchange and banking programs with District landowners, other districts, and third parties since the mid-1990s. Although the District typically has an additional 150,000 AF of physical recharge capacity available for use by neighboring Central Valley Project (CVP) or non-neighboring State Water Project (SWP) contractors, the lack of recovery and return capacity of the stored water pose constraints that limit the contractors use of the District's spreading grounds. Therefore, the District has identified a need to improve conveyance capacity to return the stored water to its banking partners during dry years.

Through this Regional Drought Resiliency Project (Project), the District proposes to replace some wells and use some of its high-quality wells to increase return capacity. This Project also entails construction of new pipelines and connections to the Friant-Kern Canal (FKC), which will be used to convey previously banked water.

The District operates a system of 100 wells with an approximate instantaneous capacity of 350 cubic feet per second (cfs). This capacity is approximately equal to peak irrigation season demands for the in-District, Class 1 Service Area. Unused well capacity is available for use on in-District, Class 2 Service Area lands and to return previously banked water to its banking partners via the FKC. Currently, 13 District wells with a combined maximum capacity of 56.9 cfs are approved for pump-in at five discharge locations. The proposed Project adds nine wells, four of which will be destroyed and replaced with newly constructed wells, with a combined maximum capacity of 46.6 cfs and three new discharge locations (**Figures 2-2** and **2-3**).

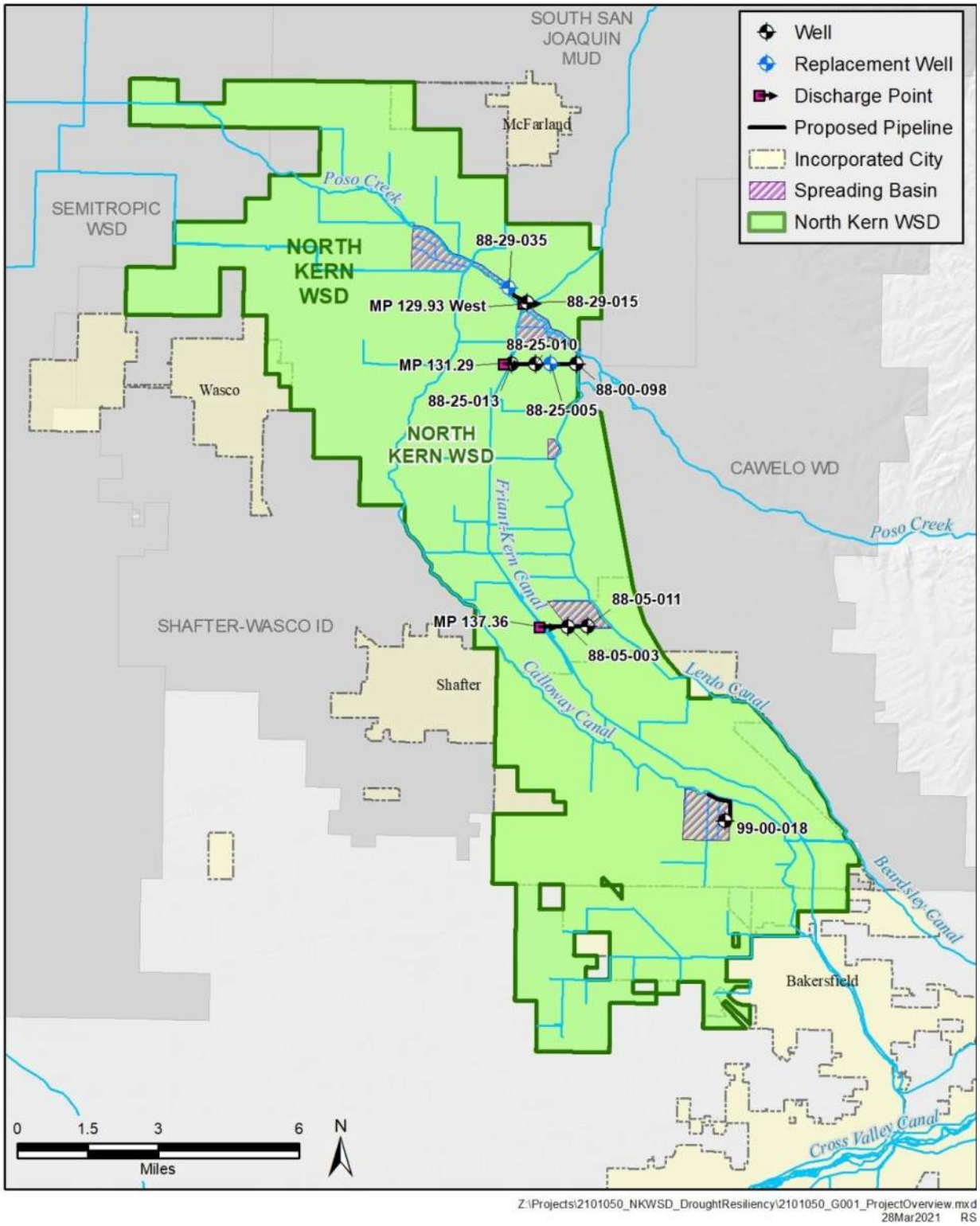
2.2 Project Objectives

The objective of this proposed Project is to improve return capacity and increase water supply reliability, especially during times of drought. The proposed Project is intended to provide the District and neighboring districts, with additional water resources for agricultural uses, or other purposes as determined by the District to:

- Improve long-term resiliency to drought.

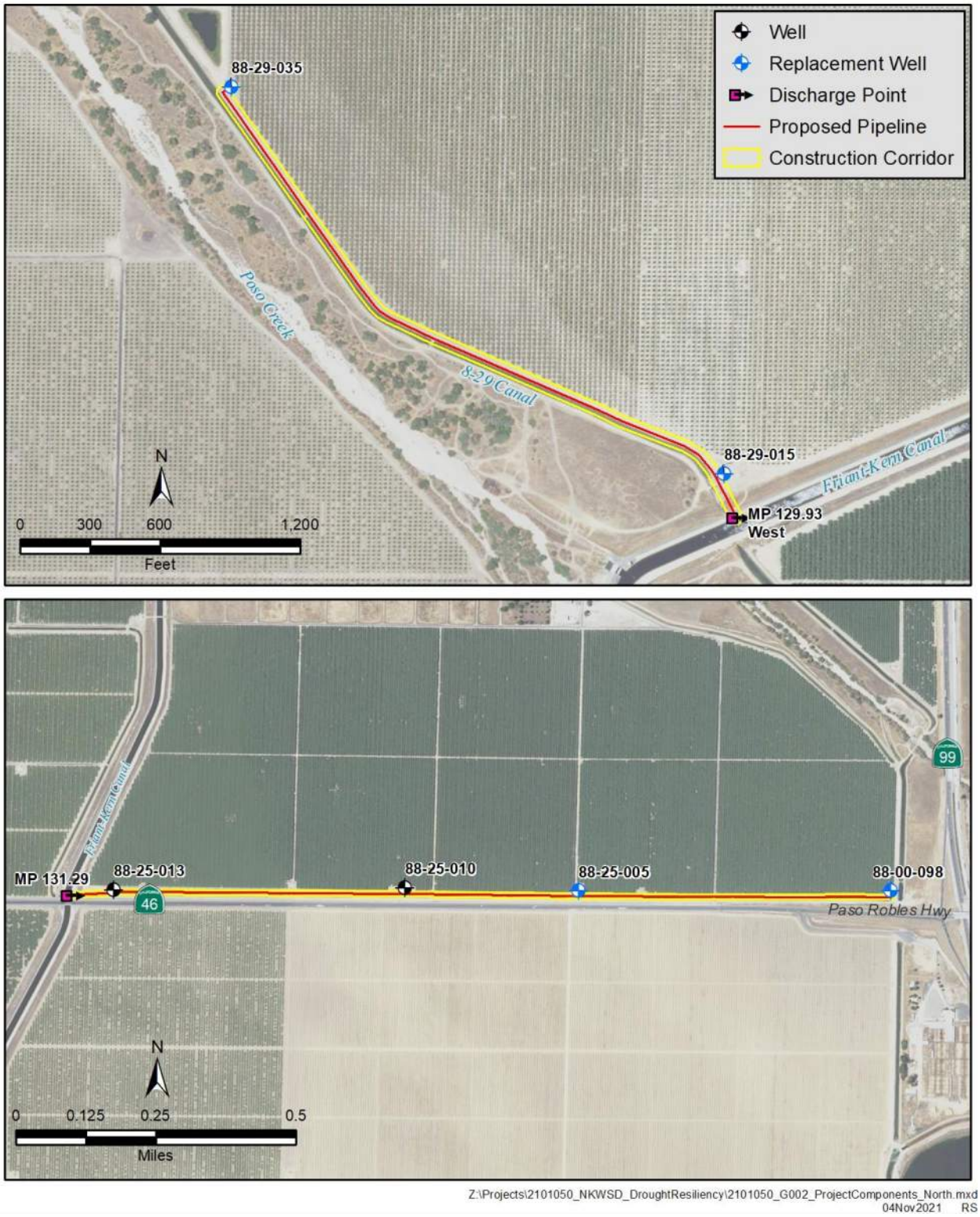
- Improve and expand District infrastructure to allow for the return of previously stored water to the Districts banking partners.
- Help achieve the U.S. Bureau of Reclamation's (Reclamation) WaterSMART Drought Response Program goals of modernizing infrastructure and restoring trust with local communities.
- Increase the District's flexibility to recover previously banked groundwater, with the least amount of potential for increased subsidence.

Figure 2-1. North Kern Water District and Proposed Project Locations.



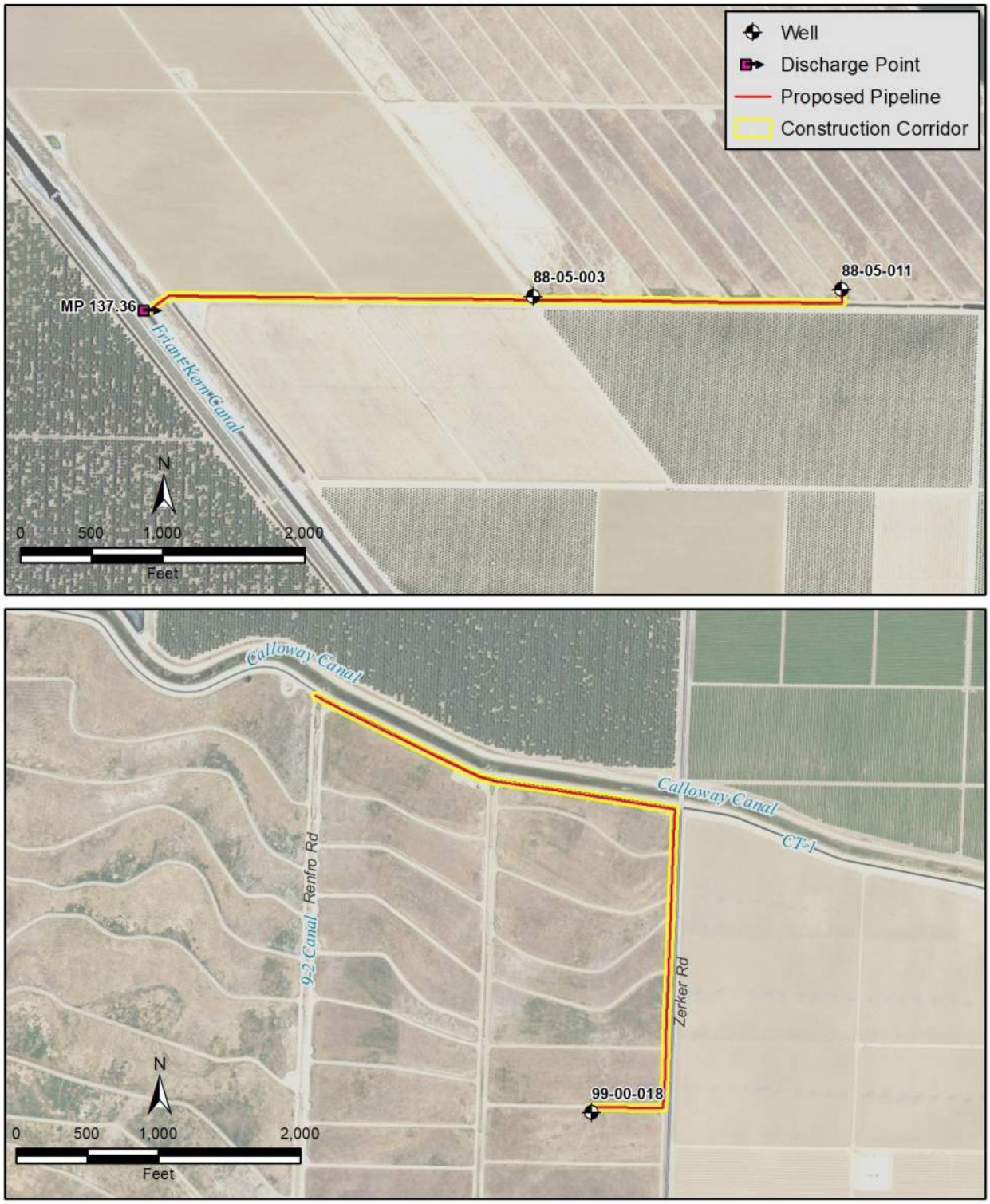
Source: GEI 2021

Figure 2-2. Project Components for Well Replacement and Improvements, MP 129.93 and MP 131.29.



Source: GEI 2021

Figure 2-3. Project Components for Well Replacement and Improvements MP 137.36.



Source: GEI 2021

2.3 Proposed Project

The proposed Project includes replacing four wells and installing three discharge outfalls and approximately 3.9 miles of pipeline. **Table 2-1** summarizes the discharge outfalls, wells, pipeline length, and location. The Project sites are in the Rosedale, Famoso, and McFarland U.S. Geological Survey (USGS) 7.5-minute quadrangles. with components in the following townships and ranges: 26S/25E (section 36), 27S/25E (section 1), 27S/26E (section 6), and 28S/26E (sections 6, 27).

Table 2-1. Discharge Outfalls, Wells, and Pipeline Length

Discharge Mile Post (MP)	Well	Pipeline Length (Miles)	Location
129.93 (new discharge)	88-29-035 (replacement well)	0.56	Adjacent to the 8-29 Canal and Poso Creek, approximately 6 miles northeast of Wasco
	88-29-015 (replacement well)		
131.29 (new discharge)	88-25-013	1.47	Adjacent to SR 46, approximately 0.15-mile west of SR 99 and approximately 5 miles east of Wasco
	88-25-010		
	88-25-005 (replacement well)		
	88-00-098 (replacement well)		
137.36 (new discharge)	88-05-003	0.93	Adjacent to the Minter Field spreading basins, approximately 2.5 miles northeast of Shafter
	88-05-011		
142.01 (existing discharge)	99-00-018	1.0	Adjacent to the Rosedale spreading basins, approximately 2.5 miles north of Bakersfield

Source: GEI Consultants, Inc.

The District would destroy four existing wells (88-29-035, 88-29-015, 88-25-005, and 88-00-098) and replace them with newly constructed wells in agricultural land within 100 feet of the existing wells. The replacement wells would be drilled to a depth of approximately 1,200 feet and have an average flow of approximately 5 cfs. A concrete pad (approximately 100 square feet, each) would be installed around the replacement well. The above-ground well heads would be approximately 9 feet tall and 10 feet radius.

The District would also connect a total of nine wells: the four replacement wells and five other wells, to the FKC. Wells 88-29-035 and 88-29-015 would be connected to a new discharge outfall at Mile Post (MP) 129.93. Wells 88-25-013, 88-25-010, 88-25-005, and 88-00-098 would be connected to a new discharge outfall at MP 131.29. Wells 88-05-003 and 88-05-011 would be connected to a new discharge outfall at MP 137.36. Well 99-00-018 will be connected to an

existing pipeline and discharge outfall at MP 142.01. The new discharge outfalls would be installed below the top-of-bank within the FKC prism. The District is required to obtain approval from Reclamation prior to construction. Each connection to the FKC would require a standard turn-in and small delivery gate for control (*see* Photo 12 for an example).

Finally, the District would install four segments of 27-inch-diameter polyvinyl chloride (commonly known as PVC) pipe totaling approximately 3.96 miles. The District would excavate trenches (up to 4 feet wide and 7 feet deep) within or along the edge of existing dirt roads. Therefore, the trenches would result in the excavation of approximately 1.92 acres and 21,700 cubic yards of soil, all of which would be in or along the edge of existing roadways. The trenches would be backfilled with the excavated material after the pipeline is installed. The pipeline construction corridor would be up to 50 feet wide to account for the trenches, access routes, materials staging, and overburden stockpiling. A maximum of approximately 24 acres of land would be temporarily disturbed by Project activities in the pipeline construction corridor.

2.4 Construction Schedule and Staging Areas

The District would drill the four replacement wells and install the pipeline in late winter/spring 2022 or as soon as environmental approvals are obtained, regardless of month or season. The three FKC discharge outfalls would likely be constructed during the typical maintenance period, which is November through January. Project construction activities will only occur during the day (from 30 minutes prior to sunrise and 30 minutes following sunset).

Staging and laydown areas (which would temporarily house construction material and excavated soil) would be located immediately adjacent to the nine wells and within the 50-foot-wide pipeline construction corridor. No additional acreage would be needed for staging and laydown. Existing roads would be used to access the wells and pipeline construction corridor.

2.5 Construction Equipment and Workers

Equipment that would be used during Project implementation includes an excavator, trencher, backhoe, dozer, drill rig, hoist crane, water truck, and pick-up trucks. Up to 10 construction workers would be onsite at one time.

2.6 Operation and Maintenance Activities

The new and replacement wells will be operated and maintained by the District under their Well Inspection and Maintenance Program. This program includes daily well site inspections (in pumping years) and minor maintenance work. Electrical panel inspections and motor/line-shaft inspections are also performed periodically. The District maintains extensive records for all District's wells to detect any deterioration of well performance. Periodic overhauls of wells help ensure the wells are operating efficiently and prolongs the useful life. The District's maintenance and overhaul procedures helps identify well problems sooner so the issue can be addressed in a timely manner.

2.7 Regulatory Requirements, Permits, and Approval

As the lead agency under CEQA, the District has the principal responsibility for approving and carrying out the proposed Project and for ensuring that CEQA requirements and all other applicable regulations are met. Other agencies that may have permitting approval or review authority over portions of the proposed Project are listed below:

- **Central Valley Regional Water Quality Control Board (C.V.R.W.Q.C.B.), Construction Activities General Permit.** Required for any Project that disturbs more than 1 acre of soil. The proposed Project would temporarily disturb a maximum of 24 acres of land in Kern County. Under this permit, the County would need to develop a Stormwater Pollution Prevention Plan (SWPPP).
- **Kern County Environmental Health Services Department, Water Well Permit.** Required for any Project proposing to construct a well in Kern County.
- **San Joaquin Valley Air Pollution Control Board (S.J.V.A.P.C.D.), Dust Control Plan.** Required for any Project that disturbs more than 1 acre of soil.
- **U.S. Bureau of Reclamation, Land Use Authorization.** Required for construction, operation, and maintenance of the pipelines across lands owned by the United States at three new discharge locations (MP 129.93, 131.29, and 137.36) on the FKC.

3.0 Environmental Checklist

Project Information

#1. Project title:	Return Capacity Improvements for Regional Drought Resiliency Project
#2. Lead agency name and address:	North Kern Water Storage District
#3. Contact person and phone number:	Mr. David Hampton (661) 393-2696
#4. Project location:	33380 Cawelo Avenue, Bakersfield, CA 93308
#5. Project sponsor's name and address:	Same as lead agency
#6. General plan designation:	Exclusive Agriculture
#7. Zoning:	Exclusive Agriculture
#8. Description of Project: (Describe the whole action involved, including but not limited to later phases of the Project, and any secondary, support, or off-site features necessary for its implementation. Attach additional sheets if necessary.)	The proposed Project consists of installing three discharge outfalls in the FKC, replacing two wells, and installing 3.96 miles of pipeline to improve return capacity and increase water supply reliability, especially during times of drought.
#9. Surrounding land uses and setting: Briefly describe the Project's surroundings:	The Project sites are located in the unincorporated area of Kern County, in an area dominated by agricultural production. Several small cities by the names of Calico, Famoso, and Slater are located within the vicinity of the Project sites. The City of Bakersfield is located approximately 2 miles south of the southernmost Project site.
#10. Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement.)	The Project is proposed to be partially funded by the U.S. Bureau of Reclamation.
#11. Have California Native American tribes traditionally and culturally affiliated with the Project area requested consultation pursuant to Public Resources Code (PRC) Section 21080.3.1? If so, is there a plan for consultation that includes, for example, the determination of significance of impacts to tribal cultural resources, procedures regarding confidentiality, etc.?	Yes. Consultation is described in more detail in Chapters 3.5, Cultural Resources, and 3.17, Tribal Cultural Resources.

Note: Conducting consultation early in the CEQA process allows tribal governments, lead agencies, and Project proponents to discuss the level of environmental review, identify and address potential adverse impacts to tribal cultural resources, and reduce the potential for delay and conflict in the environmental review process. (*See* PRC Section 21080.3.2.) Information may also be available from the California Native American Heritage Commission's Sacred Lands File per PRC Section 5097.96 and the California Historical Resources Information System administered by the California Office of Historic Preservation. **Please also note** that PRC Section 21082.3(c) contains provisions specific to confidentiality.

Environmental Factors Potentially Affected

No environmental resources were found to have "potentially significant impacts." The environmental factors listed as "Yes" in **Table 3-1** would be potentially affected by this Project, involving at least one impact that has "Less-than-Significant Impacts with Mitigation Incorporated" as indicated by the checklist on the following pages.

Table 3-1. Environmental Resources with Potentially Significant Impacts Prior to Mitigation.[1]

Environmental Resources	Yes or No?
Aesthetics	No
Agriculture and Forestry Resources	No
Air Quality	**Yes**
Biological Resources	**Yes**
Cultural Resources	**Yes**
Energy	No
Geology/Soils	**Yes**
Greenhouse Gas Emissions	No
Hazards and Hazardous Materials	No
Hydrology/Water Quality	**Yes**
Land Use/Planning	No
Mineral Resources	No
Noise	No
Population/Housing	No
Public Services	No
Recreation	No
Transportation	No
Tribal Cultural Resources	No
Utilities/Service Systems	No
Wildfire	No
Mandatory Findings of Significance	No

[1] Impacts to all resources are reduced to less-than-significant with the incorporation of mitigation measures.

Determination (To be completed by the Lead Agency)

On the basis of this initial evaluation:	Yes or No?
I find that the proposed Project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.	No
I find that although the proposed Project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the Project have been made by or agreed to by the Project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.	**Yes**
I find that the proposed Project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.	No
I find that the proposed Project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.	No
I find that although the proposed Project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier Environmental Impact Report (EIR) or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed Project, nothing further is required.	No

Signature

1/11/2022
Date

Dave Hampton
Print Name

General Manager
Title

North Kern Water Storage District
Agency

3.1 Aesthetics

#1. **AESTHETICS**. Except as provided in PRC Section 21099, **would the Project**:

#1 -a. Have a substantial adverse effect on a scenic vista?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#1 -b. Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a State scenic highway?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#1 -c. In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from a publicly accessible vantage point.) If the Project is in an urbanized area, would the Project conflict with applicable zoning and other regulations governing scenic quality?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#1 -d. Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

3.1.1 Environmental Setting

The Project sites are located west of SR 99, in Kern County. The landscape in the Project site locations is relatively flat, with open agricultural fields and orchards characteristic of Central Valley farmlands dominating the landscape (*see* Appendix A for photos of the Project area). Background views to the east consist of traffic along State Highway 99, which runs adjacent to the Project sites. Additionally, agricultural production can be seen from the Project sites as agriculture is the dominate land use in Kern County.

Elements of the built environment (e.g., roads) and water management infrastructure (e.g., pumping facilities), which are characteristic of many areas of the Central Valley, are present onsite. From the northernmost Project site, viewers can see the Poso Creek corridor. SR 99 is located approximately 0.10 mile east of the second most northern Project site and can be seen from this Project site. The Minter Field spreading basins are located just north of the Project site located

adjacent to Canal Way, and the Rosedale spreading basins are located just east of the southernmost Project site.

There are no designated scenic vistas located in the vicinity of the proposed Project. Additionally, there are no state- or County-designated scenic highways in the Project vicinity (Caltrans 2019a, 2019b). The nearest designated scenic highways are SR 58 (near Mojave) and SR 395 (near Little Lake), both of which are located approximately 60 miles from the Project sites. The two northernmost Project sites (adjacent to the Poso Creek canal and just north of Highway 46, respectively) and the southernmost Project site are zoned as letter "A" (signifying exclusive agriculture), and the Project site located on a portion of the Minter Field recharge basins and connecting to MP 137.36 is zoned letters "A H" (signifying exclusive agriculture and airport approach height) (Kern County 2021).

3.1.2 Discussion

#1 -a and b. Have a substantial adverse effect on a scenic vista? Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a State scenic highway?

There are no significant view-sheds, scenic vistas, or scenic highways located in the vicinity of the proposed Project (Caltrans 2019a, 2019b). There would be **no impact**.

#1 -c. In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point.) If the Project is in an urbanized area, would the Project conflict with applicable zoning and other regulations governing scenic quality?

During construction, several vehicles and equipment would be onsite which is similar to normal agricultural operations and water infrastructure equipment common to the area. The proposed Project would not impact the adjacent agricultural land. Following the completion of construction activities, all construction related equipment would be removed and the sites (with the exception of the two replacement wells) would be restored to pre-construction conditions. The two replacements wells would be installed in agricultural land within 100 feet of the existing wells. All pipeline connections would either be buried underground or exposed for a few feet to allow for the tie-in to the existing water infrastructure. Therefore, the Project would result in a **less-than-significant** impact.

#1 -d. Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?

The Project would not change the existing views, nor would it create new sources of light. There would be **no impact**.

3.2 Agriculture and Forestry Resources

#2. AGRICULTURE AND FORESTRY RESOURCES. In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997, as updated) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the State's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment Project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. **Would the Project:**

#2 -a. Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#2 -b. Conflict with existing zoning for agricultural use, or a Williamson Act contract?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#2 -c. Conflict with existing zoning for, or cause rezoning of, forest land (as defined in PRC Section 12220(g)), timberland (as defined by PRC Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g))?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#2 -d. Result in the loss of forest land or conversion of forest land to non-forest use?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#2 -e. Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.

3.2.1 Environmental Setting

Three of the four Project sites are designated as agriculture (Kern County 2021). The two northernmost Project sites are designated as prime farmland, the Project site that connects to the FKC at MP 137.36 is designated as urban and built-up land and prime farmland, and the

southernmost Project site is designated as urban and built-up land, as delineated by the Farmland Mapping and Monitoring Program (D.O.C. 2018). Of the four proposed Project sites, two have at least a portion of the site under a Williamson Act contract including the northernmost Project site and the Project site that ties into FKC at MP 137.36 (Kern County 2010).

3.2.2 Discussion

#2 -a and b. Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use? Conflict with existing zoning for agricultural use, or a Williamson Act contract?

For the three Projects sites designated as prime farmland, the Project would be implemented on the outer edges of the agricultural parcels, along the established dirt roads which are barren. Implementation of the proposed Project would not convert farmland to non-farmland, nor would it conflict with existing Williamson Act contracts. The purpose of the proposed Project is to improve water supply for agricultural water users, which is a benefit to agricultural production. During Project implementation, the parcel would continue to be mapped as prime farmland and the Williamson Act contract would continue to be valid. Finally, constructing and operating water facilities is a compatible use as defined by the Williamson Act. As defined by the Kern County Agricultural Preserve Standard Uniform Rules (Form 505), compatible use includes, "The erection, construction, alteration, operation, and maintenance of gas, electric, water, and communication utility facilities and similar public service facilities by corporations and companies under the jurisdiction of the Public Utilities Commission of the state of California and by public agencies." Because the District is a public agency that would construct, operate, and maintain the water facilities, the proposed Project is a compatible use consistent with the Williamson Act. Therefore, this impact would be **less than significant**.

#2 -c and d. Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code Section 12220(g)), timberland (as defined by PRC Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g))? Result in the loss of forest land or conversion of forest land to non-forest use?

The Project sites are not zoned as forest land, timberland, or timberland zoned as timberland production, therefore, no loss or conversion of forest land to non-forest land would result from the proposed Project. There would be **no impact**.

#2 -e. Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?

The proposed Project would not impact farmland to such a degree that the land would be converted to non-agricultural use. The proposed Project would be implemented on the outer edges of the parcels zoned as agriculture and would not interfere with crop production. The replacement wells

would be constructed within 100 feet of the existing wells, and the installation of the four pipeline segments would be primarily in or along the edge of existing dirt roads. Disturbance from construction activities would including use of heavy equipment, ground-disturbance, and staging of equipment and would not be substantially different that normal agricultural operations or water infrastructure maintenance equipment common to the area. The purpose of the proposed Project is to improve water supply for agricultural water users, which is a benefit to agriculture. Therefore, this impact would be **less than significant**.

3.3 Air Quality

#3. AIR QUALITY. Where available, the significance criteria established by the applicable air quality management district or air pollution control district may be relied on to make the following determinations. **Would the Project:**

#3 -a. Conflict with or obstruct implementation of the applicable air quality plan?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes.**	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#3 -b. Result in a cumulatively considerable net increase of any criteria pollutant for which the Project region is non-attainment under an applicable Federal or State ambient air quality standard?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes.**	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#3 -c. Expose sensitive receptors to substantial pollutant concentrations?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes.**	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#3 -d. Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.

3.3.1 Environmental Setting

The proposed Project is located in the San Joaquin Valley Air Basin (S.J.V.A.B.) within Kern County. The S.J.V.A.P.C.D. is responsible for obtaining and maintaining air quality conditions in the County.

The federal Clean Air Act and California Clean Air Act required the U.S. Environmental Protection Agency (EPA) and California Air Resource Boards (C.A.R.B.) to establish health-based air quality standards at the federal and state levels. National Ambient Air Quality Standards (N.A.A.Q.S.) and California Ambient Air Quality Standards (C.A.A.Q.S.) were established for the following criteria pollutants: carbon monoxide (C.O.), ozone (O_3), sulfur dioxide ($S.O._{2.}$), nitrogen dioxide ($N.O._{2.}$), particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and lead. Areas of the state are designated as attainment,

nonattainment, maintenance, or unclassified for the various pollutant standards according to the federal Clean Air Act and California Clean Air Act.

An "attainment" designation for an area signifies that pollutant concentrations did not violate the N.A.A.Q.S. or C.A.A.Q.S. for that pollutant in that area. A "nonattainment" designation indicates that a pollutant concentration violated the standard at least once, excluding those occasions when a violation was caused by an exceptional event, as identified in the criteria. A "maintenance" designation indicated that the area previously categorized as nonattainment is currently categorized as attainment for the applicable pollutant; though the area must demonstrate continued attainment for a specific number of years before it can be re-designated as an attainment area. An "unclassified" designation signifies that data does not support either an attainment or a nonattainment status. The EPA established N.A.A.Q.S. in 1971 for six air pollution constituents. States have the option to add other pollutants, to require more stringent compliance, or to include different exposure periods. C.A.A.Q.S. and N.A.A.Q.S. are listed in **Table 3-2**.

Table 3-2. Federal and California Ambient Air Quality Standards and Attainment Status.

Pollutant	Averaging Time	California Standards Concentration	Federal Primary Standards Concentration
Ozone (O_3)	8-hour	0.070 parts per million. (137 micrograms per cubic meter)	0.070 parts per million (137 micrograms per cubic meter) (*see* Note #1)
	1-hour	0.09 parts per million. (180 micrograms per cubic meter)	(None; *see* Note #2)
Respirable Particulate Matter (PM_{10})	24-hour	50 micrograms per cubic meter	150 micrograms per cubic meter
	Annual Arithmetic Mean	20 micrograms per cubic meter	(None)
Fine Particulate Matter ($PM_{2.5}$)	24-hour	(None)	35 micrograms per cubic meter
	Annual Average	12 micrograms per cubic meters	12 micrograms per cubic meter
Carbon Monoxide	8-hour	9 parts per million (10 milligrams per cubic meter)	9 parts per million (10 milligrams per cubic meter)
	1-hour	20 parts per million (23 milligrams per cubic meter)	35 parts per million (40 micrograms per cubic meter)
Nitrogen Dioxide	Annual Average	0.03 parts per million (57 micrograms per cubic meters)	0.053 parts per million (100 micrograms per cubic meters)
	1-hour	0.18 parts per million (339 micrograms per cubic meters)	0.100 parts per million (188 micrograms per cubic meters)
Lead	30-day Average	1.5 micrograms per cubic meters	(None)
	Rolling 3-Month Average	(None)	0.15 micrograms per cubic meter
	Quarterly Average	(None)	1.5 micrograms per cubic meter
Sulfur Dioxide	24-hour	0.04 parts per million	0.14 parts per million (for certain areas)

Pollutant	Averaging Time	California Standards Concentration	Federal Primary Standards Concentration
		(105 micrograms per cubic meter)	
	3-hour	(None)	(None)
	1-hour	0.25 parts per million (655 micrograms per cubic meter)	0.075 parts per million (196 micrograms per cubic meter)
Sulfates	24-hour	25 micrograms per cubic meter	No federal standard
Hydrogen Sulfide	1-hour	0.03 parts per million (42 micrograms per cubic meter)	No federal standard
Vinyl Chloride	24-hour	0.01 parts per million (26 micrograms per cubic meter)	No federal standard

Notes:

#1. On October 1, 2015, the national 8-hour ozone (O_3) primary and secondary standards were lowered from 0.075 to 0.070 parts per million.

#2. 1-Hour ozone standard revoked effective June 15, 2005, although some areas have continuing obligations under that standard.

Source: C.A.R.B. 2016

Under the N.A.A.Q.S., the County is designated as nonattainment for 8-hour O_3, and $PM_{2.5}$, and attainment/unclassified for PM_{10}, C.O., N.O.$_2$, S.O.$_2$, lead, and sulfates (C.A.R.B. 2018). Under C.A.A.Q.S., the County is designated unclassified for all criteria pollutants (C.A.R.B. 2018).

The area's air quality monitoring network provides information on ambient concentrations of air pollutants in the S.J.V.A.B. S.J.V.A.P.C.D. operates several monitoring stations in Kern County, air quality data was obtained from the Bakersfield-California Avenue station. **Table 3-3** compares a 5-year summary of the highest annual criteria air pollutant emissions collected at this station with applicable C.A.A.Q.S., which are more stringent than the corresponding N.A.A.Q.S. Due to the regional nature of these pollutants, O_3, $PM_{2.5}$, and PM_{10} are expected to be representative of the Project site. As indicated in **Table 3-3**, O_3, $PM_{2.5}$, and PM_{10} standards have been exceeded over the past 5 years.

Table 3-3. Ambient Air Quality Monitoring Data Measured at the Bakersfield-California Avenue Monitoring Station.

Pollutant Standards, 1-Hour Ozone (O_3)	2015	2016	2017	2018	2019
Maximum 1-hour concentration (parts per million)	0.104*	0.092*	0.122*	0.107*	0.097*
Days Exceeding[a] C.A.A.Q.S. 1-hour (>0.09 parts per million)	6	0	11	8	2
Pollutant Standards, 8-Hour Ozone (O_3)	**2015**	**2016**	**2017**	**2018**	**2019**
National maximum 8-hour concentration (parts per million).	0.096*	0.085*	0.104*	0.098*	0.088*
State max. 8-hour concentration (parts per million).	0.097*	0.086*	0.104*	0.098*	0.088*
Days Exceeding[a] N.A.A.Q.S. 8-hour. (>0.075 parts per million.) (See note #1.)	28	30	47	34	11
Days Exceeding[a] C.A.A.Q.S. 8-hour. (>0.070 parts per million.) (See note #1.)	54	63	87	64	28
Pollutant Standards, Particulate Matter (PM_{10})	**2015**	**2016**	**2017**	**2018**	**2019**
National max. 24-hour concentration (micrograms per cubic meter).	104.7	90.9	138.0	136.1	116.3
State max. 24-hour concentration (micrograms per cubic meter).	103.6*	92.2*	143.6*	142.0*	125.9*
State max. 3-year average concentration (micrograms per cubic meter).	44	44	44	43	43
State annual average concentration (micrograms per cubic meter).	44.1	40.9	42.6	-	39.0
Days Exceedinga N.A.A.Q.S. 24-hour (>150 micrograms per cubic meter).	0	0	0	0	0
Days Exceedinga C.A.A.Q.S. 24-hour (>50 micrograms per cubic meter).	121.4	121.4	98.7	-	108.1
Pollutant Standards, Particulate Matter ($PM_{2.5}$)	**2015**	**2016**	**2017**	**2018**	**2019**
National max. 24-hour concentration (micrograms per cubic meter).	107.9*	66.4*	101.8*	98.5*	59.1*
State max. 24-hour concentration (micrograms per cubic meter).	111.9	66.4	101.8	98.5	59.1
State annual average concentration (micrograms per cubic meter).	16.6*	15.9*	15.9*	15.6*	11.4
Days Exceedinga N.A.A.Q.S. 24-hour (>35 micrograms per cubic meter).	32.3	25.5	30.2	40.3	12.3

Notes:

* = Values in excess of applicable standard.

- =There was insufficient (or no) data available to determine the value.

2018 is the latest year of data available as of preparation of this Chapter.

#1. An exceedance is not necessarily a violation.

Sources: C.A.R.B. 2020.

3.3.2 Discussion

#3 -a and b. Conflict with or obstruct implementation of the applicable air quality plan? Result in a cumulatively considerable net increase of any criteria pollutant for which the Project region is non-attainment under an applicable Federal or State ambient air quality standard?

The proposed Project would generate criteria pollutants from the use of diesel-powered vehicles and equipment, and earthmoving activities. Construction of the proposed Project would require approximately 58 round trips to drop off all required material and equipment to the Project sites. An additional 1,000 truck trips, or 10 trips per day, would be required for workers commuting to the Project sites during construction. A total of 1,058 trips would be required to construct the proposed Project. The District assumes that one vehicle trip per week (2,600 total trips) would be required for operation of the groundwater storage pond during Project operations.

The S.J.V.A.P.C.D. has published guidance on assessing construction projects to determine if they fall below the Small Project Analysis Level (SPAL) threshold (S.J.V.A.P.C.D. 2012). This analysis is based on the estimated number of horsepower hours (hp-hr) per day during construction. For the proposed Project, the horsepower of construction equipment was estimated based on Table 3.3 of Appendix D of the User's Guide for CalEEMod version 2016.3.2 (California Air Pollution Control Officers Association, 2021). The number of pieces of construction equipment was estimated based on District input and Table 3.2 of Appendix D of the User's Guide for CalEEMod version 2016.3.2., assuming the Project is > 50 acres and the task is grading (**Table 3-4**).

Table 3-4. Horsepower-Hours Per Day Per Phase of Project Construction and Operation.

Equipment Type	Units	Estimated Hours of Use per Day for Phase	HP	Working Days Per Activity	Total Equipment Hours	hp-hr	hp-hr/ construction day
Mobilization							
Semi-Truck (equipment delivery)	1	8	402	1	8	3,216	3,216
Sum – Mobilization							**3,216**
Phase 1 - Construction of Pipelines							
Excavator CAT 329 w/36" bucket	2	8	158	30	480	75,840	2,528
Dozer CAT D7	1	6	247	30	180	44,460	1,482
Trench Compactor - Wacker RTL82-SC3	2	8	78	30	480	37,440	1,248
Loader CAT 960	1	7	97	30	210	20,370	679

Equipment Type	Units	Estimated Hours of Use per Day for Phase	HP	Working Days Per Activity	Total Equipment Hours	hp-hr	hp-hr/ construction day
Water Truck	1	8	330	30	240	79,200	2,640
Pickup Truck	3	6	350	30	540	189,000	6,300
Pickup Truck (commute)	10	0.5	350	30	150	52,500	1,750
Sum – Phase 1							**16,627**
Phase 2 - Construction of Wells							
Drill Rig	1	8	221	20	160	35,360	1,768
Support Rig	2	8	221	20	320	70,720	3,536
Hoist Rig for well installation and development	1	8	221	30	240	53,040	1,768
Pickup Truck	1	6	350	30	180	63,000	2,100
Pickup Truck (commute)	10	0.5	350	30	150	52,500	1,750
Sum – Phase 2							**10,922**
Phase 3 - Construction of FKC Discharge Outfalls							
Excavator	2	8	158	4	64	10,112	2,528
Trencher	2	8	78	4	64	4,992	1,248
Loader	1	6	97	1	6	582	582
Pickup Truck	1	6	350	4	24	8,400	2,100
Pickup Truck –(commute)	4	0.5	350	4	8	2,800	700
Sum – Phase 3							**7,158**
Maximum HP-HR per day[3]							**16, 627**
SJVAPCD HP-HR Threshold							18,278
Would the project exceed the SJVAPCD Threshold?							*No*

Notes:

1) Horsepower was taken from CalEEMod
2) There would not be any overlapping of construction phases.

Source: Info provided by District and compiled by GEI in 2021, California Air Pollution Control Officers Association 2021

The proposed Project would result in a maximum of 16,627 hp-hr per day which is lower than the SPAL threshold of 18,278 hp-hr per day. The S.J.V.A.P.C.D has determined that projects in which the total combined hp-hr for all equipment operated on site, within a 24-hr period, is less than 18,278 hp-hr are determined not to require an ambient air quality analysis (S.J.V.A.P.C.D 2012).

However, since the Project would disturb more than 1 acre, the District would obtain the following permits: State Water Resources Control Board (State Water Board) National Pollutant

Discharge Elimination System (N.P.D.E.S.) for general construction activity (Order 2009-0009 DWQ as amended by Order 2012-0006-DWQ), and SWPPP. The District would also need to submit a Dust Control Prevention Plan, which is required for non-residential developments that include 5 acres or more of disturbed surface area (S.J.V.A.P.C.D. 2007). The Project would comply with all Best Management Practices (BMPs) outlined in the above-mentioned permits.

Additionally, the Project would generate a significant amount of PM from the use of construction equipment and ground disturbing activities. This impact would be **potentially significant**, and the following mitigation measure has been identified to address this impact.

Mitigation Measure AQ-1: District Regulation VIII Fugitive PM_{10} Prohibitions Best Management Practices

All projects are subject to S.J.V.A.P.C.D. rules and regulations in effect at the time of construction. Control of fugitive dust is required by S.J.V.A.P.C.D. Regulation VIII. The District shall implement or require its contractor to implement all of the following measures as identified by S.J.V.A.P.C.D.:

- Apply water to unpaved surfaces and areas
- Use non-toxic chemical or organic dust suppressants on unpaved roads and traffic areas
- Limit or reduce vehicle speed on unpaved roads and traffic areas
- Maintain areas in a stabilized condition by restricting vehicle access
- Install wind barriers
- During high winds, cease outdoor activities that disturb the soil
- Keep bulk materials sufficiently wet when handling
- Store and hand material in a three-sided structure
- When storing bulk material, apply water to the surface or cover the stage pile with a tarp
- Do not overload haul trucks. Overlanded trucks are likely to spill bulk materials
- Cover haul trucks with a tarp or other suitable cover. Or, wet the top of the load enough to limit visible dust emissions
- Clean the interior of cargo compartments on emptied haul trucks prior to leaving the site
- Prevent track-out by installing a track-out control device
- Clean up track-out at least once a day. If along a busy road or highway, clean up track-out immediately
- Monitor dust-generating actives and implement appropriate measures for maximum dust control

Implementation of Mitigation Measure AQ-1, acquisition of a N.P.D.E.S. construction activity general permit and SWPPP, and submitting a Dust Control Prevention Plan, this impact would be **less than significant with mitigation incorporated**.

#3 -c. Expose sensitive receptors to substantial pollutant concentrations?

Some members of the population are especially sensitive to emissions of air pollutants and should be given special consideration during the evaluation of the Project air quality impacts. These people include children, senior citizens, and persons with pre-existing respiratory or cardiovascular illnesses, and athletes and other who engage in frequent exercise, especially outdoors. Sensitive receptors include schools, residences, playgrounds, childcare centers, athletic facilities, long-term health care facilities, rehabilitation centers, convalescent centers, and retirement homes. The Project sites are in a predominately agricultural area. The Project sites are not located in the vicinity of any sensitive receptors. The closest sensitive receptors include a residence located approximately 1.5 miles north of the northernmost Project site, a residence located approximately 1.5 miles northwest of the Project site located adjacent to Highway 46 that ties into the FKC at MP 131.29, a residence located approximately 0.80 mile northeast of the Project site near Canal Way that ties into FKC at MP 137.36, and a residence located 0.60 mile west of the southernmost Project site.

During construction, most of the particulate matter (PM), emissions are released in the form of fugitive dust during ground disturbance activities, mostly during the drilling and grading phases. PM emissions are also generated in the form of equipment exhaust and re-entrained road dust from vehicle travel. Impacts from PM emissions would be temporary and would go back to normal after completing the construction phase. However, construction activities would generate significant PM emissions. This impact would be **potentially significant**, and the following mitigation measure has been identified to address this impact.

> **Mitigation Measure AQ-1: District Regulation VIII Fugitive PM_{10} Prohibitions Best Management Practices**
>
> Please refer to Mitigation Measure AQ-1 in Question "a and b" for the full text of this mitigation measure.

Implementation of Mitigation Measure AQ-1 would reduce generation of fugitive dust during construction activities. Impacts from PM emissions would be temporary and would go back to normal after completing the construction phase. Given the short-term emissions and incorporation of Mitigation Measure AQ-1, impacts would be **less-than-significant with mitigation incorporated**.

#3 -d. Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?

Human response to odors is subjective, and sensitivity to odor varies from person to person. Typically, odors are considered an annoyance rather than a health hazard. However, a person's response to odor can range from psychological (e.g., irrigation, anger, anxiety) to physiological (e.g., circulatory and respiration reaction, nausea, headaches, etc.). During construction, the Project would generate odor from the use of diesel fuels, though this would be short-term and nonsignificant. During operation, the Project would consist of the operation of an electrically powered pump. No odors would be generated by this use. Potential odor effects would be **less-than-significant**.

3.4 Biological Resources

#4. BIOLOGICAL RESOURCES. Would the Project:

#4 -a. Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife (CDFW) or U.S. Fish and Wildlife Service (U.S.F.W.S.)?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes.**	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#4 -b. Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the CDFW or U.S.F.W.S.?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes**.	Have Beneficial Impact? No.
#4 -c. Have a substantial adverse effect on State or Federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	Have Potentially Significant Impact? No..	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#4 -d. Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#4 -e. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#4 -f. Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or State habitat conservation plan?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

3.4.1 Environmental Setting

A complete discussion of biological resources is provided in the biological technical report that was completed for the Project (*see* **Appendix B**). This Chapter summarizes the environmental setting and impact evaluation provided in the technical report.

Background Review

Before conducting biological field surveys, GEI, Consultants, Inc. (GEI) reviewed the California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB) (CDFW 2021a) and the California Native Plant Society (CNPS) online Inventory of Rare and Endangered Vascular Plants of California (CNPS 2021). These reviews included the Pond, McFarland, Wasco, Famoso, Rio Bravo, Rosedale, and Oildale USGS 7.5-minute quadrangles. A resources list of species and habitats of federal conservation concern that could occur in the Project area was obtained from the U.S. Fish and Wildlife Service (U.S.F.W.S.) Information for Planning and Conservation website (U.S.F.W.S. 2021a); the U.S.F.W.S. online map of critical habitat for Federally threatened and endangered species (U.S.F.W.S. 2021b) also was reviewed.

Field surveys of the locations where improvements would occur were conducted by a GEI biologist on May 21 and October 23, 2018, and August 13 and 14, 2021, to assess the potential for special-status species to occur on or adjacent to the Project sites and for special-status species and sensitive habitats to be affected by construction activities.

Existing Conditions

All four Project sites and the surrounding areas are almost entirely comprised of agricultural land and associated facilities. Topography is generally flat, with an average elevation of approximately 400 feet above mean sea level. The only remnant natural habitat near the Project sites is a small portion of the Poso Creek corridor, which is adjacent to but almost entirely separated from the northernmost pipeline by a water delivery canal.

3.4.2 Discussion

#4 -a. Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or the U.S. Fish and Wildlife Service?

Results of the CNDDB searches (*see* Appendix B) yielded occurrences of 31 special-status plants and wildlife. (Note: Not all species tracked in the CNDDB and included in the search results in Appendix A of the Biological Technical Report meet the special-status definition described above. CNDDB tracks "Special Animals," regardless of their legal or protection status.) (CDFW 2021b) Twelve of these species have been documented within 5 miles of a Project site. However, nearly all of the nearby plant occurrences are considered extirpated, and many of the animal occurrences are more than 40 years old.

Based on observations made during the field survey, habitat for special-status plants is absent from the Project sites, and none of the species were determined to have potential to occur on or adjacent to any of the Project sites. Therefore, there would be **no impact** on special-status plants.

Based on the review of existing documentation, habitat requirements of each species, and habitat evaluations made during field survey, most of the wildlife species also have no potential to occur on or adjacent to the Project sites. Because the Project sites do not support natural vegetation or aquatic habitat, suitable habitat for most of the species considered is absent. Despite the poor habitat conditions for most wildlife species, several have some low degree of potential to occur on or near the Project sites, particularly the northernmost site, because of its adjacency to Poso Creek. These species are discussed further below. No special-status wildlife species were observed during the field surveys.

Special-status reptiles. Four special-status reptiles could occur along Poso Creek adjacent to the northernmost Project site. These species include Bakersfield legless lizard (*Anniella grinnelli*), blunt-nosed leopard lizard (*Gambelia silus*), coast horned lizard (*Phrynosoma blainvillii*), and California glossy snake (*Arizona elegans occidentalis*). Potential for these species to occur on the northernmost Project site is very low, because the site does not provide the appropriate habitat conditions for these species, such as sandy soils and appropriate vegetation, and there is no evidence that these species occur along this portion of Poso Creek.

Potential for special-status reptiles to be impacted by the Project is minimal. Because Project activities would be limited to existing roadways and canal and orchard/field margins, nearly the entire disturbance area is barren. Less than 0.1 acre of poor-quality ruderal habitat at the northernmost Project site would be disturbed by Project activities. Therefore, it is very unlikely that an individual of any special-status reptile species would be present on this Project site and vulnerable to being injured or killed by Project activities. Project activities are also very unlikely to disturb individuals that may be present in adjacent habitat, because Project disturbance levels would be similar to those of on-going agricultural activities, canal maintenance, and off-road recreation that occur under existing conditions. Based on the very small area of poor-quality habitat that would be affected and very low probability for a very few, if any, individuals of these species to be impacted, this would not have a substantial adverse effect on Bakersfield legless lizard, coast horned lizard, or California glossy snake. Therefore, impacts on these species would be **less-than-significant**. Because of the endangered and fully protected status of blunt-nosed leopard lizard, potential to injure or kill even one individual could be considered a substantial adverse effect, this impact would be **less-than-significant with mitigation incorporated**. Mitigation Measure BIO-1, described below, has been identified to reduce this impact to a less-than-significant level.

Special-status birds. Three special-status bird species have potential to occur in the Project vicinity. These species include burrowing owl (*Athene cunicularia*), Swainson's hawk (*Buteo swainsoni*), and tricolored blackbird (*Agelaius ticolor*). No suitable nesting habitat for tricolored blackbird was present on or adjacent to these sites during the field surveys. However, if grain crops or extensive areas of tall ruderal vegetation (e.g., in fallow fields) are present near these Project sites during Project activities, there is some potential for these species to nest in such habitat. Large

trees along Poso Creek, provide marginally suitable nest sites for Swainson's hawk and white-tailed kite (as well as common raptor species), although neither species is known to nest along that section of Poso Creek. No potential nest trees are present on or near the other two Project sites. In addition, Kern County is at the south end of the Swainson's hawk breeding range, and the species occurs sparsely in this region. Potentially suitable habitat for burrowing owl also is limited to uncultivated fields and ruderal habitat near the northernmost and southernmost Project sites. No concentrations of ground squirrel burrows were observed during the field surveys, but scattered burrows were present in ruderal habitat adjacent to these sites and could be suitable for burrowing owl.

Because Project activities would be limited to existing roadways and canal and orchard/field margins, there is no potential for nests of these species to be directly destroyed. In addition, most of the Project sites are subject to regular disturbance from existing agricultural activities and/or road traffic, and Project disturbance would be similar in intensity to agricultural activities. Therefore, potential for Project-related disturbance to result in nest failure or burrow abandonment is low. However, if an active nest or occupied burrow is present very close to a Project site, Project activities could result in burrow or nest abandonment, reduced care of eggs or young, or premature fledging. Depending on the species and number of individuals that are affected, burrow abandonment or nest failure could be considered a substantial adverse effect. This impact would be **less-than-significant with mitigation incorporated**. Mitigation Measures BIO-2a and BIO-2b, described below, have been identified to reduce this impact to a less-than-significant level.

Special-status mammals. Four special-status mammals have low or very low potential to occur on or adjacent to the northernmost and southernmost Project sites. These species include Tipton kangaroo rat (*Dipodomys nitratoides*), San Joaquin kit fox (*Vulpes macrotis mutica*), American badger (*Taxidea taxus*), and western mastiff bat (*Eumops perotis californicus*). Tipton kangaroo rat has been documented in the CNDDB as occurring along FKC, north and south of Poso Creek, and near the northernmost Project site. This apparently isolated population of Tipton kangaroo rat was documented more than 25 years ago, when much of the adjacent habitat was in non-orchard crops and fallow/open fields. Since then, all adjacent agricultural lands have been planted in orchards. All other occurrences of this species that are documented in the CNDDB are at least 8 miles from the Project sites and most are from farther away. Potential for Tipton kangaroo rat to occur on the northernmost Project site is very low, because the site does not provide the appropriate habitat conditions for this species. Several occurrences of San Joaquin kit fox have been documented within 5 miles of the Project sites. Most of these occurrences are from more than 40 years ago. The nearest occurrence to the action area was a sighting in 1993, approximately 0.5 miles northeast of the Project site along the left bank of the FKC. The nearest relatively recent occurrence of badger in the area is from 1989, in saltbush scrub along Poso Creek, approximately 10 miles southwest of the northernmost Project site. Occurrences of western mastiff bat in the region are generally from the valley floor margins, adjacent to hills that likely provide suitable natural roost sites. Because there is no suitable natural roosting habitat within at least 5 miles, and the Project vicinity provides poor artificial roost sites, these bats have very low potential to occur on or adjacent to Project sites.

As discussed above for special-status reptiles, less than 0.1 acre of poor-quality ruderal habitat for Tipton kangaroo rat would be disturbed by Project activities at the northernmost Project site. It is very unlikely that an individual would be present on this Project site and vulnerable to being injured or killed by Project activities, and Project activities are also very unlikely to disturb individuals that may be present in adjacent habitat, because Project disturbance levels would be similar to those of on-going agricultural activities, canal maintenance, and off-road recreation that occur under existing conditions. Based on the very small area of poor-quality habitat that would be affected, the probability for Tipton kangaroo rat to be adversely affected by the Project is very low. However, because of the endangered status of the species, potential to injure or kill even one individual could be considered a substantial adverse effect; this impact would be **less-than-significant with mitigation incorporated**. Mitigation Measure BIO-1, described below, has been identified to reduce this impact to a less-than-significant level.

Based on the current agricultural land use and observations made during the field surveys, San Joaquin kit fox and American badger are very unlikely to den on any of the Project sites. However, because the Poso Creek corridor and FKC right-of-way could provide travel corridors, there is potential for individuals to occasionally disperse through the sites. Additionally, both species could travel through agricultural areas. If a kit fox or badger is present during Project activities, it could be injured or killed if struck by a Project vehicle or Project equipment or become trapped in pipes or trenches. In the very unlikely event that an occupied den is present adjacent to a Project site, Project-related disturbance could result in den abandonment. Very few individuals, if any, would be affected. This is unlikely to have a substantial adverse effect on the regional badger population; therefore, impacts on badger would be **less-than-significant**. However, because of the endangered status of San Joaquin kit fox, potential to injure or kill even one individual could be considered a substantial adverse effect; this impact would be **less-than-significant with mitigation incorporated**. Mitigation Measure BIO-1, described below, has been identified to reduce this impact to a less-than-significant level.

Foraging activities of mastiff bats that may use the Project sites are very unlikely to be disturbed by construction activities, and there is no potential for roosts to occur on or near enough to any of the Project sites to be susceptible to disturbance. Therefore, Project activities would not have a substantial effect on this species; this impact would be **less-than-significant**.

> **Mitigation Measure BIO-1: Conduct Focused Surveys and Implement Measures to Minimize Potential for Impacts on Blunt-nosed Leopard Lizard, Tipton Kangaroo Rat, and San Joaquin Kit Fox.**
>
> To minimize potential effects of Project construction on blunt-nosed leopard lizard, Tipton kangaroo rat, and San Joaquin kit fox, the District will ensure that the following measures are implemented:
>
> - An Environmental Awareness Program will be presented to all Project personnel working in the field before Project activities begin. The program will be presented by a qualified biologist with knowledge of special-status wildlife that could occur on the Project sites. The program will address each species biology and habitat needs; status of each species and their regulatory

protections; and measures required to reduce impacts to the species during Project construction.

- To prevent wildlife entrapment during construction, all excavated, steep-walled holes or trenches more than 2 feet deep will be covered with plywood or similar material at the end of each workday. If the trenches cannot be closed, one or more escape ramps of no more than a 45-degree slope will be constructed of earthen fill or created with wooden planks. All covered or uncovered excavations will be inspected at the beginning, middle, and end of each day. Before trenches are filled, they will be inspected for trapped animals. If a trapped or injured animal is discovered, Project activities will stop, and escape ramps or structures will be installed immediately to allow the animal(s) to escape.
- All construction pipes, culverts, or similar structures with a diameter of 4 inches or more that are stored at a construction site for one or more overnight period will be thoroughly inspected for wildlife before the pipe is buried, capped, or otherwise used or moved in any way. Pipes laid in trenches overnight will be capped. If an animal is discovered inside a pipe, the pipe will not be moved, and the animal will be allowed to leave on its own.
- All food-related trash items such as wrappers, cans, bottles or food scraps generated during Project activities will be disposed of in closed containers and removed daily from the Project site. No deliberate feeding of wildlife will be allowed, and no domestic pets associated with Project personnel will be permitted on the Project site.
- No more than 30 days before Project activities begin, a qualified biologist will conduct a pre-construction survey to determine the potential for blunt-nosed leopard lizard, Tipton kangaroo rat and San Joaquin kit fox to occur in the action area. If potential dens for San Joaquin kit fox are found, exclusion zones will be established and maintained, in accordance with the *Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox* (U.S.F.W.S. 2011). If burrows that show evidence of occupation by Tipton kangaroo rat or blunt-nosed leopard lizard are identified, a qualified biologist will determine an appropriate exclusion zone that will be maintained to prevent disturbance of the burrows and occupants.

Mitigation Measure BIO-2a: Conduct Focused Surveys for Burrowing Owls and Avoid Loss of Occupied Burrows.

To minimize potential effects of Project construction on burrowing owl, the District will ensure that the following measures are implemented, consistent with the *Staff Report on Burrowing Owl Mitigation* (CDFG 2012).

- A qualified biologist will assess burrowing owl habitat suitability in the area subject to direct impact and adjacent areas within 500 feet. If suitable habitat or sign of burrowing owl presence is observed, a take avoidance survey will be conducted within 14 days before Project activities begin. If any occupied burrows are observed, protective buffers will be established and implemented. A qualified biologist will monitor the occupied burrows during Project

activities to confirm effectiveness of the buffers. The size of the buffer will depend on type and intensity of Project disturbance, presence of visual buffers, and other variables that could affect susceptibility of the owls to disturbance.

- If it is not feasible to implement a buffer of adequate size and it is determined, in consultation with CDFW, that passive exclusion of owls from the Project site is an appropriate means of minimizing impacts, an exclusion and relocation plan will be developed and implemented in coordination with CDFW. However, passive exclusion cannot be conducted during the breeding season (February 1–August 31), unless a qualified biologist verifies through noninvasive means that either (1) the birds have not begun egg laying or (2) juveniles from the occupied burrows are foraging independently and are capable of independent survival.

Mitigation Measure BIO-2b: Conduct Focused Surveys for Nesting Swainson's Hawk, other Special-status Birds, and Common Birds and Implement Buffers Around Active Nests.

To minimize potential effects of Project construction on nesting Swainson's hawk, other special-status birds, and common raptors, the District will ensure that the following measures are implemented:

- A qualified biologist will conduct surveys of potential Swainson's hawk nesting trees within 0.25 mile of the Project site. To the extent practicable, depending on timing of Project initiation, surveys will be conducted in accordance with the *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (Swainson's Hawk Technical Advisory Committee 2000). At a minimum, a survey will be conducted within 14 days before Project activities begin near suitable nest trees during the nesting season (April–August).

- If an active Swainson's hawk nest is observed, a protective buffer will be established and implemented until the nest is no longer active. A qualified biologist will monitor the nest during Project activities to confirm effectiveness of the buffer. The size of the buffer will depend on type and intensity of Project disturbance, presence of visual buffers, and other variables that could affect susceptibility of the nest to disturbance.

- A qualified biologist will conduct surveys of suitable nesting habitat that would be directly disturbed by Project activities and suitable nesting habitat for tricolored blackbird, white-tailed kite, northern harrier, and common raptors, if present within 500 feet of Project activities. Surveys will be conducted within 14 days before Project activities begin near suitable nesting habitat during the nesting season (February-August).

- If any active bird nests are documented in the area that would be directly disturbed by Project activities or active nests of tricolored blackbird, white-tailed kite, northern harrier, and common raptors are documented within 500 feet, protective buffers will be established and implemented until the nests are no longer active. A qualified biologist will monitor the nests during Project activities to confirm effectiveness of the buffers. The size of the buffers will

depend on type and intensity of Project disturbance, presence of visual buffers, and other variables that could affect susceptibility of the nest to disturbance.

#4 -b. Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?

The Project sites do not support any riparian habitat, designated critical habitat, or other sensitive natural community identified in local or regional plans, policies, or regulations; there would be **no impact** on these resources.

#4 -c. Have a substantial adverse effect on state- or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

Aquatic habitat on the Project sites is limited to irrigational canals that are heavily maintained, generally lack vegetation, and provide very poor aquatic habitat. The new discharge outfalls would be installed when the FKC is dry. Therefore, impacts associated with disturbance of very small portions of several canals during Project construction would be **less-than-significant**.

#4 -d. Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

The Project sites are part of a much larger extent of agricultural lands and do not serve as a corridor or other primary route for wildlife movement. Although terrestrial wildlife likely travels along FKC and other canals at the Project sites, agricultural lands adjacent to the canals typically provide equally suitable movement opportunities. In addition, Project activities would only occur during the day, while most wildlife movement would likely be at night, and disturbance of the canal corridor would be relatively minor. The Project sites also are not known or anticipated to serve as a nursery site for any wildlife species. Therefore, implementing the proposed Project would not substantially interfere with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites; this impact would be **less-than-significant**.

#4 -e. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

The 2004 Kern County General Plan, which is currently being updated, includes several policies and implementation measures designed to protect and conserve threatened and endangered species and oak trees (Kern County 2004a). No oak trees are present on the Project site, and the Project has no potential to conflict with Kern County's General Plans oak retention policy. The Plan requires discretionary Projects to consider effects to biological resources and wildlife agency comments during the CEQA process; this is consistent with the CEQA process being implemented by the District for the proposed Project. Therefore, implementing the proposed

Project would not conflict with any local policies or ordinances protecting biological resources and this impact would be **no impact**.

#4 -f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or State habitat conservation plan?

The Project sites are within the area anticipated to be covered by the Kern County Valley Floor Habitat Conservation Plan (HCP). A draft of the plan was issued many years ago (Kern County Planning Department 2006), but a final plan has not been released. The Project sites are within an extensive area of "White Zone," which is of lower conservation concern and not identified for acquisition of preserve areas. In addition, all of the Project sites are north of the existing Metropolitan Bakersfield HCP area and the plan area for the Bakersfield HCP that is currently in development. Therefore, implementing the proposed Project would not conflict with any provisions, guidelines, goals, or objectives related to biological resources anticipated to be included in a potential final and adopted version of this plan, and there would be **no impact**.

3.5 Cultural Resources

#5. CULTURAL RESOURCES. Would the Project:

#5 -a. Cause a substantial adverse change in the significance of a historical resource pursuant to California Code of Regulations (CCR) Section 15064.5?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes.**	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#5 -b. Cause a substantial adverse change in the significance of an archaeological resource pursuant to CCR Section 15064.5?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes.**	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#5 -c. Disturb any human remains, including remains interred outside of dedicated cemeteries?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes.**	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.

3.5.1 Environmental Setting

Cultural resources are defined as buildings, sites, structures, or objects, each of which may have historic, architectural, archaeological, cultural, or scientific importance.

Methods

The cultural resources investigations carried out for the proposed Project included a records search at the South San Joaquin Valley Information Center (S.S.J.V.I.C.), archival research, Native American consultation conducted by Reclamation, archaeological and built environment field surveys of the Project area, and a desktop geoarchaeological study.

Record Search

GEI archaeologist, Matthew Chouest, M.A., R.P.A., submitted a records search on April 13, 2021, at the S.S.J.V.I.C., covering a broad study area that encompassed the District. General Land Office plats dating to 1855, which include the Project study area, were also examined in order to search for locations of possible cultural resources. No cultural resources were identified by the records search within the Project area.

Desktop Geoarchaeological Sensitivity Assessment

GEI archaeologists, in a previous investigation, conducted a geoarchaeological desktop study encompassing the entire District service area (GEI 2017). The geoarchaeological study was conducted to determine the sensitivity for buried resources within the District.

GEI's geoarchaeological desktop study relied primarily on available geologic and soils mapping for the area. Online Natural Resources Conservation Service (NRCS) soils data for the Project sites were gathered and include descriptions of soil morphology, as well as information about parent material origin, lithology, and landform associations (NRCS 2019).

Meyer et al. (2010), as part of a series of investigations for California Department of Transportation (Caltrans) cultural resources inventory of rural roads in Districts 6 and 9, conducted a geoarchaeological investigation across seven counties, including Kern County. Taking radiocarbon age as a baseline, the researchers also took other factors into account such as proximity to water and landform slope, with areas nearer to springs and smaller streams as well as landforms with slopes of nine degrees or less being weighed heaviest, to develop an estimation of buried site potential by soil type.

GEI's desktop study used the above resources, as well as historic maps and aerial photographs, to determine the sensitivity for buried archaeological resources by soil type across the District. Soils are either very old (>25 thousand years ago (kya)) or very young (<2 kya). All of these soils formed atop Quaternary sedimentary units comprising primarily regionally extensive alluvial fan deposits. The very old soils (Lewkalb sandy loam) have low sensitivity for buried cultural resources based on their older Pleistocene (>25 kya) ages; the landforms upon which these soils formed accumulated well before human settlement of the area. The two very young soils (Riverwash and Wasco sandy loam) have high sensitivity for buried cultural resources, based on age. However, while the Riverwash soil probably has high potential to contain historical resources, it has low potential to contain pre-contact archaeological resources. However, age of soils alone does not always determine actual resource sensitivities. Given the fact that each of the proposed Project areas have been highly disturbed by previous construction work, that new disturbance depths are unlikely to exceed approximately 3-5 feet in depth, and that no archaeological resources were identified during intensive surface survey, the potential for disturbing cultural resources of any kind is low.

Field Surveys

GEI archaeologists Jesse Martinez, M.A., R.P.A., and William R. Gillean, completed the pedestrian surveys on May 6 and 7, 2021. The survey was conducted to intensive standards utilizing transects spaced no more than 15 meters (49 feet) apart. No archeological resources were observed during the pedestrian survey.

GEI's architectural historians, who meet the Secretary of the Interior's Professional Qualifications Standards in history and architectural history, conducted a survey of historic era (50 years old or older) built environment resources on May 6 and 7, 2021. As part of the survey, one historic-era resource was photographed and recorded, the FKC.

3.5.2 Discussion

a, b) Cause a substantial adverse change in the significance of a historical resource pursuant to in CCR Section 15064.5? Cause a substantial adverse change in the significance of an archaeological resource pursuant to CCR Section 15064.5?

Under CEQA, public agencies must consider the effects of their actions on "historical resources." CEQA defines an "historical resource" as any resource listed in or determined to be eligible for listing in the California Register of Historical Resources (CRHR). The CRHR includes resources listed in or formally determined eligible for listing in the National Register of Historic Places (NRHP), as well as some California Historical Landmarks and Points of Historical Interest. Properties of local significance that have been designated under a local preservation ordinance (local landmarks or landmark districts) or that have been identified in a local historical resources inventory may be eligible for listing in the CRHR and are presumed to be significant resources for purposes of CEQA unless a preponderance of evidence indicates otherwise (California PRC Section 5024.1, 14 CCR Section 4850). The eligibility criteria for listing in the CRHR are similar to those for NRHP listing but focus on importance of the resources to California history and heritage.

A cultural resource may be eligible for listing in the CRHR if it:

1. is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage
2. is associated with the lives of persons important in our past
3. embodies the distinctive characteristics of a type, period, region, or method of construction or represents the work of an important creative individual or possesses high artistic values
4. or has yielded, or may be likely to yield, information important in prehistory or history

In addition to meeting one or more of the above criteria, resources eligible for listing in the CRHR must retain enough of their historic character or appearance to be recognizable as historical resources and to convey the reasons for their significance. Integrity is evaluated with regard to the retention of location, design, setting, materials, workmanship, feeling, and association (Office of Historic Preservation 1999).

Impacts would be deemed significant if there is substantial adverse change by means of physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of the resource would be materially impaired. Per Section 15064.5 (b)(2) of the CEQA Guidelines the significance of a historical resource is materially impaired when a Project:

- Demolishes or materially alters in an adverse manner those physical characteristics of an historical resource that convey its historical significance and that justify its inclusion in, or eligibility for, inclusion in the California Register of Historical Resources; or

- Demolishes or materially alters in an adverse manner those physical characteristics that account for its inclusion in a local register of historical resources pursuant to section 5020.1(k) of the Public Resources Code or its identification in an historical resources survey meeting the requirements of section 5024.1(g) of the Public Resources Code, unless the public agency reviewing the effects of the Project establishes by a preponderance of evidence that the resource is not historically or culturally significant; or
- Demolishes or materially alters in an adverse manner those physical characteristics of an historical resource that convey its historical significance and that justify its eligibility for inclusion in the CRHR as determined by a lead agency for the purposes of CEQA.

No previously recorded archaeological resources are present within the Project sites or within 0.5 mile of the Project sites, and no archaeological resources were discovered during the pedestrian survey. One historic-era built environment resource was identified: the FKC. The FKC was previously determined as eligible for the NRHP through a consensus determination between the California Department of Transportation and State Historic Preservation Office in 1997. The FKC is therefore also considered a historical resource for the purposes of CEQA. Upon completion of the Project, the FKC would retain its integrity and significance. The materials, workmanship, and the general physical characteristics that convey the historical significance of the canal would remain in place and the canal would continue to function as originally designed. Therefore, the impact would be less-than-significant.

Though very unlikely, the possibility remains that a resource meeting CRHR significance criterion for a historical resource may be discovered during Project-related ground-disturbing activities. If this were to occur, then it would be a potentially significant impact. Implementation of Mitigation Measure CR-1 would reduce this impact to ***less-than-significant***.

> **Mitigation Measure CR-1: Address Previously Undiscovered Historic Properties, Archaeological Resources, and Tribal Cultural Resources.**
>
> If cultural resources are identified during Project-related ground-disturbing activities, all potentially destructive work in the immediate vicinity of the find should cease immediately and the District should be notified. In the event of an inadvertent discovery, additional CEQA review might be necessary to make a determination on a properties' eligibility for listing in the CRHR and any actions that would be necessary to avoid adverse effects. A qualified archaeologist should assess the significance of the find, make a preliminary determination, and if appropriate, provide recommendations for treatment. Any treatment plan should be reviewed by the District prior to implementation. Ground-disturbing activities should not resume near the find until treatment, if any is recommended, the find is complete or if the qualified archaeologist determines the find is not significant.

Implementing Mitigation Measure CR-1 would reduce the potential impact related to discovery of unknown historical resources to a less-than-significant level because the find would be assessed by an archaeologist and the treatment or investigation would be conducted in accordance with CEQA and its implementing guidelines. Therefore, the proposed Project would have a **less-than-significant impact with mitigation**.

c) Disturb any human remains, including remains interred outside of dedicated cemeteries?

No human remains have been discovered in the Project area and it is not anticipated that human remains, including those interred outside of dedicated cemeteries, would be discovered during ground-disturbance activities with the proposed Project. There is no indication from the records searches or pedestrian survey that human remains are present within the Project site locations. However, in the event that human remains, including those interred outside of formal cemeteries and including associated items and materials, are discovered during subsurface activities, the human remains, and associated items and materials could be inadvertently damaged. Therefore, a **potentially significant impact** would occur. The following mitigation measure has been identified to address this impact:

> **Mitigation Measure CR-2: Avoid Potential Effects on Undiscovered Burials.**
>
> If human remains are found, the District should be immediately notified. The California Health and Safety Code requires that excavation be halted in the immediate area and that the County coroner be notified to determine the nature of the remains. The coroner is required to examine all discoveries of human remains within 48 hours of receiving notice of a discovery on private or state lands (Health and Safety Code, Section 7050.5[b]). If the coroner determines that the remains are those of a Native American, the coroner must contact the Native American Heritage Commission (NAHC) by telephone within 24 hours of making that determination (Health and Safety Code, Section 7050.5[c]).
>
> Once notified by the coroner, the NAHC shall identify the person determined to be the Most Likely Descendant (MLD) of the Native American remains. With permission of the legal landowner(s), the MLD may visit the site and make recommendations regarding the treatment and disposition of the human remains and any associated grave goods. This visit should be conducted within 24 hours of the MLD's notification by the NAHC (PRC Section 5097.98[a]). If a satisfactory agreement for treatment of the remains cannot be reached, any of the parties may request mediation by the NAHC (PRC, Section 5097.94[k]). Should mediation fail, the landowner or the landowner's representative must reinter the remains and associated items with appropriate dignity on the property in a location not subject to further subsurface disturbance (PRC, Section 5097.98[b]).

Implementing Mitigation Measure CR-2 would reduce the potentially significant impact related to discovery of human remains to a less-than-significant level because the find would be assessed by an archaeologist and treated or investigated in accordance with state and federal laws. Therefore, the proposed Project would have a **less-than-significant impact with mitigation**.

3.6 Energy

#6. ENERGY. Would the Project:

#6 -a. Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#6 -b. Conflict with or obstruct a State or local plan for renewable energy or energy efficiency?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

3.6.1 Environmental Setting

Electricity and natural gas in Kern County are supplied by Pacific Gas and Electric (PG&E), Southern California Edison, and Southern California Gas (Kern County 2004a). In 2019, the total electricity consumption for Kern County was approximately 17,105 million kilowatts per hour (CEC 2019). The District would replace two wells which would be configured with new equipment, including slightly larger electrical motors.

3.6.2 Discussion

#6 -a. Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during Project construction or operation?

The proposed Project would not result in significant environmental impacts due to wasteful, inefficient, or unnecessary consumption of energy resources because the Project would only consume enough energy required to construct and operate the Project. The proposed Project would involve the use of diesel-fueled vehicles during constructions; however, use of these vehicles would be short-term and temporary. The two replacement wells will be equipped with new, energy-efficient electrical motors (up to a capacity of 650 horsepower) which would allow for the conveyance of water into the new and existing pipelines and FKC. The seven existing wells would retain the current electrical motors which have a capacity of 150 to 400 horsepower. Moreover, the replacement wells and pipeline would only be used to convey water to the FKC during drought conditions. Therefore, the net increase in energy consumption would be *de minimis* but not wasteful, inefficient, or unnecessary. Therefore, impacts would be **less-than-significant**.

#6 -b. Conflict with or obstruct a State or local plan for renewable energy or energy efficiency?

Kern County does not have a local plan for renewable energy or energy efficiency. The proposed Project would comply with the state's Climate Commitment to reduce the reliance on non-renewable energy sources by half by 2030 (CEC 2015). There would be **no impact**.

3.7 Geology and Soils

#7. GEOLOGY AND SOILS. Would the Project:

#7 -a. Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:	Potentially Significant Impact. No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#7 -a. i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? (Refer to California Geological Survey Special Publication 42.)	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#7 -a. ii. Strong seismic ground shaking?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#7 -a. iii. Seismic-related ground failure, including liquefaction?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#7 -a. iv. Landslides?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#7 -b. Result in substantial soil erosion or the loss of topsoil?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.

#7. GEOLOGY AND SOILS. Would the Project:

#7 -c. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes**.	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#7 -d. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994, as updated),), creating substantial direct or indirect risks to life or property?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#7 -e. Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#7 -f. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes.**	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.

3.7.1 Environmental Setting

Geology and Soils

The Project sites are located on the following soil types: Riverwash, Wasco Sandy Loam, Driver Coarse Sandy Loam (0 to 2 percent slopes), and Lewkalb Sandy Loam (0 to 2% slopes) (NRCS 2021). The northern most Project site is located adjacent to the Poso Creek fault. Other nearby faults include the Pond fault located approximately 2 miles north of the northernmost site, the Premier fault located approximately 5 miles northeast of the southernmost site, and the Kern Front fault located approximately 7 miles northeast of the southernmost site (CGS 2015a). The Project sites are not located within an Alquisto-Priolo Earthquake fault zone (CGS 2021).

In 2014, the state of California adopted the Sustainable Groundwater Management Act (SGMA), which requires local Groundwater Sustainability Agencies (GSAs) to be formed for all high and medium priority basins in the state. North Kern is a member of the Kern Groundwater Authority. GSAs must develop and implement Groundwater Sustainability Plans (GSPs), which were submitted in January 2020, for managing and using groundwater without causing undesirable

results for groundwater-level declines, groundwater-storage reductions, water quality degradation, and land subsidence; also referred to sustainability indicators.

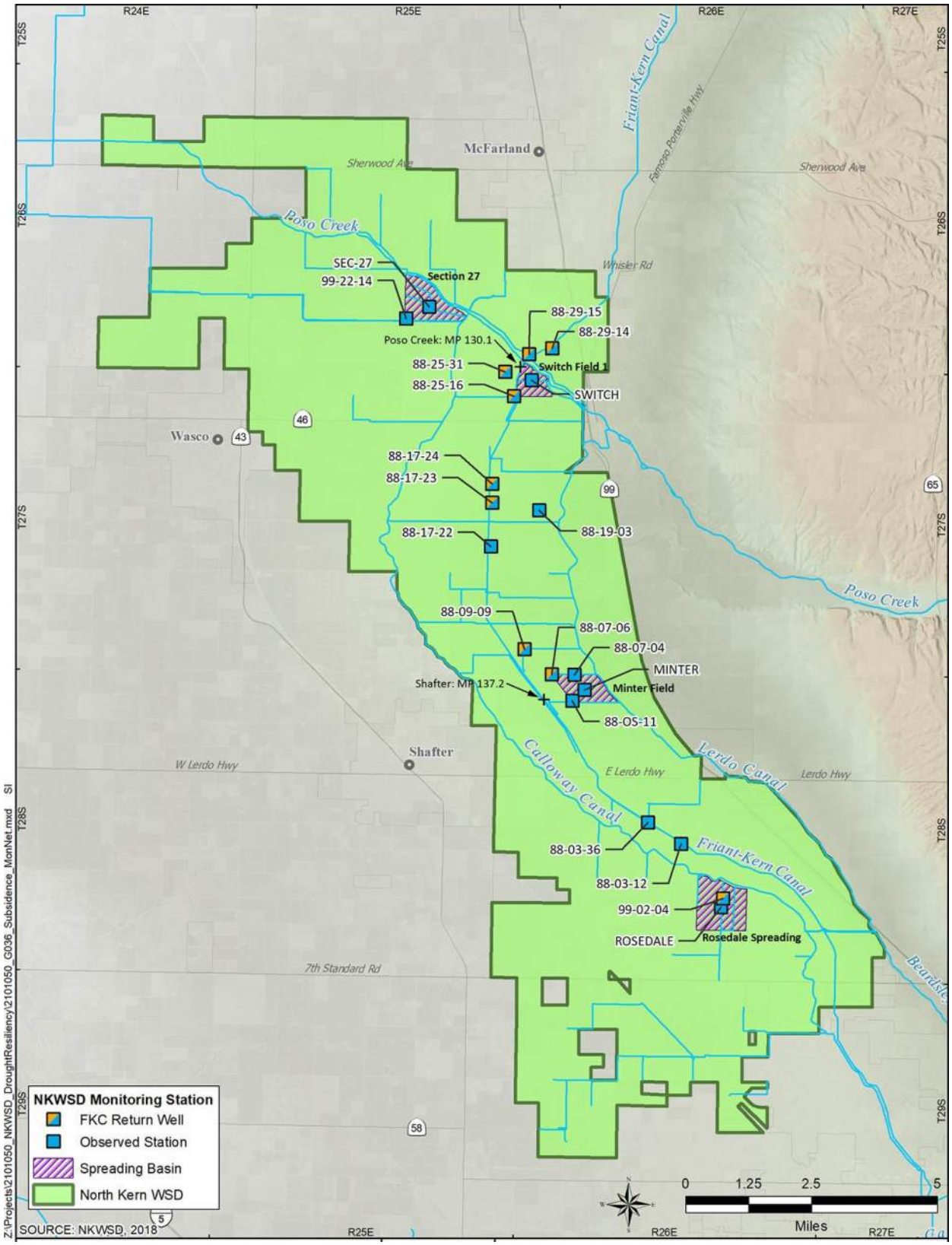
Subsidence

Subsidence is the gradual settling or sudden sinking of the ground surface resulting from subsurface movement of earth materials. There are multiple causes and types of subsidence. Subsidence caused by withdrawal of groundwater in quantities much larger than replacement is one cause of subsidence, of concern in parts of Kern County. Subsidence of this type is one of the six undesirable results presented in SGMA where the undesirable result is defined as "significant and unreasonable land subsidence that substantially interferes with surface land uses".

North Kern's understanding towards the effects of subsidence, and commitment to sustainably managing groundwater, precedes SGMA requirements. In 2011, the District installed a subsidence monitoring network which consists of four dedicated monitoring wells and 2.5-inch brass monuments installed in the concrete foundation at 20 District well sites, all of which are proximate to the FKC (**Figure 3-1**). The north-south line of monuments extends for a little more than 10 miles; from about 1.5 miles north of Highway 46 to about 1.5 miles south of Lerdo Highway (approximately MP 130 to 140 of the FKC). The initial survey of this monitoring network was conducted in Spring 2012 and resurveyed in July 2017.

Figure 3-1 shows the District's subsidence monitoring network as well as other infrastructure relevant to this Project and the District's conjunctive use program. As shown, nine of the 22 wells (13 approved and nine proposed) used to return banked water are part of the subsidence monitoring network. Locations were strategically identified to represent impacts from groundwater banking during times of surplus and recovery during times of need.

Figure 3-1. North Kern Subsidence Monitoring Network



3.7.2 Discussion

#7 -a. Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

#7 -a. i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? (Refer to California Geological Survey Special Publication 42.)

The Project sites are not located within an Alquisto-Priolo Earthquake fault zone; however, the quaternary Pond fault and historic Premier fault are located within the vicinity of the proposed Project. Surface fault rupture is most likely to occur on active faults (i.e., faults showing evidence of displacement within the last 11,700 years). Damage from surface fault rupture is generally limited to a linear zone a few yards wide. Since the proposed Project is not located on an active fault line and is at least 1 mile away from an active fault line, impacts would be **less-than-significant**.

#7 -a. ii and iii. Strong seismic ground shaking, Seismic-related ground failure, including liquefaction?

The Project facilities, wells and conveyance pipes, would either be buried or extend only a few feet above ground, and would not pose a direct risk to people during seismic activity. Project design would comply with California Uniform Building Code (UBC) which is based on, but more detailed and stringent than, the federal UBC. Chapter 18 of the California UBC regulates excavation and geotechnical considerations, and Appendix J addresses grading, excavation, fill, drainage, and erosion control considerations. Additionally, if a seismic event should cause a pipeline break or well to collapse, the water would be released underground in a low gradient, agricultural area, posing minimal risk to people or structures. Therefore, there would be no significant impact to people or structures from any seismic-related activity as a result of implementation of the proposed Project. Additionally, the Project sites are not located within a known liquefaction zone (CGS 2015b). This impact would be **less-than-significant**.

#7 -a. iv. Landsides?

The Project sites are located in topographically flat areas and thus there would be no harm from landslides. Additionally, the California Geologic Survey (CGS) does not identify the Project sites as susceptible to landslides (CGS 2015b). Therefore, this impact would be **less-than-significant**.

#7 -b, c, and d. Result in substantial soil erosion or the loss of topsoil? Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on or off-site landslide, lateral spreading, subsidence, liquefaction or collapse? Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994, as updated), creating substantial direct or indirect risks to life or property?

Potential Impacts of Soil Disturbance

Construction activities would result in short-term soil disturbance and could expose disturbed areas if a storm event occurs during construction. Rainfall of sufficient intensity could dislodge soil particles from the soil surface. If particles are dislodged and the storm is large enough to generate runoff, substantial localized erosion could occur. In addition, soil disturbance could result in substantial loss of topsoil from wind erosion.

The District would prepare and implement a SWPPP to prevent and control pollution and to minimize and control runoff and erosion in compliance with state and local laws. The SWPPP would identify the activities that may cause pollutant discharge (including sediment) during storms or strong wind events, techniques to control pollutant discharge, and an erosion control plan. Additionally, construction techniques and BMPs would be identified and implemented, as appropriate to reduce the potential for runoff and exposure to hazardous materials.

Topsoil may be stripped and stockpiled onsite for later reuse. Additionally, a Dust Control Plan or Construction Notification would be in place and therefore loss of topsoil would be minimized during construction. Operation of the Project would not create the potential for soil erosion or loss of topsoil as the area is in a cultivated agricultural field and is topographically flat. With the implementation of a SWPPP and associated construction techniques and BMPs, as well as a Dust Control Plan or Construction Notification, the Project would result in an impact that would be **less than significant.**

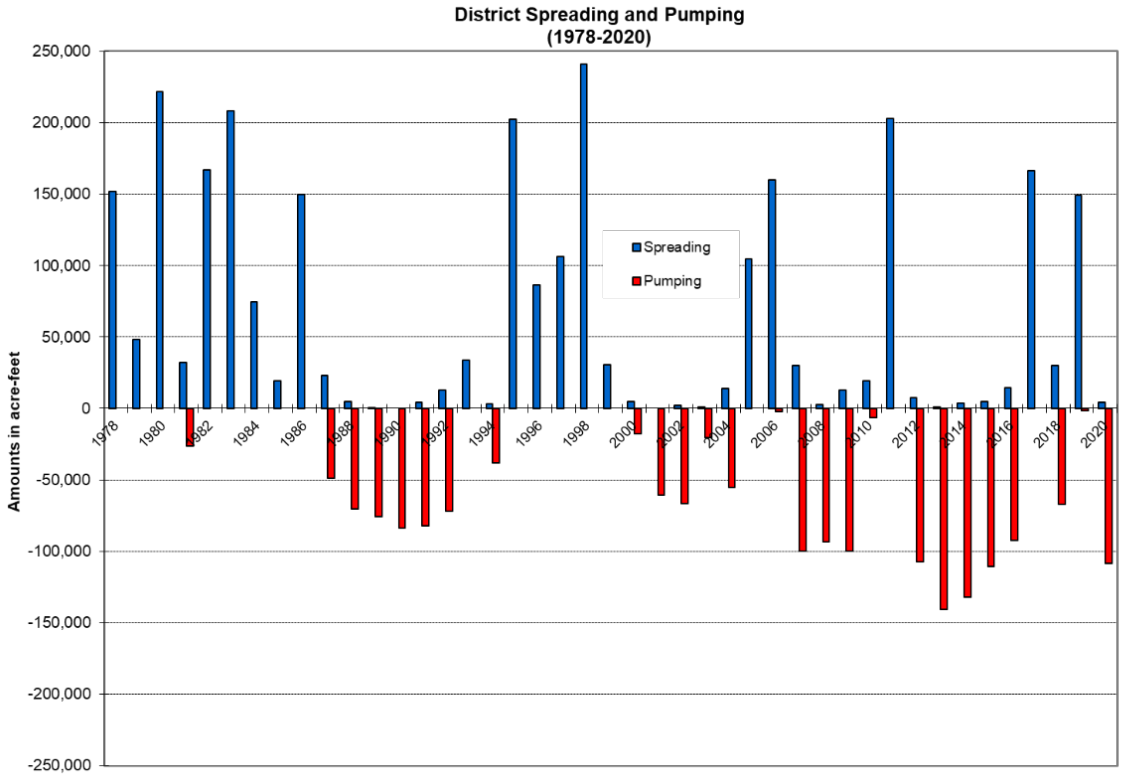
Potential for Subsidence Impacts

The groundwater to be pumped is extracted from wells at varying depths, at a wide range of locations along the FKC and delivered to Districts within its respective groundwater basin. This Project relies on unused capacity from existing and replacement wells. Water supplies in the area are managed through conjunctive use, and aquifers are recharged with surface water in wet years to offset the effects of pumping during dryer periods. The District employs strategies and management actions that balance the positive effects of recharge with the stress of pumping on the aquifer. One key strategy is to develop water exchanges and/or banking agreements with a specified quantity of "leave behind," which is recharged but not recovered, resulting in a net increase in groundwater supplies. Current banking agreements do not allow the District's banking partners to request water more than the volume previously banked. In this manner, the District manages water levels to reduce potential to cause subsidence.

The District currently has three banking partners (Kern Tulare Water District, Delano-Earlimart Irrigation District, and South San Joaquin Municipal Water District) who can request that up to 23,500 AFY of banked water be returned via the FKC. All banking returns are made by currently approved wells. This Project adds nine wells and three new discharge locations to increase return capacity and provide operational flexibility. To minimize impacts on groundwater levels caused by pumping, the District identified wells near recharge facilities and spread across approximately a 13-mile span of the FKC. Historically, banked water has predominately been returned during dry and critically dry water years with smaller volumes of water are returned during the later portion

of normal water years. Water is banked during above normal years and sometimes during the early portion of normal water years. Future banking and return operations are expected to follow the same pattern. **Figure 3-2** shows that historically, the District's banking program has provided a net increase of almost 1-million AF in groundwater supplies.

Figure 3-2. District Spreading and Pumping from 1978 through 2020



Source: GEI 2021

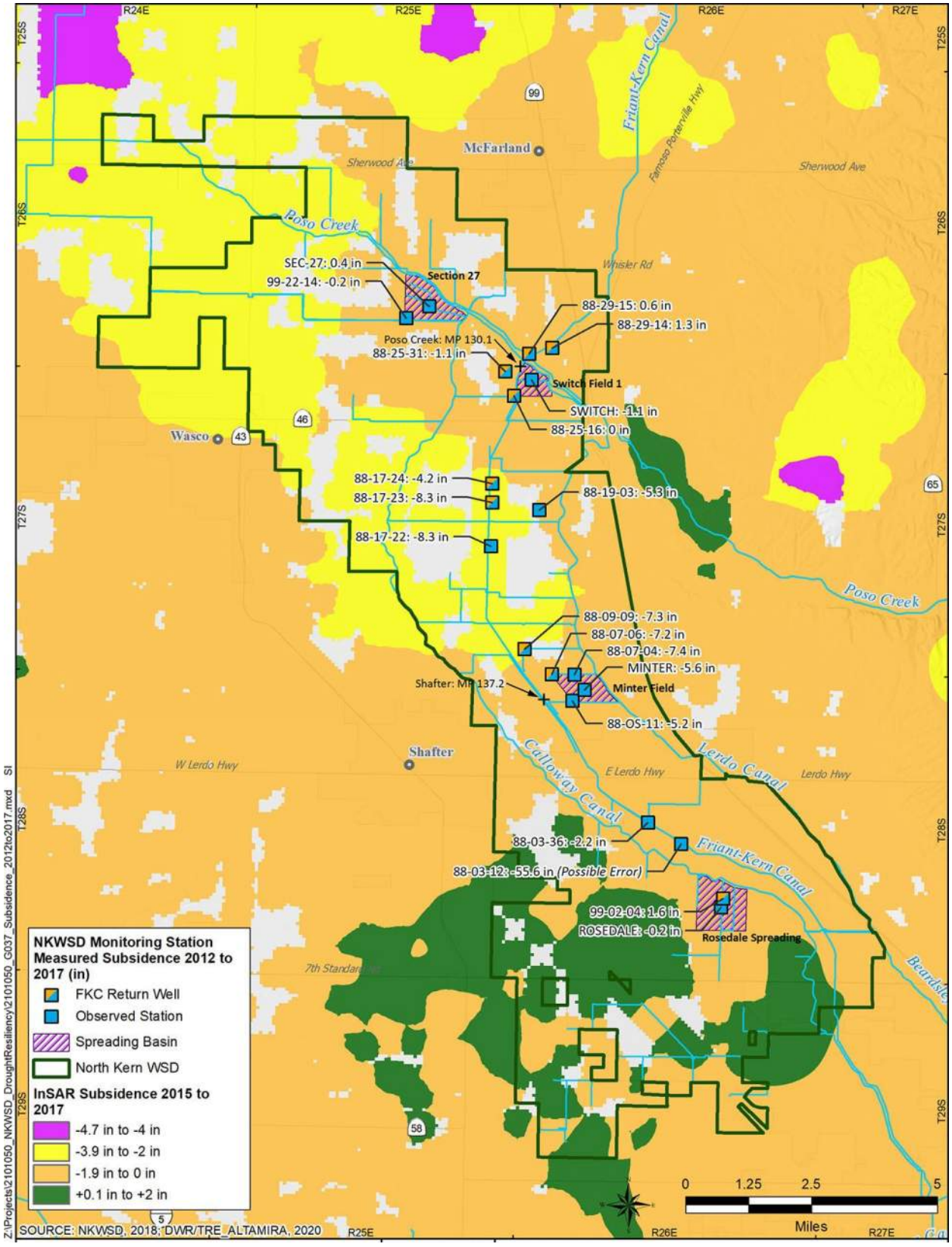
Figure 3-3 shows Interferometric Synthetic Aperture Radar (InSAR) subsidence data as well as the observed change in elevation between North Kern's 2012 and 2017 surveys. While InSAR data are only available from 2015 to 2017, there is general agreement between the datasets. The observed differences in elevation between 2012 and 2017 in the northern (Whistler Rd to Highway 46) and the extreme southern (Rosedale Spreading Basin) portions of the District are near, or within, the expected error range of the survey method used (Odum 2017). The central portion of the District, between Highway 46 and Lerdo Highway, reveals a slight depression with an average of -6.5 inches of elevation change over the 5-year period, or approximately -1.3 inches per year.

While reviewing **Figure 3-3**, it should be noted that subsidence documented at Station 88-03-12, located on the south side of the FKC between Rosedale Spreading Basin and Lerdo Highway, is an outlier. The 2012 Survey Report and processing information were reviewed by Odom (2017), but no topographical errors were found in the reported elevations; other potential issues including equipment and/or computer programs used did not reveal any issues. Consequently, this anomalous data cannot be explained. The reported subsidence of -55.6 inches is not consistent with the InSAR data which indicates -1.9 to 0 inches from 2015 to 2017.

Subsidence observed in the 2017 survey represents two periods of extensive pumping from 2007 through 2009, then 2012 through 2016. Over this span of 8 years, approximately 884,000 AF of groundwater was pumped; however, banking in the years spanning from 2005 through 2020 approximately 871,000 AF was banked (**Figure 3-2**). The 2012 subsidence survey was performed following an above normal water year, where approximately 205,000 AF was banked., The 2017 subsidence survey was performed following heavy pumping during dry and critically dry years. The surveys indicate the impacts pumping has on the aquifer. However, there is not enough subsidence monitoring data to fully understand the balance between banking and pumping.

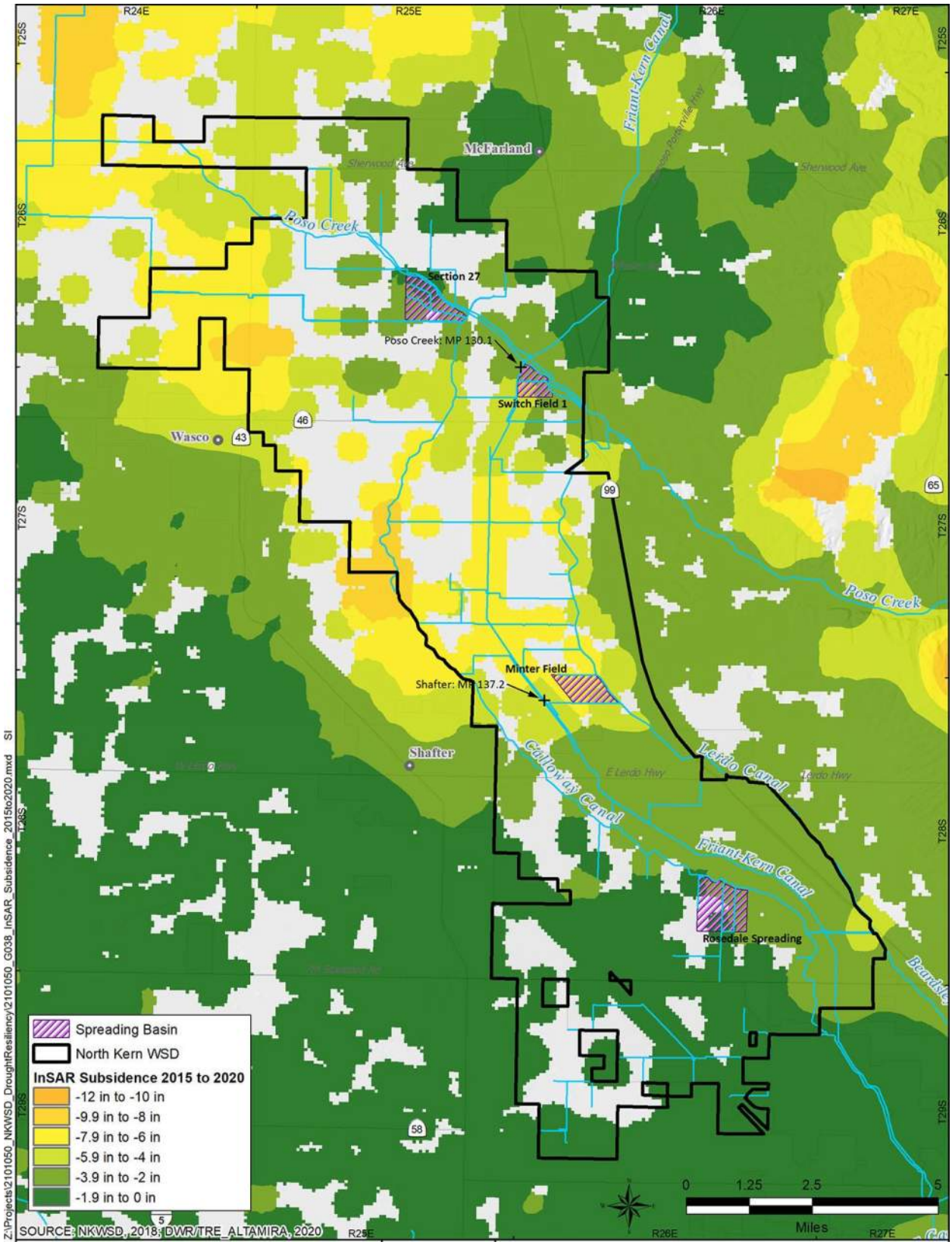
Subsidence data from 2015 to 2020 indicates recovery from elastic subsidence, where the southern and northern portions of the District range from -3 to 0 inches of subsidence, and a smaller area of the more impacted central portion of the District is in the range of -7.9 to -6 inches of subsidence. Refer to **Figure 3-4** which was created using a spliced combination of InSAR and California Department of Water Resources' (DWR) SGMA data spanning from June 2015 through October 2020.

Figure 3-3. InSAR and North Kern Subsidence Results from 2012 to 2017



Source: DWR 2020

Figure 3-4. InSAR Subsidence Results from 2015 through 2020



Source: North Kern 2018 and DWR 2020

To mitigate the potential for impacts on subsidence caused by groundwater pumping for return water, the District is:

> **Mitigation Measure GEO-1: Equip new monitoring wells with water-level sensors**. The District is constructing new monitoring wells equipped with water-level sensors to collect information on groundwater levels which can be used to document the effects of banking operations and groundwater pumping.
>
> **Mitigation Measure GEO-2: Conduct subsidence monitoring surveys**. In addition to North Kern's subsidence monitoring program, the District will participate in other subsidence monitoring and mitigation programs, including basin-wide efforts coordinated through the Kern Groundwater Authority (KGA). The KGA has identified the area between FKC mileposts 130 to 137 as an Area of Interest and is seeking funding to install an extensometer to monitor subsidence. Monitoring parameters include groundwater level monitoring and ground-truthing of subsidence detected in InSAR (i.e., continuous global positioning system, extensometer, or level surveying). In coordination with the Kern County Subbasin GSA's, North Kern will make operational adjustments or implement new management actions to mitigate impacts caused by their operation.
>
> **Mitigation Measure GEO-3: Develop water exchanges and/or banking agreements that result in a net increase in District water supplies**. The current return program relies on unused capacity of existing wells. Additionally, banking partners cannot request return volumes in excess of previously banked volumes allocated for return.

Implementing Mitigation Measures GEO-1 and GEO-2 enable the District to monitor potential for subsidence resulting from the Project. GEO-3 manages the banking program to result in a net positive to the District's groundwater supplies. Therefore, the proposed Project would have a **less-than-significant impact with mitigation**.

#7 -e. Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?

The Project would not require the use of septic tanks or alternative wastewater disposal systems. Temporary portable restrooms would likely be provided for construction workers. Therefore, there would be **no impact**.

#7 -f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

The Project sites are located on marine and non-marine sedimentary rock that consist of alluvium, lake, playa, and terrace deposits, and is from the Pleistocene-Holocene ages (CGS 2015c). Since paleontological resources are found almost exclusively in sedimentary rock, there is a chance of discovering unknown paleontological resources within the Project sites. Therefore, a **potentially**

significant impact would occur. The following mitigation measure has been identified to address this impact:

> **Mitigation Measure GEO-4: Avoid Potential Effects on Paleontological Resources.**
>
> In the event that a paleontological resource is uncovered during Project implementation, all ground-disturbing work within 165 feet (50 meters) of the discovery shall be halted. A qualified paleontologist shall inspect the discovery and determine whether further investigation is required. If the discovery can be avoided and no further impacts will occur, no further effort shall be required. If the resource cannot be avoided and may be subject to further impact, a qualified paleontologist shall evaluate the resource and determine whether it is "unique" under CEQA, Appendix G, part VII. The determination and associated plan for protection of the resource shall be provided to the District for review and approval. If the resource is determined not to be unique, work may commence in the area. If the resource is determined to be a unique paleontological resource, work shall remain halted, and the paleontologist shall consult with the District staff regarding methods to ensure that no substantial adverse change would occur to the significance of the resource pursuant to CEQA. Preservation in place (i.e., avoidance) is the preferred method of mitigation for impacts to paleontological resources and shall be required unless there are other equally effective methods. Other methods may be used but must ensure that the fossils are recovered, prepared, identified, catalogued, and analyzed according to current professional standards under the direction of a qualified paleontologist. All recovered fossils shall be curated at an accredited and permanent scientific institution according to Society of Vertebrate Paleontology standard guidelines; typically, the Natural History Museum of Los Angeles County and University of California, Berkeley accept paleontological collections at no cost to the donor. Work may commence upon completion of treatment, as approved by the District.

Implementing Mitigation Measure GEO-4 would reduce the potential impact related to discovery of unknown paleontological resources to a less-than-significant level because the fossil would be preserved. Therefore, the proposed Project would have a **less-than-significant impact with mitigation**.

3.8 Greenhouse Gas Emissions

#8. GREENHOUSE GAS EMISSIONS. Would the Project:

#8 -a. Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#8 -b. Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.

3.8.1 Environmental Setting

On June 1, 2005, Governor Schwarzenegger announced Executive Order S-3-05, which established the following greenhouse gas (GHG) emission reduction targets:

- By 2010, California shall reduce GHG emissions to 2000 levels
- By 2020, California shall reduce GHG emissions to 1990 levels
- By 2050, California shall reduce GHG emissions to 80 percent below 1990 levels

California's statewide reduction goals were subsequently revised by legislation (Assembly Bill 32 Health & Safety Code § 38500 et seq.) requiring California to reduce its overall GHG emissions to 1990 levels by 2020 and 40% below 1990 levels by 2030. GHGs were defined as carbon dioxide (CO_2), Methane (CH4), Nitrous Oxide (N2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulfur Hexafluoride (SF6).

C.A.R.B. was appointed to develop policies to achieve this goal. Subsequently, Senate Bill 32 (Health & Safety Code § 38566) increased and extended the emission reduction mandate to 40 percent below 1990 levels by 2030. Executive Order B-55-18 set a target of statewide carbon neutrality by 2045. In 2017, C.A.R.B. published an updated Climate Change Scoping Plan: The Strategy for Achieving California's 2030 Greenhouse Gas Target (Scoping Plan).

Kern County has not adopted a local plan for reducing GHG emissions. The S.J.V.A.P.C.D. has adopted the Guidance for Valley Land-use Agencies Addressing GHG Emissions Impacts for New Projects under CEQA (S.J.V.A.P.C.D. 2009). Although the Guidance addresses stationary source and development Projects, the District has adopted it for construction-related Projects.

3.8.2 Discussion

#8 -a. Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

GHG emissions would be generated during the construction phase of the proposed Project from the use of diesel-powered vehicles. As described in the Air Quality analysis, the SPAL screening tool estimated that emissions during all phases of the Project are below the applicable level of significance. Therefore, GHG emissions related to vehicle engine exhaust would be **less-than-significant**.

Water movement to the proposed Project sites will be primarily through gravity flow in existing facilities. To the extent that water is pumped to reach the proposed Project sites, those pumps are electric and do not directly produce GHG. The electricity is sourced from PG&E, which is covered by cap-and-trade. Since the electricity provider is already compliant with and exceeding California's mandates for reducing the emissions of GHGs, the electricity used for operation of the proposed Project would be **less-than-significant**.

#8 -b. Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

California has issued numerous Executive Orders directing state agencies to implement programs to reduce GHG emissions to meet 2030 target of 40 percent below 1990 levels (California 2018). C.A.R.B. is the primary state agency responsible implementing GHG reduction programs. The Scoping Plan (C.A.R.B. 2017) describes agriculture's role in emissions reductions and carbon sequestration. Natural and working lands are a key sector in the state's climate change strategy. Storing carbon in trees, other vegetation, soils, and aquatic sediment is an effective way to remove carbon dioxide from the atmosphere (C.A.R.B. 2017).

The Scoping Plan states that, "In 2030 and 2050, the agricultural sector must remain vibrant and strong. California's agricultural production is critical to global food security. It is also vulnerable to climate change." The Scoping Plan points out that "Resilient natural and working lands provide habitat for species and functions to store water, recharge groundwater, naturally purify water, and moderate flooding." "California's natural and working lands make the state a global leader in agriculture, a U.S. leader in forest products, and a global biodiversity hotspot. These lands support clean air, wildlife and pollinator habitat, rural economies, and are critical components of California's water infrastructure. Keeping these lands and waters intact and at high levels of ecological function (including resilient carbon sequestration) is necessary for the well-being and security of Californians in 2030, 2050, and beyond. Forests, rangelands, farms, wetlands, riparian areas, deserts, coastal areas, and the ocean store substantial carbon in biomass and soils."

State policy is clear that preservation of agriculture is a critical goal, and a benefit to GHG reduction. The proposed Project is designed to recharge groundwater, making water supplies available to irrigated agriculture during times of drought. For these reasons, the proposed Project is compatible with the state's climate change policy.

Kern County does not have an adopted local GHG reduction plan. The S.J.V.A.P.C.D. provides guidance for addressing GHG emissions from land use development projects. The S.J.V.A.P.C.D. considers development projects to be less than significant if the Project achieves 29 percent GHG emission reductions target by using approved Best Performance Standards (BPS), which includes Project design elements and technologies, such as the use of energy efficient equipment, that reduce GHG emissions (S.J.V.A.P.C.D. 2009). The Guidance does not require quantification of Project specific GHG emissions for projects that implement BPS. Consistent with CEQA Guidelines, such projects would be determined to have a less-than-significant individual and cumulative impact for GHG emissions (S.J.V.A.P.C.D. 2009). Because the District would comply with state policy regarding climate change and the S.J.V.A.P.D.C Guidance, the impact would be **less-than-significant**.

3.9 Hazards and Hazardous Materials

#9. HAZARDS AND HAZARDOUS MATERIALS. Would the Project:

#9 -a. Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#9 -b. Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#9 -c. Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#9 -d. Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#9 -e. For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#9 -f. Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#9 -g. Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

3.9.1 Environmental Setting

The database search included all data sources included in the Cortese List (enumerated in PRC Section 65962.5). These sources include the GeoTracker database, a groundwater information management system that is maintained by the State Water Board; the Hazardous Waste and Substances Site List (i.e., the EnviroStor database), maintained by the California Department of Toxic Substances Control (DTSC); and EPA's Superfund Site database (DTSC 2021a and 2021b, State Water Board 2021a and 2021b, CalEPA 2021). There were no hazardous materials sites identified within 0.25 mile of the Project sites. The Project sites are not in an area identified as more likely to contain asbestos by the California Department of Conservation (D.O.C. 2000). This issue is not discussed further in this IS/MND.

There are no schools within 0.25 mile of the Project sites. The nearest schools to the Project sites are Horizon Elementary (located approximately 3 miles north from the northernmost site), Shafter High School (located approximately 2.5 miles southwest of the Project site located adjacent to the Minter Field spreading basin), and Norris Elementary School (located approximately 3 miles south of the southernmost Project site).

3.9.2 Discussion

#9 -a, b. Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials? Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

The Project consists of temporary construction activities and would not result in new or different long-term activities that would include the use, transport, or disposal of hazardous materials. However, Project construction would involve the storage, transport, and use of small amounts of hazardous substances necessary to operate and maintain construction vehicles and equipment such as oils, lubricants, and fuel. The Project would not involve routine or long-term transport or disposal of such materials. None of the proposed Project activities would involve the use of acutely hazardous materials.

The transport and use of hazardous materials are strictly regulated by local, state, and federal agencies to minimize adverse hazards from accidental release. EPA, California Highway Patrol, Caltrans, and DTSC implement and enforce state and federal laws regarding hazardous material transportation. Contractors would be required to use, store, and dispose of any hazardous materials in accordance with all applicable regulations. Additionally, the District would prepare and implement a SWPPP to prevent and control pollution and to minimize and control runoff and erosion in compliance with state and local laws. The SWPPP would include construction techniques and BMPs, as appropriate to reduce the potential for runoff and exposure to hazardous materials.

Compliance with state and federal laws as well as implementation of a SWPPP would reduce the potential impact from accidental spill of or exposure to hazardous materials during routine use, transport, or disposal. The SWPPP would include a spill prevention, control, and countermeasure plan, and would identify the types of materials used for equipment operation (including fuel and hydraulic fluids), along with measures to prevent and materials available to clean up hazardous material and waste spills. The SWPPP would also identify emergency procedures for responding to spills. Therefore, the proposed Project would have a **less-than-significant** impact.

#9 -c. Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

There are no schools within 0.25 mile of any Project sites. There would be **no impact**.

#9 -d. Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

The Project sites are not identified on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5. There would be **no impact**.

#9 -e. For a Project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project result in a safety hazard or excessive noise for people residing or working in the Project area?

Kern County has established an Airport Land Use Compatibility Plan which has been incorporated into the General Plan (Kern County 2012). The purpose of the Airport Land Use Compatibility Plan is to establish procedures and criteria by which Kern County and affected incorporated cities can address compatibility issues when making planning decisions. The Project site located adjacent to the Minter Field spreading basins is within Airport Influence Areas, specifically Approach/Departure (Zone B1), Extended Approach/Departure (Zone B2), and Common Traffic Pattern (Zone C), as designated in the Airport Land Use Compatibility Plan. These zone designations are identified by various levels of risk depending on proximity to runways and specify maximum land use densities and required amounts of open land (Kern County 2004b). According to the ALUCP, Zone B1 presents “substantial” level of risk and noise, Zone B2 present "significant" levels of risk and noise, and Zone C presents a "limited" level of risk and noise. The three other discreet Project sites are not located within areas subject to the Airport Land Use Compatibility Plan nor are they within 2 miles of any public airports. This impact would be **less than significant**.

#9 -f. Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

Kern County does not have an adopted emergency response plan or emergency evacuation plan; however, the Project would not affect emergency response or evacuation activities as the

replacement wells, pipeline, and discharge outfalls are minor is size and scope. Additionally, the Project would not require any road closures for Project implementation and therefore the Project would not interfere with traffic routes or response vehicle transport. There would be **no impact**.

#9 -g. Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires?

The Project sites are not located in a very high fire hazard severity zone (CAL FIRE 2007a, 2007b). Construction activities would not expose people or structures to a significant risk of loss, injury, or death involving wildland fires. There would be **no impact**.

3.10 Hydrology and Water Quality

#10. HYDROLOGY AND WATER QUALITY. Would the Project:

#10 -a. Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes**.	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#10 -b. Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#10 -c. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#10 -c. i. result in substantial erosion or siltation on- or off-site;	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#10 -c. ii. substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#10 -c. iii. create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

#10. HYDROLOGY AND WATER QUALITY. Would the Project:

#10 -c. iv. impede or redirect flood flows?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#10 -d. In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#10 -e. Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

3.10.1 Environmental Setting

The FKC runs directly through North Kern's service area, entering approximately at MP 127.90 and exiting approximately at MP 148.89, with turnouts at various locations between these points. This enables the District to receive delivery of water from the FKC on behalf of other CVP contractors during wet years for recharge in its spreading ponds. The primary source of water conveyed in the FKC is from the San Joaquin River watershed and stored in or flowing through Millerton Lake, which exhibits excellent water quality; however, in some years, Non-Millerton Lake water is introduced into the FKC at various locations. Non-Millerton Lake water is typically groundwater, and of lesser quality than Millerton Lake water. Accordingly, the quality of the water in the FKC changes with the introduction of Non-Millerton Lake water.

Reclamation establishes water quality standards for water conveyed in the FKC. Friant Water Authority (FWA), a non-federal entity, operates and maintains the FKC to Reclamation directives and standards. At a minimum, all pump-in water must comply with drinking water Maximum Contaminant Levels (MCL) defined in Title 22[2]. The most current written standards specific to the FKC are provided in Reclamation's 2008 *Policy for Accepting Non-Project Water into the Friant-Kern and Madera Canals* (2008 Policy; Reclamation 2008). Allowable levels of salts in Title 22 and Reclamation's current policy exceed agronomic thresholds (conductivity, chloride, and boron) and are not considered protective of agricultural uses. Consequently, FWA and FKC contractors

[2] Title 22. The Domestic Water Quality and Monitoring Regulations specified by the State of California Health and Safety Code (Sections 4010-4037), and Administrative Code (Sections 64401 et seq.), as amended.

are working closely with Reclamation to revise the 2008 Policy. Proposed revisions to the 2008 Policy remove all references to Project and Non-Project Water and are focused on Millerton Lake versus Non-Millerton Lake water supplies. New water quality thresholds as well as monitoring and mitigation requirements are key revisions being requested by Friant Division Long-Term Contractors in order to implement comprehensive water quality management on the FKC.

Since Title 22 limits for salts (i.e., conductivity, chloride, and boron) are significantly higher than agronomic limits, FWA formed a Water Quality Ad Hoc Committee to develop a comprehensive policy that addresses salinity thresholds that are protective of agricultural uses. The proposed Water Quality Ledger Program, encompassed in FWA's draft Water Quality Policy (FWA 2020) and attached as Appendix C, tracks and accounts for all inflows and diversions into and from the FKC to determine appropriate mitigation for impacted water quality aiming to balance concerns by southern FKC contractors as a multi-layered assessment of agronomic impacts as a durable solution. The proposed Water Quality Ledger Program includes an in-prism conductivity baseline of 200 micro siemens per centimeter: the level at which is assumed that growers are already managing the effects of applied water quality. The proposed Water Quality Ledger Program principles that are relevant to this analysis are:

- Accounts for all inflows and diversions into and from the FKC, including diversions from Millerton Lake, groundwater and surface water pump-in and pump-back water, and all deliveries from the FKC.
- Establishes a baseline salinity threshold based on assumptions of current, minimum leaching practices by water users, or growers, in the region. Consistent with good agricultural practices, it is assumed that growers are currently applying at least a 5% leaching fraction. Mitigation is only required for water quality conditions with incremental conductivity that exceed the baseline of 200 micro siemens per centimeter.
- FKC in-prism water quality that exceeds any of the following thresholds will require systematic ceasing of pump-in and pump-back operations, prioritizing the greatest contributors until water quality conditions are below the threshold:
    - Title 22 drinking water quality regulations.
    - Constituent thresholds that account for sensitive crops, leaching requirements, regulated deficit irrigation during almond hull split from July 1 – August 31, and provides flexibility in the second half of the contract year depending on observed water quality from March 1 – June 30. **Table 3-5** summarizes the thresholds in the proposed Water Quality Ledger Program.

Table 3-5. FKC In-Prism Thresholds, Proposed Water Quality Ledger Program.

	Conductivity (micro siemens per centimeter)	Chloride (parts per million)	Boron (parts per billion)	Sodium absorption ratio (SAR)
Period 1 March 1 – June 30	1,000	102	400	3
Period 2 July 1 – August 31	500	55	400	3
Period 3 September 1 – February 28	1,000	102[3]	400	3
Period 3 September 1 – February 28	1,000	123	400	3

The proposed Water Quality Ledger Program states that when FKC in-prism water quality conditions in **Table 3-5** are exceeded, Friant Division Long-Term Contractors will work together to seek exchanges for pump-in and pump-back programs. This does not apply to spot-market or third-party exchanges.

Wells used to return previously banked water via the FKC have undergone extensive testing to confirm compliance with present Title 22 drinking water MCLs. Project wells have been sampled for all constituents listed in Title 22 and the additional constituents of concerns identified in Reclamation's policy. Overall, groundwater from North Kern's wells is high-quality, most wells have less than half of the agricultural threshold for conductivity, chloride, and boron. **Table 3-6** presents water quality of the 13 wells approved for pump-in with implementation of the 1,2,3-Trichloropropane (TCP) Mitigation Program (baseline conditions), compared against the thresholds established in FWA's draft Water Quality Policy. It should be noted that most of the wells individually meet the Period 2, July 1 through August 31, conductivity threshold for pump-in wells (500 micro siemens per centimeter). If in-prism water exceeds a threshold, systematic ceasing of pump-in or pump-back operations may be required.

[3] If the measured average chloride concentration in Period 1 is less than or equal to 70 parts per million, the allowable chloride threshold for Period 3 increases to 123 parts per million.

Table 3-6. Salinity Values of North Kern's Current Approved Project Wells.

Constituents	Units	Draft WQ Policy Threshold	Project Wells[1]
Conductivity	micro siemens per centimeter	500	240 – 510
			313
Chloride	parts per million	55	10 – 39
			21
Boron	parts per billion	400	Non-detect – 140
			Non-detect
Sodium Adsorption Ratio	---	3	1.1 – 6.9
			3.0
Total Dissolved Solids	parts per million	325[2]	150 – 330
			196

Notes:

[1] Top row represents the range of values from the 13 currently approved wells; bottom row is the flow weighted average.

[2] FWA acknowledges Shafter-Wasco Irrigation District's proposed threshold of 325 parts per million for Total Dissolved Solids; however, it is not an established threshold of the Draft Policy.

The FKC predominately supplies San Joaquin River water from Millerton Lake, which is relatively pure water with very little mineral or salt content. However, Non-Millerton water is pumped-in most years. Analysis of Reclamation's FKC Water Delivery Monthly Tables (Table 22)[4], during the past 11 years, 2010 is the only year with 100-percent Millerton only water. From 2011 through 2020, Millerton supplied 61 to 99-percent of the total water stored or conveyed in the FKC. **Table 3-7** provides the percentage of supply each year from 2010 through June 2021, Class 1 water allocation is provided below each water year. For the purpose of this analysis, North Kern and Cross Valley Canal (CVC) are shown separately from other Non-Millerton supplies because their impacts are individually evaluated. Typically, in normal and above normal water years, North Kern either does not return water to its banking partners, or only returns a nominal volume.

As shown in **Table 3-7**, previously banked water is typically returned as extracted groundwater and only substantially supplements the FKC during critically dry years. In total, there are seven agencies approved to pump-in Non-Millerton water which causes variation in water quality. This variation is more prominent in the southern FKC reaches as the ratio of Millerton water decreases from upstream extractions, and groundwater pump-in increases. **Figure 3-5** shows percentages of water supplies during critically dry, above normal, and below normal water years. **Figure 3-6** graphically shows the 11-year total water volume and percentage of supplies.

[4] Central Valley Operations, Friant-Kern Canal Deliveries (Table 22). https://www.usbr.gov/mp/cvo/deliv.html

Table 3-7: Volume of FKC Water by Source, 2010-2020.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Jun-21
Class 1 Water Allocation	100%	100%	50%	62%	0%	0%	75%	100%	88%	100%	65%	0%
Millerton	1,337,892	1,450,831	637,091	404,698	143,346	58,352	673,725	1,497,165	966,497	1,529,020	648,096	95,538
Non-Millerton	0	13,257	7,807	59,687	47,281	29,582	5,190	14,825	29,042	56,438	57,558	17,010
North Kern	0	7,592	6,803	8,713	13,587	7,345	1,818	0	3,823	0	10,082	4,554
Cross Valley Canal	0	165	4,820	8,472	698	0	0	0	1,678	12,291	1,619	8,727

Notes:
*Data updated in Reclamation's Table 22 through June, except CVC input. Pump-back started in March 12; total input is estimated based on FKC Operations tracking.
Background colors indicate water year: green is below normal; blue is above normal; yellow is normal; light pink is dry; and salmon is critically dry.

Figure 3-5: FKC Water Supplies During Representative Water Years.

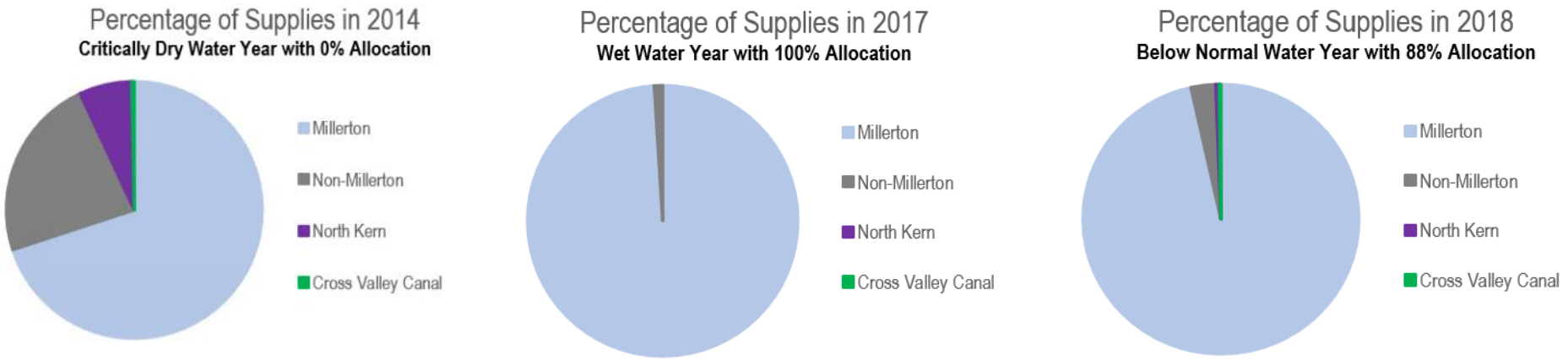
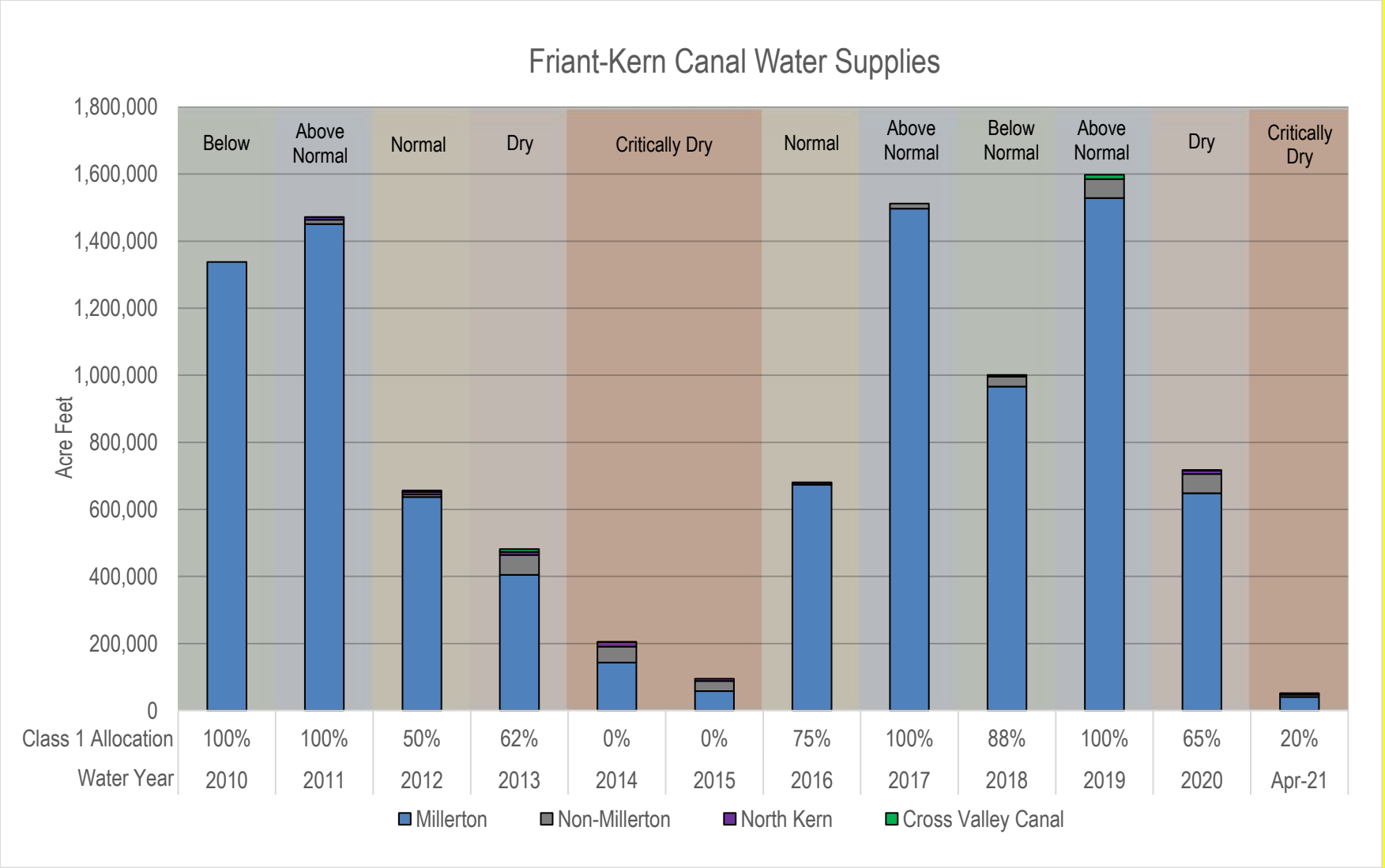


Figure 3-6: FKC Total Water Volume and Percentage of Supplies.



FWA annually collects samples from various locations along the FKC. Locations that are relevant to this evaluation include MP 122.05 (about 0.5 mile downstream of the Woollomes Check) which is located upstream of North Kern's existing and proposed pump-in locations, and MP 151.80, which corresponds to the Kern River Check and is located downstream of North Kern's existing and proposed pump-in locations. General water chemistry data (irrigation suitability analyses) are available for most years since 1963. Data for an 11-year span (2010–2020) were incorporated into this evaluation. **Table 3-8** provides a list of the constituents which are routinely tested.

Table 3-8: FKC Annual Sample Parameters.

Parameter Group	Constituents
General Minerals	sodium, potassium, calcium, carbonates, magnesium, chloride, conductivity, total dissolved solids, sulfate, and pH
Inorganics	boron and nitrate

3.10.2 Discussion

#10 -a. Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?

The purpose of this Project is to expand North Kern's capacity to return previously banked water by adding nine additional wells and three discharge locations. With this Project, North Kern will have 22 wells with a maximum combined capacity of 103.6 cfs discharging at eight locations into the FKC. This estimated maximum capacity would only be exercised when the District has recharged quantities and appropriate leave behind as envisioned in the Expanded Banking Program (briefly discussed in section on Mandatory Findings of Significance). The number of wells and maximum capacity offer the District operational flexibility while meeting their obligation to return water. This Project is being implemented at this time to maximize the District's flexibility to return water to banking partners, and because of grant funding obligations. All proposed wells meet the high-water quality standards established by Title 22 and FWA's draft Water Quality Policy. **Table 3-9** provides the pump capacity, conductivity, chloride, boron, sodium adsorption ratio (SAR), and total dissolved solids of each Project well.

Table 3-9: Water Quality of Proposed Project Wells.

Well	Capacity	Conductivity	Chloride	Boron	SAR	Total Dissolved Solids
	(cfs)	<500 micro siemens per centimeter	<55 parts per million	<400 parts per billion	<3	<325 parts per million
*88-29-035	5.0	290	17	Non-detect	1.1	170
*88-29-015	5.0	310	22	100	1.1	130
88-25-013	5.8	420	24	Non-detect	1.1	250
88-25-010	5.8	330	24	Non-detect	1.4	210
*88-00-098	5.0	300	29	Non-detect	1.6	180
*88-25-005	5.0	460	41	100	0.9	220
88-05-011	4.9	**740**	**80**	Non-detect	2.5	**470**
88-05-003	4.5	410	**80**	Non-detect	2.5	**470**
99-00-018	5.7	400	27	Non-detect	**4.5**	250

Notes:
Results presented in this table are from sample collections in February-March 2021. Water quality exceeding the summer in-prism thresholds of the proposed Water Quality Ledger Program in **bold**.
*Capacity of wells scheduled for replacement is estimated at 5.0 cfs for planning purposes

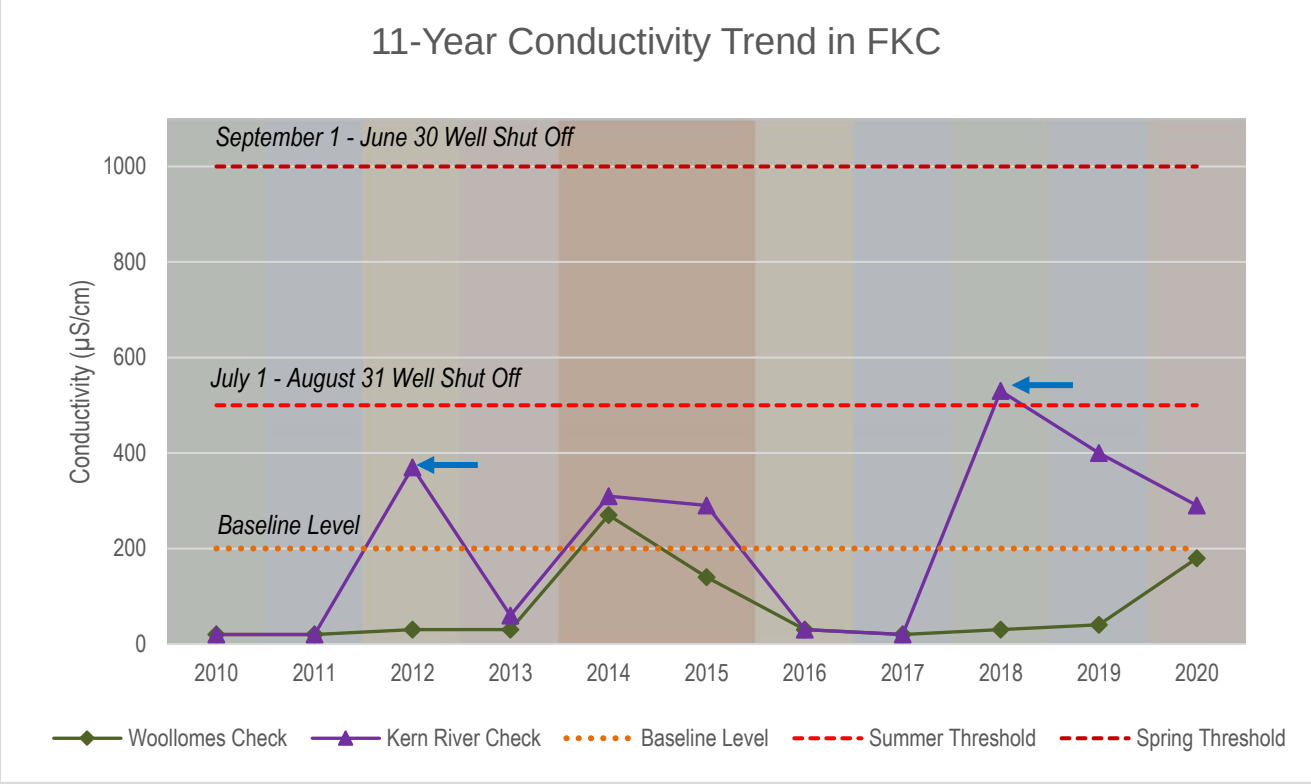
Historical Conductivity Levels FKC Woollomes Check to Kern River Check

Figure 3-7 presents in-prism conductivity levels from annual sampling at MP 122.05 (Woollomes Check), which represents water quality coming into Kern County when the FKC is operating in forward flow (north to south), prior to any pump-in from North Kern's wells. Graphing conductivity values shows the salinity variation between above normal, below normal, and critically dry water years (**Figure 3-7**). Salinity levels were elevated in 2014 and 2015, which represent critically dry years. Samples collected in above normal water years 2010, 2011, and 2012 show salinity was very low at the Woollomes Check (30 micro siemens per centimeter). However, in 2012, at the Kern River Check, conductivity was high at 370 micro siemens per centimeter which represents pump-back operation. Pump-back operation is where surface water from the SWP and groundwater from the Kern Fan is conveyed through the CVC and is pumped into the FKC flowing north to northern Friant Contractors over the Shafter Check. Water supplies in the CVC are either groundwater extracted from the Kern Fan or California SWP water via the California Aqueduct. Water flowing south over the Woollomes Check and north over Shafter Check are blended between the Shafter and Poso check structures. Pump-back operation is also represented in the 2018 annual sample results. Blue arrows on the graph signify pump-back operation.

Figure 3-7 also shows conductivity was elevated during forward flow operation (water moving from north to south) during severe drought years 2014 and 2015. The increased salinity indicates that Non-Millerton Lake water was the primary supply to the FKC. Since North Kern selected its highest quality wells to return banked water via the FKC, water quality may be improved during critically dry years when Non-Millerton Lake water is the predominate supply crossing over

Woollomes Check. Sample results from 2017, 2018 (at the Woollomes Check), and 2019 are consistent with typical San Joaquin River water quality where conductivity is less than 50 micro siemens per centimeter.

Figure 3-7: 11-Year FKC Salinity Trend between Lake Woollomes and Kern River Checks. [5]



Note:
Background colors indicate water year: green is below normal; blue is above normal; yellow is normal; light pink is dry; and salmon is critically dry.

Conductivity Levels in FKC With Proposed Project

Water quality blending calculations were used to predict in-prism conductivity levels with various FKC operating scenarios. The mass balance relationship used to estimate the concentration in the blended supply is shown below, where "V" equals volume and "C" equals the concentration of the given constituent for each source of supply.

$$C_{TOTAL} = \frac{(V_1 \times C_1) + (V_2 \times C_2) + (V_3 \times C_3)}{V_{TOTAL}}$$

In the following sections, modeling using this mass balance equation was performed using baseline conditions of the TCP Mitigation Project (13 wells with a maximum capacity of 56.9 cfs).

[5] Thresholds are from the proposed Water Quality Ledger Program.

Additional calculation was performed to evaluate impacts when the proposed Project wells are added (22 total wells with a combined maximum capacity 103.6 cfs). Since banked water is typically returned during dry and critically dry years, this analysis assumes very little Millerton water is passing over Woollomes Check to blend with the pumped groundwater. Additionally, there are scenarios to represent the variability of water quality historically observed from pump-in projects north of Kern County. Flow volumes used in this analysis are also presumed to be a worst-case scenario where, at times, North Kern's pump-in could be greater than the total supply in the FKC between the Woollomes and Kern River Checks. It should be noted that flow over Woollomes Check is variable throughout the year and is based on water orders at the southern reaches of the Canal. Conductivity was used as a representative measure of salinity. Flow weighted calculations estimate the potential impacts to in-prism conductivity during average and dry water years (based on the San Joaquin Index), and during pump-back operations.

Historically, during a normal water year, conductivity at Woollomes Check is 40 micro siemens per centimeter and GEI estimates the lowest calculated flow over Woollomes Check is an average of 75 cfs. **Figure 3-8** shows the modeled water quality in the FKC with the implementation of the TCP Mitigation Program wells. The blue dots show the most recent conductivity value of each well. The green diamonds show conductivity of the blended wells at each discharge point, the blue line shows increasing conductivity as each well is pumped in. To show potential impacts to receiving water quality, **Figure 3-9** was created for a visual display of increasing salinity as proposed Project wells are pumped into the FKC during an average year.

Conductivity of the proposed Project wells range from 290 to 740, with an average of 361 micro siemens per centimeter. As indicated by the blue trend line, in-prism conductivity increases from 40 micro siemens per centimeter at Woollomes Check to 160 micro siemens per centimeter at MP 142.01 (southernmost District discharge point) with the implementation of the TCP Mitigation Program. The Project wells increase in-prism conductivity to 213 micro siemens per centimeter at MP 142.01. While most proposed Project wells individually have less than 500 micro siemens per centimeter of conductivity, the in-prism concentration is noticeably increased because groundwater could be the predominate water supply when very little Millerton water is flowing south over Woollomes Check (75 cfs FKC and 103.6 cfs groundwater). When there is very little Millerton water available, in-prism conductivity increases slightly above the 200 micro siemens per centimeter; the baseline level that growers are assumed to be already managing the effects of applied water quality conditions, therefore proposed Project impact in a normal year is **potentially significant** prior to implementation of mitigation.

Figure 3-8: Flow Weighted Calculation of Conductivity in an Average Water Year with Forward Flow Operations with TCP Mitigation Program Implementation.

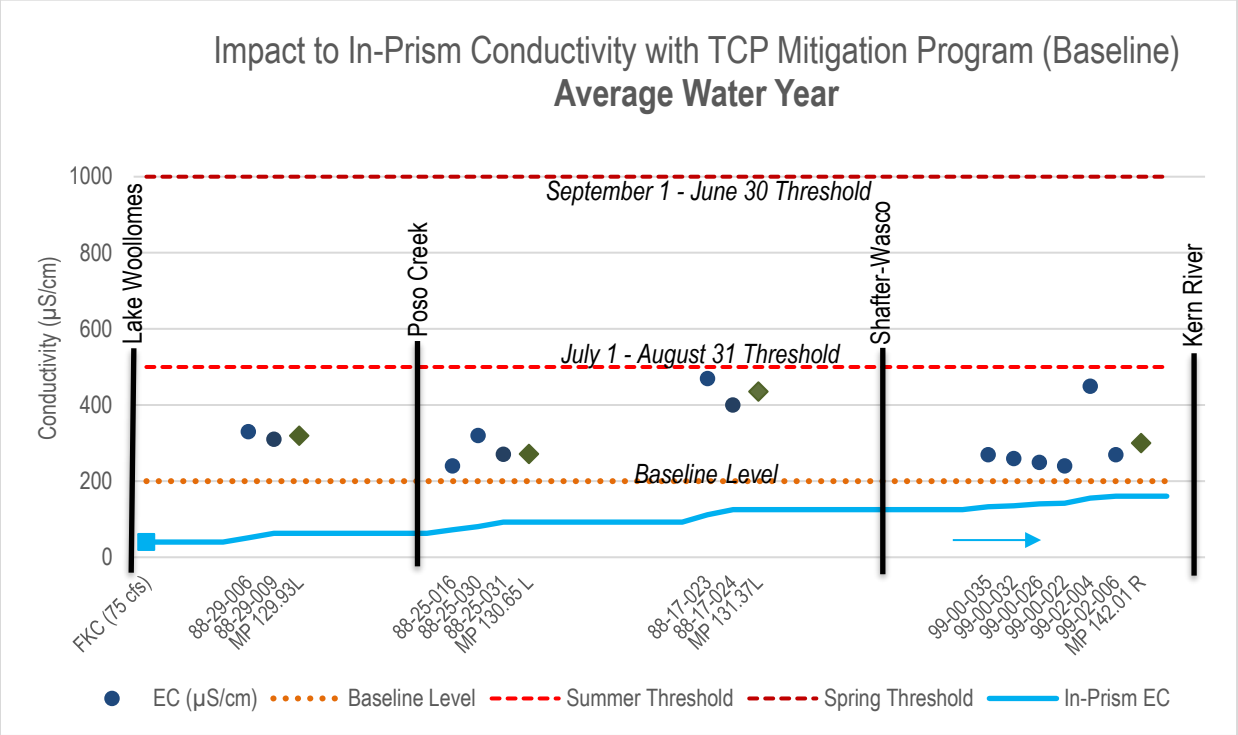
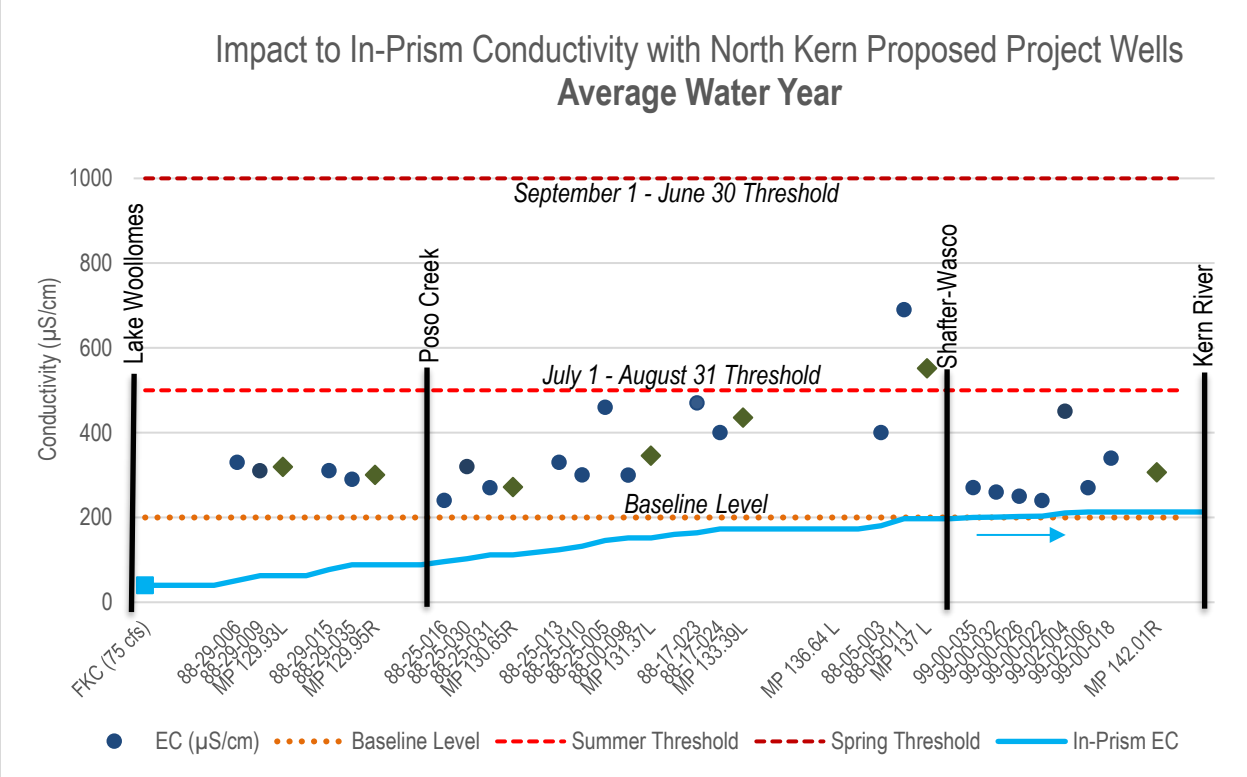


Figure 3-9: Flow Weighted Calculation of Conductivity in an Average Water Year with Forward Flow Operations with Addition of Project Wells



Note: Green diamonds represent the flow weighted conductivity at each discharge point.

In a dry water year, conductivity at Woollomes Check is typically much higher than in above normal or normal years because of groundwater pump-in projects north of Kern County. For this scenario, conductivity is assumed to be 150 micro siemens per centimeter, and flow is assumed to be 50 cfs. Groundwater remains the predominate source of supply pumping in at 103.6 cfs. **Figure 3-10** shows that, in a dry year, in-prism conductivity increases from 150 to 240 micro siemens per centimeter with implementation of the TCP Mitigation Program. **Figure 3-11** shows that, in a dry year, in-prism conductivity increases from 150 to 260 micro siemens per centimeter with the addition of proposed Project wells.

Figure 3-10: Flow Weighted Calculation of Conductivity in a Dry Water Year with Forward Flow Operation and Implementation of the TCP Mitigation Program

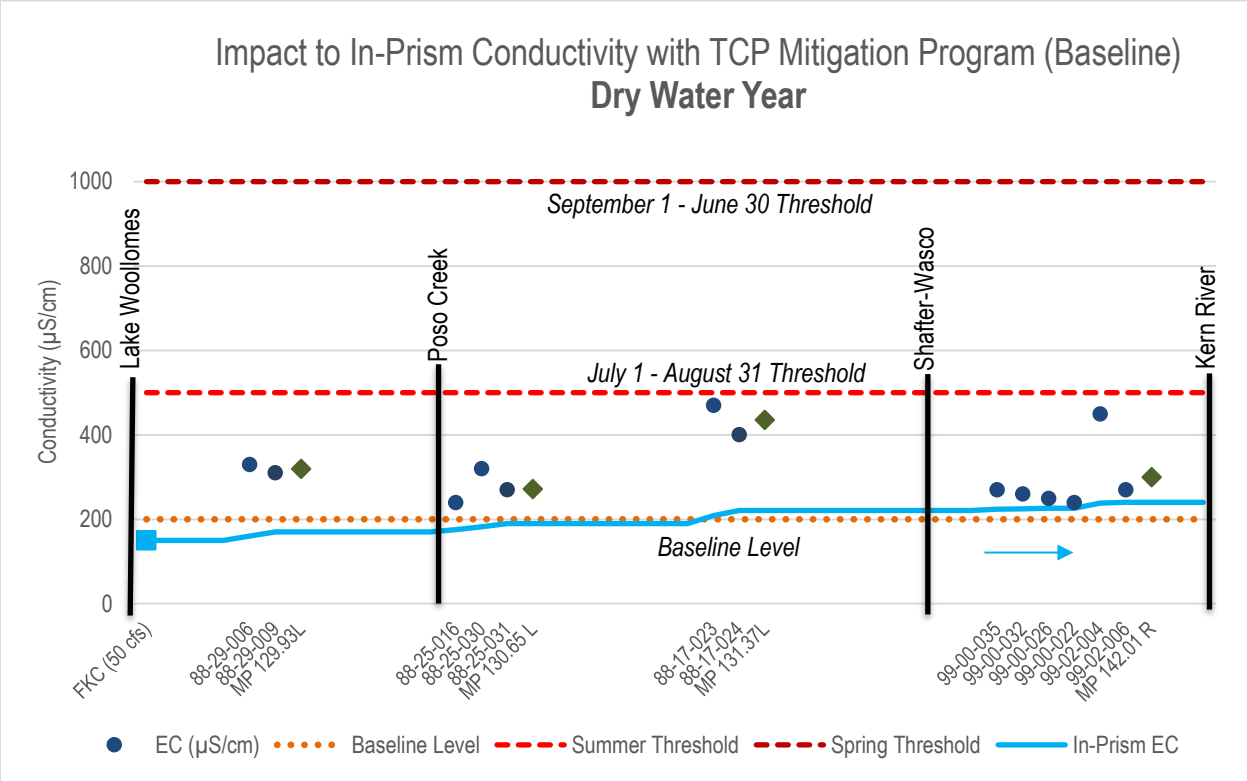
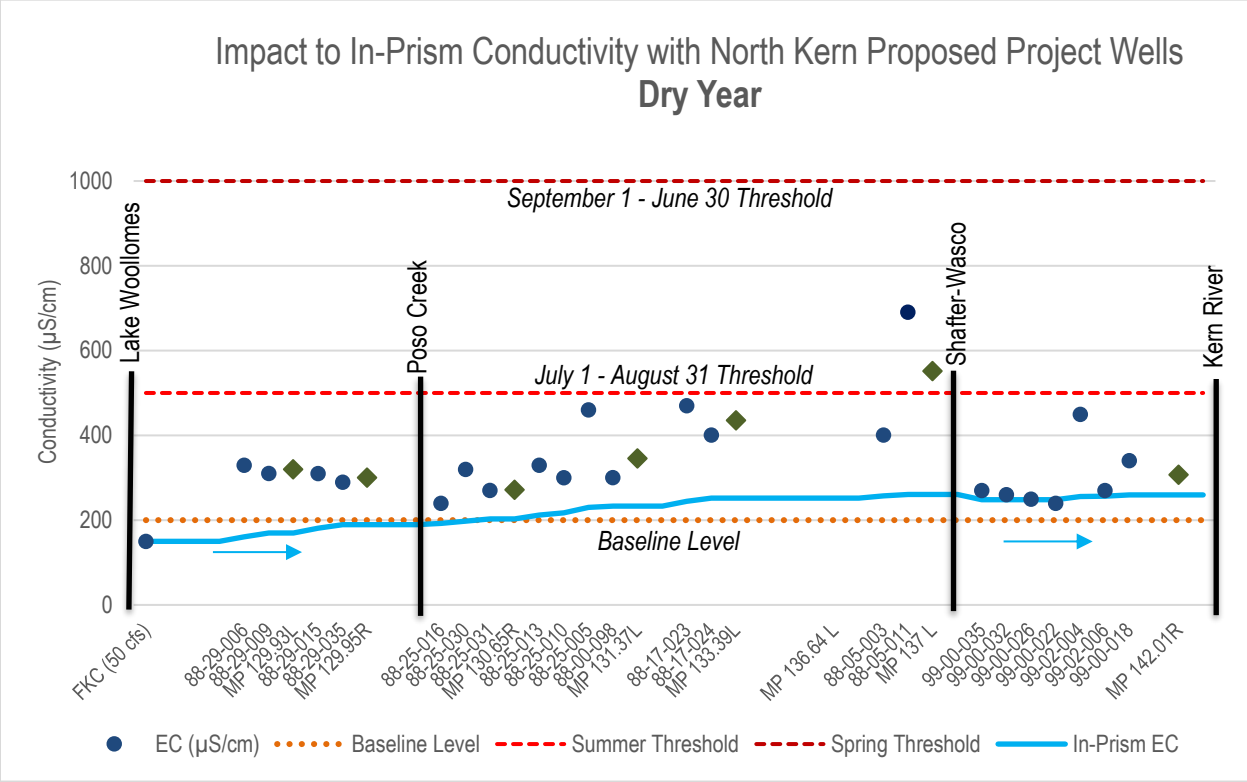


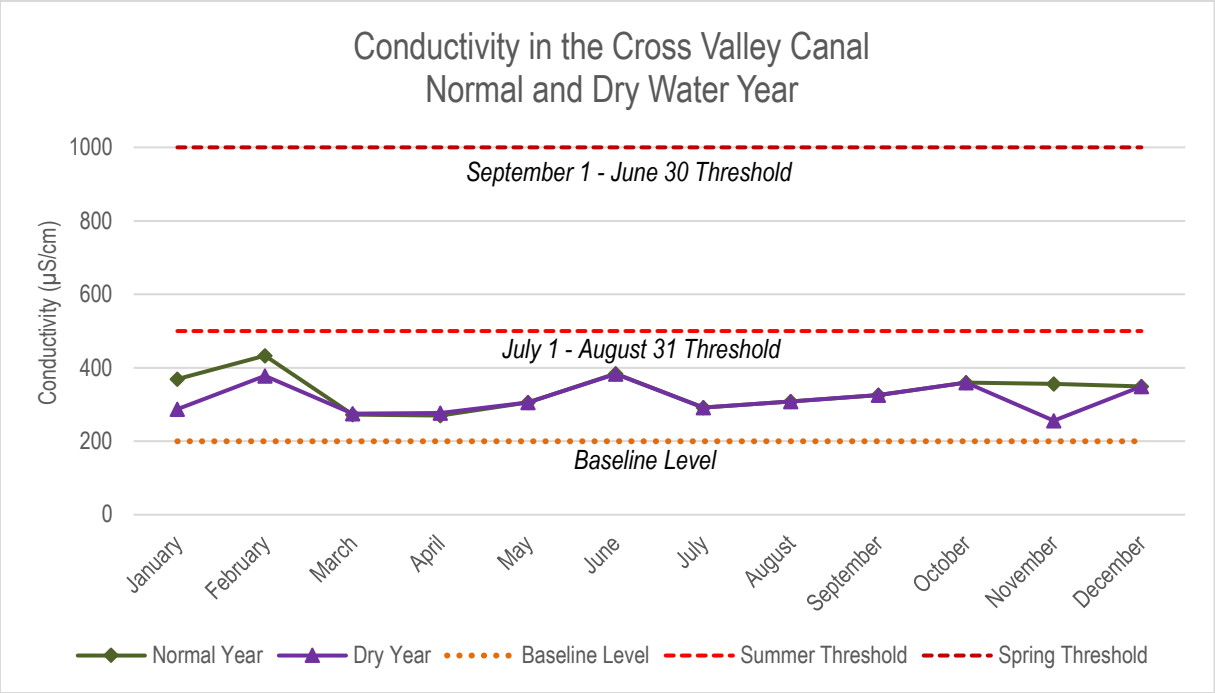
Figure 3-11: Flow Weighted Calculation of Conductivity in a Dry Water Year with Forward Flow Operation and Addition of Project wells



Note: Green diamonds represent the flow weighted conductivity at each discharge point.

FWA addresses agronomic impacts of pump-back operations in its draft Water Quality Policy (June 2020), which incorporates the proposed Water Quality Ledger Program. Average monthly conductivity values are provided for above normal, normal, and dry water years, based on the San Joaquin Index year types. **Figure 3-12** shows the CVC has relatively little variation in conductivity levels between normal and dry water years, which are the years that the District would be returning banked water. The range of conductivity is 270 to 433, with an average of 336 micro siemens per centimeter.

Figure 3-12: Monthly Average Conductivity in the Cross Valley Canal



During pump-back operation, water is pumped from south to north, starting at the CVC intertie at the Kern River Check, over the Shafter Check. Water may also be flowing from north to south from the Woollomes Check, creating an intermediate pooling zone between the Poso and Shafter check structures. **Figure 3-13** shows the calculated conductivity values (blue line) during pump - back operation with the implementation of the TCP Mitigation Program. During pump-back operation, conductivity increases from 150 to 230 micro siemens per centimeter between Woollomes and Poso check structures. **Figure 3-14** shows the calculated conductivity values (blue line) during pump-back operation with the addition of the Project wells. During pump-back operation, the proposed Project's pump-in increases conductivity from 150 to 189 micro siemens per centimeter between Woollomes and Poso check structures, a slight improvement. It should be noted that these calculations represent the maximum expected conductivity values, representative of dry-year conditions, to evaluate a worst-case scenario. From the CVC intertie to the Shafter Check, conductivity is slightly decreased from 336 to 321 micro siemens per centimeter. The intermediate mixing zone between Poso and Shafter check structures does not appear to materially change: the highest calculated in-prism conductivity value is 348 micro siemens per centimeter.

Figure 3-13: Flow Weighted Calculation of Conductivity, Pump-Back Over the Shafter Check, Average Year, with the Implementation of the TCP Mitigation Program.

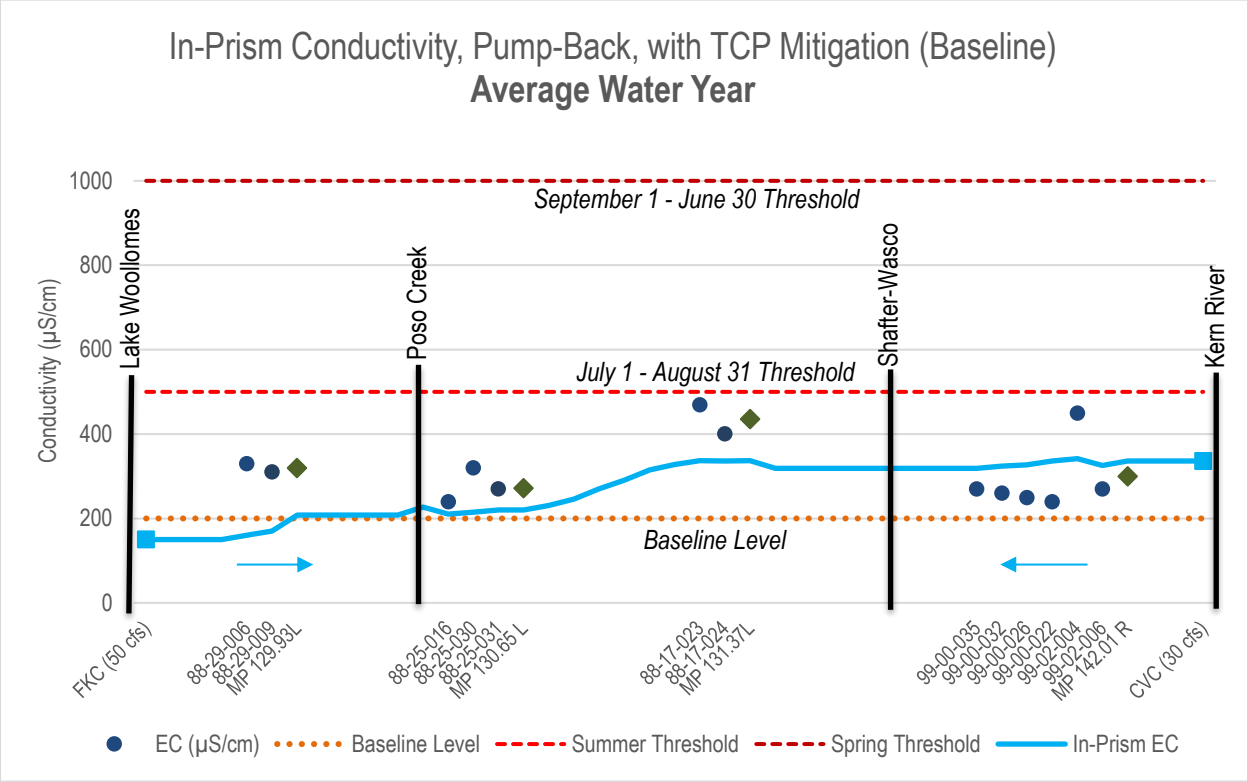
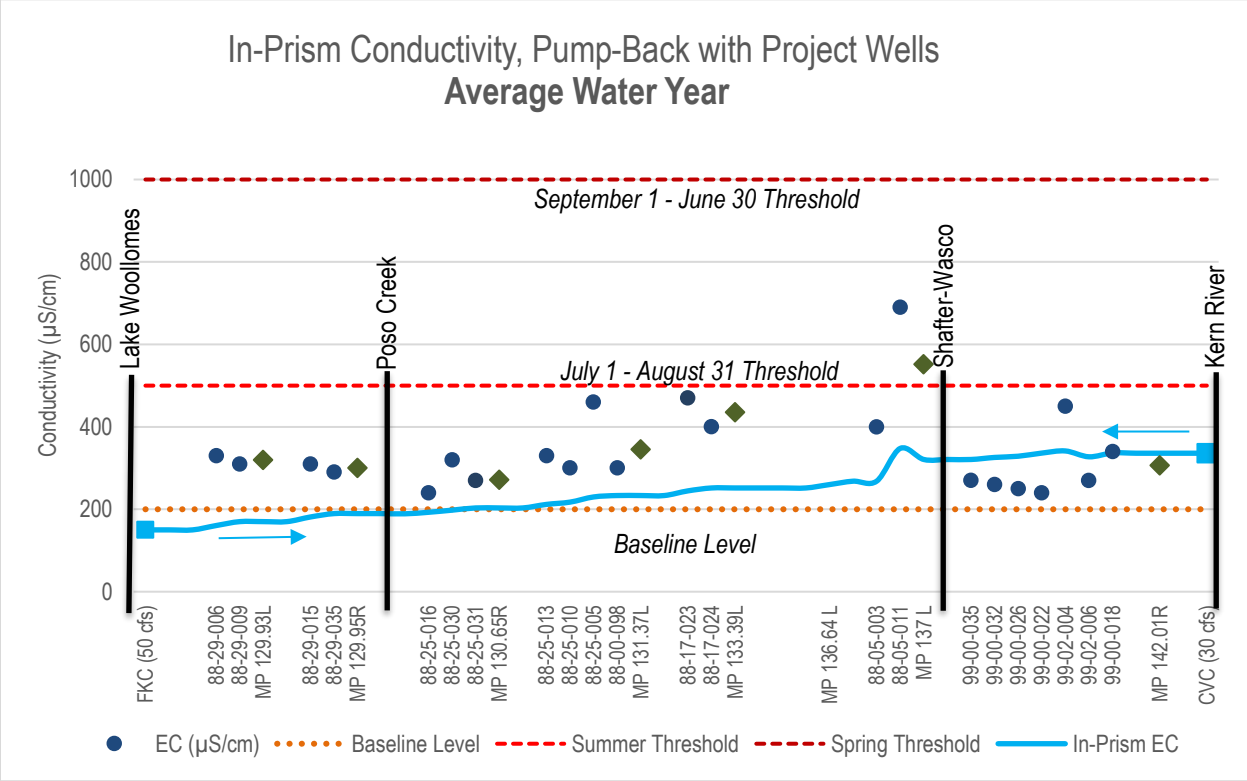


Figure 3-14: Flow Weighted Calculation of Conductivity, Pump-Back Over the Shafter Check with the addition of the Project wells.



Note: Green diamonds represent the flow weighted conductivity at each discharge point.

In February 2021, pumps were installed at the Woollomes Check to facilitate pump-back north of Kern County. **Figure 3-15** shows the flow weighted calculation for in-prism conductivity when source water is pumped from the CVC (30 cfs) and groundwater is the predominate source of supply to Woollomes Check with the implementation of the TCP Mitigation Program (59.6 cfs). Water quality is very similar to that shown on **Figure 3-13** because water quality in wells that pump-in between the Poso Check and the Woollomes Check is very similar to wells that pump-in between Poso Creek and the Shafter Check. **Figure 3-16** shows the flow weighted calculation for in-prism conductivity when source water is pumped from the CVC (30 cfs) and groundwater is the predominate source of supply (103.6 cfs) to Woollomes Check with the addition of the Project wells. Since there is essentially no change in the average conductivity from CVC (336 micro siemens per centimeter) and the calculated in-prism value at Woollomes (331 micro siemens per centimeter), the proposed Project impact in an average year during pump-back conditions is **less-than-significant**.

Figure 3-15: Flow Weighted Calculation of Conductivity, Pump-Back Over the Woollomes Check, with Implementation of TCP Mitigation Program.

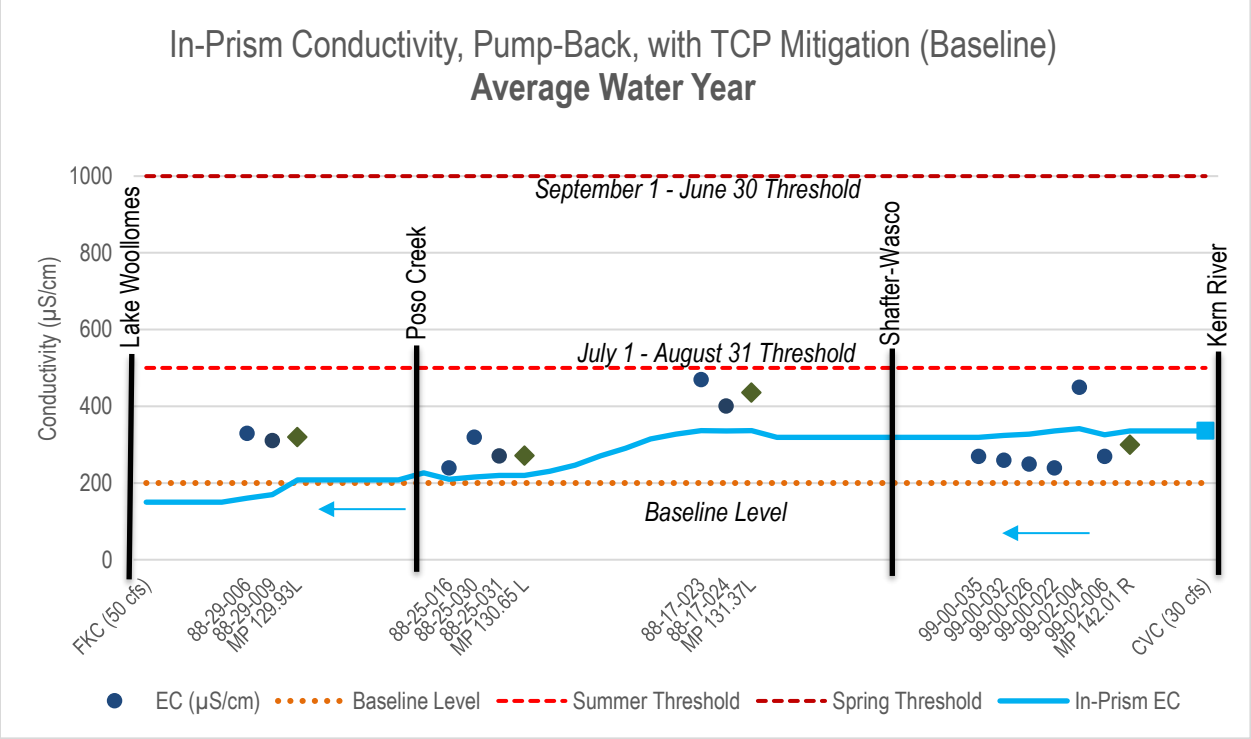
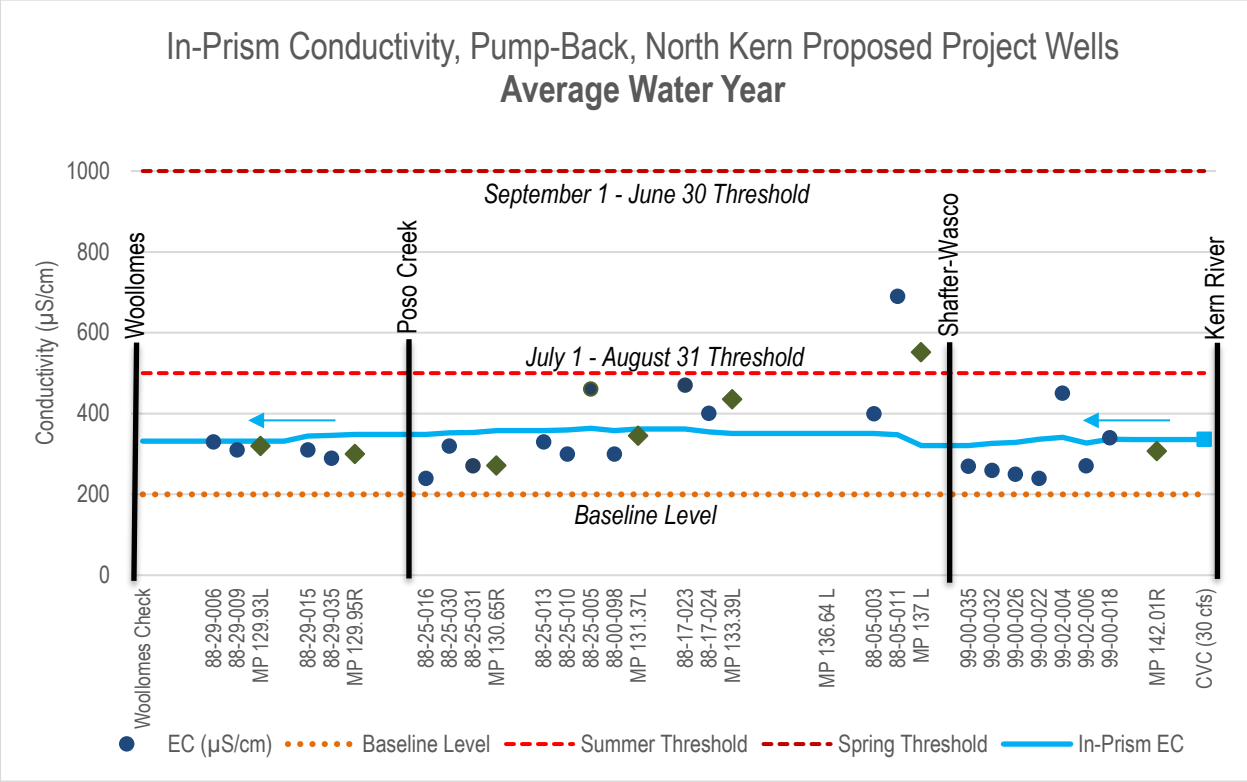


Figure 3-16: Flow Weighted Calculation of Conductivity, Pump-Back Over the Woollomes Check with Project Wells.



Note: Green diamonds represent the flow weighted conductivity at each discharge point.

Of the four worst-case scenarios presented, conductivity is increased during forward flow (north to south) operations. The agronomic threshold for in-prism water is marginally exceeded in normal years, assuming very low flow in the southern reach of the FKC: conductivity increases from 40 to 213 micro siemens per centimeter. During dry water years, conductivity increases from 150 to 260 micro siemens per centimeter. During pump-back operations, no material increase in salinity was observed since proposed Project wells selected for this Project are comparable to CVC conductivity levels.

Therefore, in the limited circumstances of average and dry years and forward flow operations, the proposed Project will have a **potentially significant** impact on in-prism salinity in the FKC. The following mitigation measures have been identified to address this impact:

Mitigation Measure HYDRO-1: Water Quality Monitoring.

To minimize potential effects of Project operations on groundwater quality, the District will ensure that the following measures are implemented:

- Each year that banked water is returned, the District will conduct water quality sampling of all the wells used for pump-in and report results to Friant's Contracting Officer. Sampling will include Division of Drinking Water's Title 22 constituents along with Reclamation's "Constituents of Concern" that are not included in Title 22.

- The District will follow the water quality monitoring and reporting requirements in the Pump-In Agreement with Reclamation. Sample results will be submitted to FWA's Contracting Officer.
- **Timing:** During Project operation
- **Responsibility:** District

Mitigation Measure HYDRO-2: Comply with the proposed Water Quality Ledger Program when adopted by Reclamation and as implemented by FWA.

The District will comply with the mitigation measures in the proposed Water Quality Ledger Program, when the program is approved by Reclamation and implemented by FWA, as well as state and federal water quality standards. The proposed Ledger Program includes mitigation measures to compensate for potential effects related to Non-Millerton Lake supplies being introduced into the FKC.

- **Timing:** During operation
- **Responsibility:** District

Implementation of Mitigation Measures HYDRO-1 and HYDRO-2 will reduce the impact of the proposed Project to **less than significant with mitigation incorporated.**

#10 -b. Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?

The proposed Project seeks to increase utilization of the District's recharge and recovery facilities to further expand water banking in the District, which is supportive of sustainable groundwater management. During above normal water years, the Districts banking partners take advantage of their available banking capacity with a percentage of water left behind. The District's GSP reports the expected benefit of this Project is a net increase in water supply of 4,000 AF each year with excess water is available for banking.

The Project would allow the District to fulfill its obligation to return up to 23,500 AFY of previously banked water, when needed, by connecting additional pump-in wells, and to increase the District's operational flexibility. Banking agreements include a percentage of banked water is left behind, resulting in a net increase of water supply for North Kern. Therefore, the Project would have **no impact** on groundwater supplies or recharge.

#10 -c. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:

#10 -i, ii, iii, and iv) Result in substantial erosion or siltation on- or off-site; Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or

offsite; Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or Impede or redirect flood flows?

The Project will not alter the existing drainage pattern of the site or the area, therefore there will be **no impact**.

#10 -d. In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?

The Project is not located in a flood hazard, tsunami, or seiche zone, therefore there will be **no impact.**

#10 -e. Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

This proposed Project will meet all Title 22 drinking water standards and the agronomic thresholds for pump-in wells and other requirements established in Friant Water Authority's proposed Water Quality Ledger Program (June 2020 Draft), and since it is the most restrictive water quality policy, that was the standard applied in this analysis. Therefore, the impact is **less-than-significant**.

3.11 Land Use and Planning

#11. LAND USE AND PLANNING. Would the Project:

#11 -a. Physically divide an established community?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#11 -b. Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

3.11.1 Environmental Setting

The two northernmost Project sites (adjacent to the 8-29 Canal and just north of SR 46, respectively) and the southernmost Project site are zoned as letter "A" (signifying exclusive agriculture), and the Project site located on a portion of the Minter Field recharge basins and connecting to MP 137.36 is zoned letters "A H" (signifying exclusive agriculture and airport approach height) (Kern County 2021). The Project sites are located in rural areas and surrounded by various agricultural crops, water conveyance canals, and spreading basins.

3.11.2 Discussion

#11 -a and b. Physically divide an established the community, and cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?

The Project would be implemented on the outer edges of agricultural and spreading basin parcels, along the established dirt roads which are barren. The proposed Project sites are located outside of existing communities and are consistent with existing zoning. There are no adopted HCPs, Natural Community Conservation Plans, other local, regional, or state habitat conservation plans within the Project sites or vicinity, see Chapter 3.11 "Biological Resources". There would be **no impact**.

3.12 Mineral Resources

#12. MINERAL RESOURCES. Would the Project:

#12 -a. Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#12 -b. Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

3.12.1 Environmental Setting

The Project sites are located within a Surface Mining and Reclamation Act of 1975 (S.M.A.R.A.) study area for aggregate materials in the Bakersfield production-consumption region. The Project sites are designated as Mineral Resource Zone-3 (Areas containing mineral deposits, the significance of which cannot be evaluated from available data) (D.O.C. 2009).

3.12.2 Discussion

#12 -a. Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State?

The Project sites are located in a S.M.A.R.A. study area and, though unlikely, have the potential to contain mineral resources. The Project include the replacement of two wells and four pipeline segments. The wells would be constructed in previously disturbed areas near agricultural fields and are anticipated to disturb 200 square feet in total. The pipelines would be installed primarily in or along the edge of existing dirt roads and would temporarily disturb 1.92 acres. The Project sites are not located in areas of known significant mineral deposits. Although unlikely, there is a potential to lose a minimal amount of mineral resources, which would not affect the overall availability of mineral resources in Kern County. Therefore, this impact would be **less-than-significant**.

#12 -b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?

The Project sites are not located within the vicinity of a locally important mineral resource recovery site. There would be **no impact**.

3.13 Noise

#13. NOISE. Would the Project:

#13 -a. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or in other applicable standards of other agencies?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#13 -b. Generation of excessive groundborne vibration or groundborne noise levels?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#13 -c. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.

3.13.1 Environmental Setting

The Project sites are located in agricultural areas. The closest sensitive receptor to the Project sites includes a residence located approximately 1.5 miles north of the northernmost Project site, a residence located approximately 1.5 miles northwest of the Project site located adjacent to SR 46 that ties into the FKC at MP 131.29, a residence located approximately 0.8 miles northeast of the Project site near Canal Way that ties into FKC at MP 137.36, and a residence located 0.6 mile west of the southernmost Project site. Additionally, SR 99 is located within close proximity to all four Project sites, and SR 46 is located adjacent to the Project site that ties into the FKC at the 131.29 MP. The Kern County Code of Ordinances states that construction related noise is limited to the hours of 6:00 a.m. to 9:00 p.m. on weekdays and 8:00 a.m. to 9:00 p.m. on weekend (Kern County 2020).

3.13.2 Discussion

#13 -a. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or in other applicable standards of other agencies?

Construction noise impacts typically occur when construction activities take place during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), when construction

activities occur immediately adjacent to noise sensitive land uses, or when construction durations last over extended periods of time. Construction of the proposed Project would temporarily increase the ambient noise levels within the vicinity of the Project site.

Although construction activities would for the most part occur only during the daytime hours, uncontrolled construction noise could still be considered disruptive to residents adjacent to the proposed. The proposed Project would generate temporary construction noise from the use of heavy machinery during construction activities, and from the transport of construction workers and materials to the site. The list of construction equipment that may be used for Project construction activities is shown in **Table 3-10** with typical noise levels generated at 50 feet from the equipment (reference levels). Since the closest sensitive noise receptor is approximately 0.6 mile from the Project site, construction noise levels at the sensitive noise receptors would be considerably lower. Additionally, construction related noise would be short-term and temporary and therefore is not considered significant. All work at the proposed Project sites would be limited to the hours identified in Kern County's Noise Ordinance.

Table 3-10: Water Quality of Proposed Project Wells.

Type of Equipment	Typical Noise Levels (dBA)
	L_{max} at 50 feet
Backhoe	80
Dozer	82
Drill Rig	79
Excavator	81
Hoist Crane	81
Trencher	80
Pick-up Truck	75
Water Truck	75

Notes:
dB = decibels; Lmax = maximum instantaneous sound level
Leq = 1-hour equivalent sound level (the sound energy averaged over a continuous 1-hour period)
Source: Construction equipment list based on Federal Highway Administration 2006, adapted by GEI.

During operations, minimal noise would be generated from the use of existing electric well motors and pumps. Impacts related to noise levels would be **less-than-significant**.

#13 -b. Generation of excessive groundborne vibration or groundborne noise levels?

Ground vibration would only be caused during construction activities and would primarily occur during well drilling. Vibrations could be detectable by nearby sensitive receptors; however, the closest sensitive noise receptor is approximately 0.6 mile from the Project site so a vibrational impact would not be significant. No adverse levels of vibration would be generated during Project operations. Therefore, impacts would be **less-than-significant**.

#13 -c) For a project located within-the vicinity of a private airstrip or-an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

Kern County has established an Airport Land Use Compatibility Plan which has been incorporated into the General Plan (Kern County 2012). The Project site located adjacent to the Minter Field spreading basins is within Airport Influence Areas. The three other discreet Project sites are not located within areas subject to the Airport Land Use Compatibility Plan nor are they within 2 miles of any public airports. *See* Section 3.9 "Hazards and Hazardous Materials" Question 9e for further discussion. This impact would be **less than significant**.

3.14 Population and Housing

#14. POPULATION AND HOUSING. Would the Project:

#14 -a. Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#14 -b. Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

3.14.1 Environmental Setting

The Project sites are located in unincorporated Kern County. In 2019, the population of Kern County was estimated to be 917, 553 in (Department of Finance 2020).

3.14.2 Discussion

#14 -a. Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?

The proposed Project would not include any new developments that would support or facilitate construction of new homes or businesses or extend roadways or other infrastructure that could increase population near the proposed Project. The Project does not involve construction of any permanent housing nor would it require additional employees to operate. The Project would not increase the amount of water pumped to the District; it would allow for more efficient conveyance of stored water to the District partners during dry years. There would be **no impact**.

#14 -b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?

The Project would not displace people or housing. The Project sites are located in a predominately agricultural area with little to no residential properties in the vicinity. There would be **no impact**.

3.15 Public Services

#15. PUBLIC SERVICES. Would the Project:

#15 -a. Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
Fire protection?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
Police protection?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
Schools?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
Parks?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
Other public facilities?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

3.15.1 Environmental Setting

The Kern County Sheriff and California Highway Patrol provide law enforcement services for unincorporated Kern County. The Kern County Fire Department provides fire protection to residents of the unincorporated areas of the County, and the cities of Arvin, Delano, Maricopa, McFarland, Ridgecrest, Shafter, Tehachapi and Wasco (Kern County 2004b). A mutual agreement between the County and the cities of Bakersfield, Taft, and California City allows for protection and assistance in the jurisdiction of each as needed. The County also has a mutual aid contract with U.S.F.W.S. and a service agreement with the Bureau of Land Management.

3.15.2 Discussion

#15 -a. Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:

The proposed Project would not require new or altered government facilities, as the Project would not increase the need for public services from the existing conditions. There would be **no impact**.

3.16 Recreation

#16. RECREATION. Would the Project:

#16 -a. Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#16 -b. Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

3.16.1 Environmental Setting

Within 3 miles of the Project sites, recreational facilities include Madison Grove Park in Bakersfield, Mannel Park in Shafter, and Ritchey Park in McFarland.

3.16.2 Discussion

#16-a and b. Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated or include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?

The Project is not growth inducing and would not increase the use of existing parks or recreational facilities or require the construction or expansion of recreational facilities. There would be **no impact**.

3.17 Transportation

#17. TRANSPORTATION. Would the Project:

#17 -a. Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#17 -b. Conflict or be inconsistent with CEQA Guidelines Section 15064.3, subdivision (b)?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#17 -c. Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#17 -d. Result in inadequate emergency access?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

3.17.1 Environmental Setting

The proposed Project sites are located in rural, unincorporated Kern County. The Project sites can be accessed via SR 99. There are no transit or on-street bicycle/pedestrian facilities near the Project sites.

3.17.2 Discussion

#17 -a, b, c, and d). Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities or be inconsistent with CEQA Guidelines Section 15064.3, subdivision (b)? Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)? Result in inadequate emergency access?

The Project would not conflict with any program plan, ordinance, or policies. Construction traffic would utilize existing public roads to deliver equipment, supplies, and workers to and from the Project sites. Because construction would occur in the FKC and along agricultural roads, the Project would not require any road closures or result in inadequate emergency access. Since no new roads are being developed, the Project would not increase hazards due to a geometric design feature or incompatible uses. There would be **no impact**.

3.18 Tribal Cultural Resources

#18. TRIBAL CULTURAL RESOURCES. Would the Project cause a substantial adverse change in the significance of a tribal cultural resource, defined in PRC Section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:

#18 -a. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in PRC Section 5020.1(k), or	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#18 -b. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of PRC Section 5024.1. In applying the criteria set forth in subdivision (c) of PRC Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

3.18.1 Environmental Setting

A request for a Sacred Lands File search was filed with the NAHC by GEI. The search was completed on May 4, 2021; the search failed to identify any tribal cultural resources on or in the vicinity of the proposed Project sites (NAHC 2021).

The District has not received any notice from California Native American tribes requesting consultation on projects per AB 52 (PRC Section 21080.3.1) and so no letters requesting consultation could be sent

3.18.2 Discussion

#18 -a and b) Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in PRC Section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in PRC Section 5020.1(k)? A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of PRC Section 5024.1. In applying the criteria set forth in subdivision (c) of PRC Section

5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.

There are no known tribal cultural resources located in the vicinity of the Project sites. There are no known Indian Sacred Sites in the vicinity of the Project sites. Since no known Indian Sacred Sites have been identified within any of the Project sites, there would be no direct, indirect, or cumulative impacts to Indian Sacred Sites from the proposed Project. The proposed Project would not have the potential to affect or prohibit access to any ceremonial use of Indian Sacred Sites. There would be **no impact**.

3.19 Utilities and Service Systems

#19. UTILITIES AND SERVICE SYSTEMS. Would the Project:

#19 -a. Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#19 -b. Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry, and multiple dry years?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#19 -c. Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#19 -d. Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#19 -e. Comply with Federal, State, and local management and reduction statutes and regulations related to solid waste?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.

3.19.1 Environmental Setting

The Project sites and vicinity are served by PG&E, Southern California Edison, and Southern California Gas (Kern County 2004a). Sewage disposal is handled by both public and private agencies, and by private individual systems. Several incorporated and unincorporated communities are severed by wastewater treatment plants managed by community service districts. The closest wastewater treatment plant to the northern two Project sites is the Wasco Wastewater Treatment Plant, and the closest wastewater treatment plant to the southern two Project sites is the Bakersfield Wastewater Treatment Plant. Domestic water is serviced to the public by various water purveyors

consisting of public and private water systems. The Kern County Waste Management Department currently owns and operates seven Class II Landfills, of which the closest landfill is the Metropolitan Bakersfield Sanitary Landfill located in Bakersfield. (Kern County 2004b).

3.19.2 Discussion

#19 -a. Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?

No utility services would need to be constructed or expanded as a result of the proposed Project. Implementation of the proposed Project would result in **no impact**.

#19 -b. Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry, and multiple dry years?

The Project would not require a water supply. The proposed Project consists of construction of two replacement wells and connecting these and seven additional existing wells to the FKC to improve return capacity and increase water supply reliability. There would be **no impact**.

#19 -c. Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?

See Question "a" above. The Project would not result in a significant amount of wastewater. There would be **no impact**.

#19 -d and e) Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals? Comply with Federal, State, and local management and reduction statues and regulations related to solid waste?

The proposed Project would not create substantial amounts of solid waste, and as such would not exceed the capacity of local infrastructure. Minimal waste would be generated during construction and no increase in waste production would occur during the operation of the Project. The Project would comply with federal, state, and local management and reduction statues and regulations related to solid waste. There would be **less-than-significant** impacts.

3.20 Wildfire

#20. WILDFIRE. If located in or near State responsibility areas or lands classified as very high fire hazard severity zones, **would the Project:**

#20 -a. Substantially impair an adopted emergency response plan or emergency evacuation plan?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#20 -b. Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#20 -c. Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines, or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#20 -d. Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

3.20.1 Environmental Setting

The Project sites are not located in a high severity fire zone. The three northern Project sites are located in unincorporated Local Responsible Area (LRA) zones whereas the southernmost Project site is located in an incorporated LRA. All sites are classified as LRA unzoned. (CAL FIRE 2007a, 2007b). The Kern County Fire Department provides fire protection for residents of the unincorporated areas of the County and the cities of Arvin, Delano, Maricopa, McFarland, Ridgecrest, Shafter, Tehachapi and Wasco (Kern County 2004b).

3.20.2 Discussion

#20 -a, b, c, and d) Substantially impair an adopted emergency response plan or emergency evacuation plan? Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire? Require the

installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines, or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment? Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?

The Project sites are not located in a high severity fire zone. The Project would include replacing two existing wells and connecting these and seven additional existing wells to the FKC. The Project would allow for an increased water conveyance capacity to return stored water to the Districts banking partners. There would not be an increase in the number of users at the sites that could impair emergency response or evacuation. Additionally, the short-term, temporary nature of construction and the intermittent nature of material off hauling and drop-off via large trucks at the Project sites would not pose a risk to emergency response or evacuation during an emergency. The Project would not require any infrastructure that would exacerbate fire risk or the risk of flooding, slope instability, or drainage changes. There would be **no impact**.

3.21 Mandatory Findings of Significance

#21. MANDATORY FINDINGS OF SIGNIFICANCE. Would the Project:

#21 -a. Have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes.**	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#21 -b. Have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes.**	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#21 -c. Have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.

3.21.1 Discussion

#21 -a. Would the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?

The analysis conducted in this IS/MND concludes that implementation of the proposed Project would not have a significant impact on the environment. As evaluated in Chapter 3.4, Biological Resources, impacts on biological resources would be less-than-significant or less-than-significant with mitigation incorporated. The proposed Project would not substantially degrade the quality of the environment; substantially reduce the habitat of a fish or wildlife species; cause a fish or wildlife population to drop below self-sustaining levels; threaten to eliminate a plant or animal community; or reduce the number or restrict the range of an endangered, rare, or threatened

species. As discussed in Chapter 3.5, Cultural Resources, the proposed Project would not eliminate important examples of the major periods of California history or prehistory. This impact would be **less-than-significant with mitigation incorporated**.

#21 -b. Would the Project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a Project are considerable when viewed in connection with the effects of past Projects, the effects of other current Projects, and the effects of probable future Projects.)

To consider cumulative impacts[6] to the environment, past, present, and reasonably foreseeable probable future Projects implemented within the vicinity of the proposed Project were considered and analyzed for potential cumulative impacts to water quality. The District is planning an Expanded Groundwater Banking Program (Expanded Program). The District's existing main conveyance, direct recharge, and recovery facilities have unused capacity from time to time to accommodate more recharge and recovery. The Expanded Program would increase the District's ability to recharge groundwater by increasing the use of the existing recharge facilities. In a second phase, the District would also increase recharge capacity in new facilities. The Expanded Program would increase the amount of groundwater left behind after recovery, thus benefiting the District and neighboring areas. In addition, the District would connect eight additional wells to the FKC, which would increase pump-in capacity to approximately 133 cfs. Six of the Expanded Program wells will be filtered through granular activated carbon (GAC) to mitigate TCP, prior to pump-in, so that all wells in the Expanded Program will meet Title 22 standards, including the TCP MCL. The Expanded Program wells were selected to meet these objectives:

- Allow for the return of previously banked water to the District's neighboring partners using wells that meet Reclamation's water quality standards for the FKC administered by Reclamation and/or the authorized operating non-federal entity.
- Comply with state and federal water quality regulations and guidelines that apply to the FKC. It is anticipated that additional TCP mitigation measures will be necessary including, but not limited to, the installation of GAC treatment on one or more District wells.
- Have conductivity less than 500 micro siemens per centimeter

Twenty-four other known Projects which could potentially result in cumulative impacts[7] (**Table 3-11**) were also evaluated.

---

[6] The CEQA Guidelines, Section 15355 state, "The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time."

[7] Project information was compiled through a review of the CEQANet Database, a comment letter from Arvin-Edison Water Storage District on the Westside Mutual Water Company Multiyear Banking and Transfer Program dated March 2019, and personal communication with staff at Kern-Tulare Water District.

Table 3-11: Summary of Friant-Kern Canal Pump-In Projects.

No.	Name	Project Status	No Pump-In	Included in Baseline Data
1	Cross Valley Contract Renewals	Active		X
2	Poso Creek Regional Water Management Group EA amendment to include S.S.J.M.U.D.	Active		X
3	Kings River Pump-In Programs	Active		X
4	Kern River Pump-In Program	Active		X
5	Pixley Water Bank	Future Project		
6	Shafter-Wasco Kimberlina Groundwater Exchange Recharge and Banking	Active	X	-
7	Fresno Irrigation District Gould Canal to FKC Intertie Project	Active		
8	5-year FKC Groundwater Pump-In Program	Active		X
9	San Joaquin River Restoration Program Recapture and Recirculation EIR/EIS (pending)	Future Project		
10	Flying J Groundwater into Millerton Lake	Active		X
11	Kaweah River Pump-in Programs	Active		X
12	Tule River Pump-in Programs	Active		X
13	Madera Irrigation District Storage and Conveyance of Non-Project water in Friant Division Facilities	Unknown		
14	Storage and Conveyance of Non-Project Water for Kern Tulare Water District and Lindsay-Strathmore Irrigation District	Active		X
15	Delta Lands 770 Warren Act	Active		X
16	Kern Tulare Water District and West Kern Water District Groundwater Banking Project	Active		X
17	Madera Irrigation District long term banking and return in North Kern Water Storage District and Semitropic Water Storage District	Active		X
18	Poso Creek Regional Water Management Group 25-year Program	Active		X
19	Cawelo Water District Warren Act	Active		X
20	Rosedale Rio-Bravo and Delano Earlimart Irrigation District Banking Program	Active		X
21	Kern Tulare Water District Return of Banked Water	Active		X
22	North Kern Water Storage District Recovery and Transportation of Banked Water	Active		X

No.	Name	Project Status	No Pump-In	Included in Baseline Data
23	Sausalito Irrigation District Deer Creek/Friant-Kern Canal Water Bank Project	Future Project	X	-
24	Porterville Irrigation District Tule River/Friant-Kern Canal Bank Project	Future Project	X	-

Based on the CEQA/NEPA status dates, 17 of the 24 projects were approved prior to 2014. Since the impact analysis conducted for the District's Project incorporates data for years 2012, 2013 and 2014, those 17 Projects are expected to be incorporated in the baseline data included in this evaluation. Of the remaining 7 Projects, 3 are not applicable because they don't have a pump-in component to the Project (Shafter-Wasco Kimberlina Groundwater Recharge [Project No. 6]), Sausalito Irrigation District Deer Creek/FKC Water Bank Project (Project No. 23), and Porterville Irrigation District Tule River/FKC Water Bank Project (Project No. 24).

The remaining four Projects are the Pixley Water Bank; Fresno Irrigation District Gould Canal to FKC Intertie Project; San Joaquin River Restoration Program; and Madera Irrigation District Storage and Conveyance of Non-Project water in Friant Division Facilities (Project No. 13). The Environmental Assessment for Madera Irrigation District (Project No. 13) states that the source water for this Project is Hensley Lake passed through Hidden Dam, or diversions from the Fresno River. While these supplies are identified as non-CVP, water quality is expected to be similar to San Joaquin River supplies since they are all originate from snowmelt. Similarly, source water to the Fresno Irrigation District Gould Canal to FKC Intertie Project (Project No. 7) is Kings River, which has high-quality water. No negative impacts to FKC water quality are expected from these Projects, and therefore, no cumulative impacts are anticipated.

No water quality data is available for Pixley Water Bank (Project No. 5) and San Joaquin River Restoration Program Recapture and Recirculation EIR/EIS (Project No. 9, pending). Impacts of these Projects on water quality cannot be estimated at this time, and a statement of cumulative impacts regarding these Projects would be unduly speculative.

Overall, cumulative impacts to water quality from the Project is **less-than-significant with mitigation incorporated**. Mitigation Measures HYDRO-1 and HYDRO-2 will be incorporated into the proposed Project to reduce potential impacts to salinity during dry years.

For all other resources, as discussed in this IS/MND, the proposed Project would result in less-than-significant impacts with mitigation incorporated, less-than-significant impacts, or no impacts on aesthetics, air quality, biological resources, cultural resources, geology and soils, GHG emissions, hazards and hazardous materials, land use and planning, mineral resources, noise, population and housing, public services, recreation, transportation, tribal cultural resources, utilities and service systems, and wildfire. The temporary nature of the proposed Project's construction impacts, and the minor, negligible changes to long-term operations and maintenance

at the Project site locations would result in no impacts or less-than-significant environmental impacts on the physical environment. None of the proposed Project's impacts make cumulatively considerable, incremental contributions to significant cumulative impacts with incorporation of mitigation presented in this IS/MND. This impact would be **less-than-significant with mitigation incorporated**.

#21 -c. Would the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?

The Project would result in less-than-significant impacts and would not cause substantial adverse effects on human beings, either directly or indirectly. This impact would be **less-than-significant**.

This page intentionally left blank

4.0 References

Chapter 3.1, Aesthetics

California Department of Transportation (Caltrans). 2019a. *List of eligible and officially designated State Scenic Highways*. August 2019. Available: https://dot.ca.gov/programs/design/lap-landscape-architecture-and-community-livability/lap-liv-i-scenic-highways Accessed: March 2, 2020.

_____. 2019b. *List of officially designated County Scenic Highways.* Available: https://dot.ca.gov/-/media/dot-media/programs/design/documents/od-county-scenic-hwys-2015-a11y.pdf, Accessed: April 5, 2021.

Kern County. 2021. *Zone Maps*. Available: https://kernpublicworks.com/maps/zone-maps/ Accessed: March 2, 2020.

Chapter 3.2, Agriculture and Forestry

Department of Conservation (D.O.C.). 2018. *California Important Farmland Finder*. Available: https://www.conservation.ca.gov/dlrp/fmmp/Pages/Kern.aspx Accessed: March 26, 2021.

Kern County. 2010. *Kern County Williamson Act Parcels and Non-Renewals, California, 2010*. GIS Layer. Available: https://databasin.org/datasets/b4b2b8e824114b32b1005c74663237fd Accessed: March 26, 2021.

_____. 2021. *Zone Maps*. Available: https://kernpublicworks.com/maps/zone-maps/ Accessed: March 26, 2021.

Chapter 3.3, Air Quality

California Air Pollution Control Officers Association. 2021. *California Emissions Estimator Model, Appendix D, Default Data Tables*. Available: http://www.aqmd.gov/docs/default-source/caleemod/user-guide-2021/appendix-d2020-4-0-full-merge.pdf?sfvrsn=12 Accessed: August 5, 2021.

California Air Resource Board (C.A.R.B.). 2016. *Ambient Air Quality Standards (CAAQS)*. Dated 5/4/16. Available: http://www.arb.ca.gov/research/aaqs/aaqs2.pdf Accessed: March 9, 2020

_____. 2018. *Maps of State and Federal Area Designations*. Available: https://ww2.arb.ca.gov/resources/documents/maps-state-and-federal-area-designations Accessed: March 9, 2020.

_____. 2020. *Air Quality Trend Summaries*. Available: https://www.arb.ca.gov/adam/ Accessed: March 9, 2020.

San Joaquin Valley Air Pollution Control District (S.J.V.A.P.C.D.) 2004. Rule 8021 Construction, Demolition, Excavation, Extraction, and Other Earthmoving Activities (Adopted November 15, 2001; Amended August 19, 2004). Available: https://www.valleyair.org/rules/1ruleslist.htm#reg7 Accessed: April 14, 2020.

S.J.V.A.P.C.D. 2007.Compliance Assistance Bulletin, Fugitive Dust Control at Construction Sites: New Requirements. April, 2007. http://www.valleyair.org/busind/comply/pm10/forms/RegVIIICAB.pdf

_____. 2012. *Small Project Analysis Level (SPAL)*. Available: http://www.valleyair.org/transportation/CEQA%20Rules/Small-Project-Analysis-Levels-for-Ambient-Air-Quality-Analysis-Combust.pdf Accessed: April 6, 2020.

Chapter 3.4, Biological Resources

California Department of Fish and Game (CDFG). 2012. Staff Report on Burrowing Owl Mitigation. State of California Natural Resources Agency, Sacramento, CA.

California Department of Fish and Wildlife (CDFW). 2021a. Results of electronic database search for sensitive species occurrences. Version 5. Biogeographic Data Branch. Available: https://apps.wildlife. ca.gov/myaccount/login? ReturnUrl=%2frarefind%2fview% 2fRareFind.aspx. Accessed July 14, 2021

_____. 2021b. *Special Animals List*. July 2021. Available: file:///C:/Users/crusso/Downloads/CNDDB_Special_Animals_List%20(1).pdf Accessed: July 16, 2021.

California Native Plant Society (CNPS). 2021. *Inventory of Rare and Endangered Plants*. Online edition, v8-03 0.38. Sacramento, CA. Available: http://www.rareplants.cnps.org. Accessed July 14, 2021

Kern County Planning Department. 2006 (December). *First Public Draft, Kern County Valley Floor Habitat Conservation Plan*. Prepared by Garcia and Associates, Lompoc, CA.

Kern County. 2004a. *General Plan*. Available: https://psbweb.co.kern.ca.us/planning/pdfs/kcgp/KCGP.pdf. Accessed: March 2, 2020.

Swainson's Hawk Technical Advisory Committee. 2000. Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83990&inline.

United States Fish and Wildlife Service (U.S.F.W.S.). 2011. *Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox Prior to or During Ground Disturbance*. Sacramento Fish and Wildlife Office, Sacramento, CA.

_____. 2021a. IPaC Resoure List. Sacramento Fish and Wildlife Office, Sacramento, CA.

_____. 2021b. Critical Habitat for Threatened and Endangered Species. Available: https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e265ad4fe09893cf75b8dbfb77. Accessed July 14, 2021

Chapter 3.5, Cultural

GEI Consultants, Inc. 2017. Cultural Resources Inventory Report for the North Kern Water Delivery Improvements Project. Report prepared for the North Kern Water District.

Meyer, J., D. C. Young, and J. S. Rosenthal. 2010. A Geoarchaeological Overview and Assessment of Caltrans Districts 6 and 9—Cultural Resources Inventory of Caltrans District 6/9 Rural Conventional Highways. Far Western Anthropological Research Group, Inc., Davis, CA. Submitted to California Department of Transportation, District 6, Fresno, CA.

Natural Resources Conservation Service (NRCS). 2019. Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database. Available: https://datagateway.nrcs.usda.gov/GDGOrder.aspx.

Chapter 3.6, Energy

California Energy Commission (CEC). 2015. Fact Sheet: California's 2030 Climate Commitment – Renewable Resources for Half of the State's Electricity by 2030. Available: https://ww3.arb.ca.gov/html/fact_sheets/2030_renewables.pdf. Accessed: March 26, 2021.

_____. 2019. Electricity Consumption by County. Available: http://www.ecdms.energy.ca.gov/elecbycounty.aspx Accessed: March 26, 2021.

Kern County. 2004a. *Kern County General Plan.* Available: https://psbweb.co.kern.ca.us/planning/pdfs/kcgp/KCGP.pdf Accessed: March 26, 2021.

Chapter 3.7, Geology and Soils

California Department of Water Resources (DWR). 2020. TRE ALTAMIRA InSAR Subsidence Data. https://data.cnra.ca.gov/dataset/tre-altamira-insar-subsidence

California Geologic Survey (CGS). 2015a. *Fault Activity Map of California (2010)*. Available: https://maps.conservation.ca.gov/cgs/fam/ Accessed: March 26, 2021.

_____. 2015b. *CSG Warehouse Information*. Available: https://maps.conservation.ca.gov/cgs/informationwarehouse/index.html?map=regulatorymaps Accessed: March 26, 2021.

_____. 2015c. *Geologic Map of California*. Available: https://maps.conservation.ca.gov/cgs/gmc/Accessed: March 26, 2021

_____. 2021. *Earthquake Zones of Required Investigation*. Available: https://maps.conservation.ca.gov/cgs/EQZApp/app/ Accessed: March 26, 2021.

Natural Resources Conservation Service (NRCS). 2021. *U.S. Department of Agriculture Natural Resources Conservation Services, Web Soil Survey*. Available: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx Accessed: March 26, 2021.

Odum, T. 2017. Subsidence Monitoring Survey Memorandum, Provost and Pritchard. July 25, 2017.

Chapter 3.8, Greenhouse Gas Emissions

California Air Resource Board (C.A.R.B.). 2017.California's 2017 Climate Change Scoping Plan. November 2017. https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf

San Joaquin Valley Air Pollution Control District (SJVAPCD). 2009. *Guidance for Valley Land-use Agencies in Addressing GHG Emissions Impacts for New Projects under CEQA*. Available: http://www.valleyair.org/Programs/CCAP/12-17-09/3%20CCAP%20-%20FINAL%20LU%20Guidance%20-%20Dec%2017%202009.pdf Accessed: March 12, 2020.

State of California (California). 2018. *California Climate Change. California Climate Change Executive Orders*. Available: https://www.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf Accessed: March 12, 2020.

Chapter 3.9, Hazards and Hazardous Waste

California Department of Conservation (D.O.C.). 2000. A General Location Guide for Ultramafic Rocks in California - Areas More Likely to Contain Naturally Occurring Asbestos, 2000, Map scale 1:1,100,000, Open-File Report 2000-19. Available: http://www.capcoa.org/Docs/noa/%5B28%5D%20USGS%20Location%20Guide%20Report%202000-19.pdf Accessed: March 26, 2021.

California Department of Forestry and Fire Protection (CALFIRE). 2007a. *Fire Hazard Severity Zones in SRA for Sacramento County*. Available: https://osfm.fire.ca.gov/media/6687/fhszs_map15.pdf Accessed: March 26, 2021.

_____. 2007b. *Very High Fire Hazard Severity Zones in LRA for Sacramento County*. Available: https://osfm.fire.ca.gov/media/6686/fhszl06_1_map15.pdf Accessed: March 26, 2021

California Department of Toxic Substances Control. (DTSC) 2021a. *Envirostor Hazardous Waste and Substances Site List (Cortese).* Available: https://www.envirostor.dtsc.ca.gov/public/search?cmd=search&reporttype=CORTESE&site_type=CSITES,OPEN,FUDS,CLOSE&status=ACT,BKLG,COM,COLUR&reporttitle=HAZARDOUS+WASTE+AND+SUBSTANCES+SITE+LIST+(CORTESE). Accessed: March 26, 2021.

_____. 2021b. *Cortese List: Section 65962.5(a).* Available: https://calepa.ca.gov/sitecleanup/corteselist/section-65962-5a/. Accessed: March 26, 2021.

CalEPA. California Environmental Protection Agency. 2021. *Sites Identified with Waste Constituents Above Hazardous Waste Levels Outside the Waste Management Unit.* Available: https://calepa.ca.gov/wp-content/uploads/sites/6/2016/10/SiteCleanup-CorteseList-CurrentList.pdf. Accessed: March 26, 2021.

California State Water Resources Control Board. 2021a. *GeoTracker Database.* Available: https://geotracker.waterboards.ca.gov/map/?global_id=T0601700073. Accessed: March 26, 2021.

_____. 2021b. *CDO-CAO List.* Available: https://calepa.ca.gov/wp-content/uploads/sites/6/2016/10/SiteCleanup-CorteseList-CDOCAOList.xlsx. Accessed: March 26, 2021.

Kern County. 2004b. *Volume I Recirculated Draft Program Environmental Impact Report*. Available: https://psbweb.co.kern.ca.us/planning/pdfs/kcgp/KCGP_RPEIR_vol1.pdf Accessed: March 11, 2020.

_____. 2012. *Airport Land Use Compatibility Plan*. Available: https://psbweb.co.kern.ca.us/planning/pdfs/ALUCP2012.pdf Accessed: March 26, 2021.

Chapter 3.10, Hydrology

U.S. Department of the Interior Bureau of Reclamation (Reclamation). 2008. *Policy for Accepting Non-Project Water into the Friant-Kern and Madera Canals*. March 2008 Available: https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc_ID=28376 Accessed: January 19, 2021.

Friant Water Authority. 2020. Friant-Kern Canal Water Quality Policy (Draft). (June 2020).

Chapter 3.11, Land Use and Planning

Kern County. 2021. *Zone Maps*. Available: https://kernpublicworks.com/maps/zone-maps/ Accessed: April 5, 2021.

Chapter 3.12, Mineral Resources

Department of Conservation (DOC). 2009. *Special Report 210*. Available: https://maps.conservation.ca.gov/cgs/informationwarehouse/index.html?map=regulatorymaps Accessed: March 9, 2020.

Chapter 3.13, Noise

FHWA. Federal Highway Administration. 2006. Construction Noise Handbook, 9.0 Construction Equipment Noise Levels and Ranges. Available: https://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm. Accessed: April 1, 2021.

_____. 2012. *Airport Land Use Compatibility Plan*. Available: https://psbweb.co.kern.ca.us/planning/pdfs/ALUCP2012.pdf Accessed: March 13, 2020.

_____. 2020. *Code of Ordinances, Title 8 Health and Safety*. Available: https://library.municode.com/ca/kern_county/codes/code_of_ordinances Accessed: March 17, 2020.

Chapter 3.14, Population and Housing

Department of Finance. 2020. *E-1 Cities, Counties, and State Population Estimates with Annual Percent Change – January 1, 2019 and 2020*. Available: https://www.dof.ca.gov/forecasting/demographics/estimates/e-1/ Accessed: March 26, 2021.

Chapter 3.15, Public Services

Kern County. 2004b. *Volume I Recirculated Draft Program Environmental Impact Report*. Available: https://psbweb.co.kern.ca.us/planning/pdfs/kcgp/KCGP_RPEIR_vol1.pdf Accessed: March 11, 2020.

Chapter 3.16, Recreation

No Citations.

Chapter 3.17, Transportation

No Citations.

Chapter 3.18, Tribal Cultural Resources

Native American Heritage Commission (NAHC). 2021. *Sacred Lands Record Search*. Accessed: March 12, 2020

Chapter 3.19, Utilities

Kern County. 2004a. *General Plan*. Available: https://psbweb.co.kern.ca.us/planning/pdfs/kcgp/KCGP.pdf Accessed: March 2, 2020.

_____. 2004b. *Volume I Recirculated Draft Program Environmental Impact Report*. Available: https://psbweb.co.kern.ca.us/planning/pdfs/kcgp/KCGP_RPEIR_vol1.pdf Accessed: March 11, 2020.

Chapter 3.20, Wildfire

CAL FIRE. 2007a. *Fire Hazard Severity Zones in SRA for Sacramento County*. Available: https://osfm.fire.ca.gov/media/6687/fhszs_map15.pdf Accessed: March 11, 2020.

_____. 2007b. *Very High Fire Hazard Severity Zones in LRA for Sacramento County*. Available: https://osfm.fire.ca.gov/media/6686/fhszl06_1_map15.pdf Accessed: March 11, 2020.

Kern County. 2004b. *Volume I Recirculated Draft Program Environmental Impact Report*. Available: https://psbweb.co.kern.ca.us/planning/pdfs/kcgp/KCGP_RPEIR_vol1.pdf Accessed: March 11, 2020.

Chapter 3.21, Mandatory Findings of Significance

No Citations.

This page intentionally left blank

5.0 Report Preparers

GEI Consultants, Inc.

Ginger Gillin, ...Project Director, Document Review

Nicholas Tomera.....Project Manager

Anne King……...Project Biologist

Stephanie Hearn…….Hydrology and Water Quality, Mandatory Findings of Significance

Chrissy Russo.....Project Introduction, Project Description, Aesthetics, Agriculture and Forestry, Air Quality, Biological Resources, Energy, Geology and Soils, Greenhouse Gas Emissions, Hazards and Hazardous Materials, Land Use and Planning, Mineral Resources, Noise, Population and Housing, Public Services, Recreation, Transportation, Utilities and Service Systems, Wildfire, and Mandatory Findings of Significance

Jesse Martinez, RPA .....Cultural Resources and Tribal Cultural Resources

Ryan Snyder.....Geographic Information Systems

Gigi Gable.....Report Editing

This page intentionally left blank

Appendix A – Project Site Photos

Photo 1. Proposed pipeline route to well 88-29-035 (facing northwest from Friant-Kern Canal tie-in location, with 8-29 Canal on the left).

Photo 2. Proposed pipeline route to well 88-29-035 (facing northwest with 8-29 Canal on the left and well 88-29-035 on the right in background).

Photo 3. Proposed pipeline route to wells 88-25-013, 88-25-010, 88-25-005 (facing east from Friant-Kern Canal, well 88-25-013).

Photo 4. Proposed pipeline route between wells 88-25-013 and 88-25-010 (facing west).

Photo 5. Well 88-25-010, on right in background (facing west).

Photo 6. Well 88-25-005 (facing west).

Photo 7. Well 88-17-036 (facing southwest).

Photo 8. Proposed pipeline route from well 17-036 to Friant-Kern Canal (facing east).

Photo 9. 8-1 Canal at proposed pipeline crossing location, with well 88-01-013 in background (facing east).

Photo 10. Proposed pipeline route between Calloway Canal and Friant-Kern Canal (facing east).

Photo 11. Calloway Canal at proposed pipeline crossing location with well 99-00-009 in the background (facing east)

Photo 12. An example of a standard turn-in and small delivery gate (center) at Friant-Kern Canal.

Appendix B – Biological Technical Report

Biological Technical Report

Return Capacity Improvements for Regional Drought Resiliency Project

Prepared for:

North Kern Water Storage District

January 2022

Prepared by:

GEI Consultants

Consulting Engineers and Scientists

Biological Technical Report

Return Capacity Improvements for Regional Drought Resiliency Project

Prepared for:

North Kern Water Storage District
33380 Cawelo Avenue
Bakersfield, CA 93308

Contact:

Mr. Ram Venkatesan
District Engineer
661-393-2696

Prepared by:

GEI Consultants
5001 California Avenue, Suite 120
Bakersfield, CA 93309

Contact:

Ginger Gillin
Principal Environmental Scientist
503-342-3777

January 2022

Project No. 1804142

Table of Contents

Figures

Tables

Appendices

Abbreviations and Acronyms

AF	acre-feet
CDFW	California Department of Fish and Wildlife
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CRPR	California Rare Plant Rank
CWA	Clean Water Act
District	North Kern Water Storage District
FGC	California Fish and Game Code
FKC	Frian-Kern Canal
IRWM	Integrated Regional Water Management
MP	Mile Post
project	Return Capacity Improvements for Regional Drought Resiliency Project
RWQCB	Regional Water Quality Control Board
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1. Introduction

This biological technical report addresses sensitive biological resources that could be affected by implementing the proposed Return Capacity Improvements for Regional Drought Resiliency Project (project). In addition, measures are recommended to avoid or minimize potential for impacts on special-status species during construction activities.

1.1 Project Background

The North Kern Water Storage District (District) is located in Kern County along the eastern side of California's southern San Joaquin Valley. The District's service area includes approximately 60,000 acres of agricultural land north of the City of Bakersfield, west of State Route 99, and east of the cities of Shafter and Wasco.

The District has practiced conjunctive use of their highly variable Kern River water supply for over 60 years. Despite the success of the District's conjunctive use program, as well as regional water management programs conducted by other districts in the Poso Creek Integrated Regional Water Management (IRWM) Group, concerns regarding future regional groundwater conditions persist. The District has identified a need to improve recovery and return capacity of their groundwater recharge facilities to allow surface water recharged and banked in the District's groundwater basin to be available to the Poso Creek IRWM Group of districts during dry years. The lack of recovery and return capacity of the stored water pose constraints that prevent Central Valley Project contractors from using water stored in District spreading grounds.

The District operates approximately 1,500 acres of spreading ponds, with a maximum monthly recharge capacity of 25,000 acre-feet (AF) and a maximum annual recharge capacity of 300,000 AF. The District directly recharges significant quantities of water in approximately 3 of 10 years, with an average of 150,000 AF recharged in its spreading ponds in these years.

The District operates a system of 100 wells with an approximate instantaneous capacity of 350 cubic feet per second. This capacity is approximately equal to peak irrigation season demands for the in-District, Class 1 Service Area. Unused well capacity is available for use on in-District, Class 2 Service Area lands and to return water to Central Valley Project contractors. The proposed project would improve the shared recovery and return capacity to reduce return constraints in dry periods.

1.2 Project Objectives

The proposed project consists of replacing two wells and connecting them and seven existing wells to the Friant Kern Canal (FKC) to improve return capacity and increase water supply reliability, especially during times of drought. The proposed project is intended to provide the District and neighboring districts, with additional water resources for industrial uses, or other purposes as determined by the District to:

- Improve long-term resiliency to drought.
- Improve water conveyance to allow for the return of previously stored water to the District and the District's banking partners.

- Help achieve the U.S. Bureau of Reclamation's WaterSMART Drought Response Program goals of modernizing infrastructure and restoring trust with local communities.

1.3 Proposed Project

The proposed project includes replacing two wells (88-29-035 and 88-25-005) and installing three discharge outfalls and approximately 3.9 miles of pipeline. The old (existing) wells will be retained and used as monitoring wells. The new production wells would be installed in cultivated agricultural land, within 100 feet of the existing wells. The replacement wells would be drilled to a depth of approximately 1,200 feet and have an average flow of approximately 5 cubic feet per second. The replacement wells would include a concrete pad (approximately 100 square feet each); the above-ground well heads would be approximately 9 feet tall and 10 feet in diameter.

The District would then connect the two replacement wells and seven other existing production wells to the FKC. Wells 88-29-035 and 88-29-015 would be connected to a new discharge outfall at Mile Post (MP) 129.93. Wells 88-25-013, 88-25-010, 88-25-005, and 88-00-098 would be connected to a new discharge outfall at MP 131.29. Wells 88-05-003 and 88-05-011 would be connected to a new discharge outfall at MP 137.36. The District would utilize an existing discharge outfall (MP 142.01) for Well 99-00-018. The new discharge outfalls would be installed below the top-of-bank within the FKC prism. The District is required to obtain approval from U.S. Bureau of Reclamation prior to construction. Each connection to the FKC would require a standard turn-in and small delivery gate for control.

Finally, the District would install four segments of 27-inch-diameter polyvinyl chloride pipe, totaling approximately 3.96 miles. The District would excavate trenches (up to 4 feet wide and 7 feet deep) within or along the edge of existing dirt roads. Therefore, the trenches would result in the excavation of approximately 1.92 acres and 21,700 cubic yards of soil, all of which would be in or along the edge of existing roadways. The trenches would be backfilled with the excavated material after the pipeline is installed. The pipeline construction corridor would be up to 50 feet wide to account for the trenches, access routes, materials staging, and overburden stockpiling. A maximum of approximately 24 acres of land would be temporarily disturbed by project activities in the pipeline construction corridor.

The District would drill the two replacement wells and install the pipeline in summer/fall 2021 or as soon as environmental approvals are obtained, regardless of month or season. The three FKC discharge outfalls would likely be constructed during the typical maintenance period, which is November through January. Project construction activities will only occur during the day (from 30 minutes prior to sunrise and 30 minutes following sunset). Equipment that would be used during project implementation includes an excavator, trencher, backhoe, dozer, drill rig, hoist crane, water truck, and pick-up trucks.

Staging and laydown areas (which would temporarily house construction material and excavated soil) would be located immediately adjacent to the nine wells and within the 50-foot-wide pipeline construction corridor. No additional acreage would be needed for staging and laydown. Existing roads would be used to access the wells and pipeline construction corridor.

1.4 Project Location

The proposed project includes four discreet project sites adjacent to FKC, west of State Route 99 in north-central Kern County (**Figure 1**). The two northern sites are approximately 5 miles east of Wasco; the central site is located approximately 2.5 miles northeast of Shafter; and the southern site is approximately 2 miles north of Bakersfield (**Figures 2** and **3**). The project sites are in the Rosedale,

Famoso, and McFarland U.S. Geological Survey (USGS) 7.5-minute quadrangles, with components in the following townships and ranges: 26S/25E (section 36), 27S/25E (section 1), 27S/26E (section 6), and 28S/26E (sections 1, 6, and 27).

1.5 Biological Resources Assessment Methods

1.5.1 Pre-field Investigation

Before conducting biological field surveys, GEI Consultants, Inc. reviewed the California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB) (CDFW 2021) and the California Native Plant Society (CNPS) online Inventory of Rare and Endangered Vascular Plants of California (CNPS 2021). These reviews included the Pond, McFarland, Wasco, Famoso, Rio Bravo, Rosedale, and Oildale USGS 7.5-minute quadrangles. A resources list of species and habitats of Federal conservation concern that could occur in the project area was obtained from the U.S. Fish and Wildlife Service (USFWS) Information for Planning and Conservation website (USFWS 2021a); the USFWS online map of critical habitat for Federally threatened and endangered species (USFWS 2021b) also was reviewed. Results of the CNDDB and CNPS Inventory queries and the USFWS resources list are provided in **Appendix A**.

1.5.2 Field Survey

Field surveys of the project sites were conducted by GEI Consultants, Inc. biologist on May 21 and October 23, 2018, and August 13 and 14, 2021. The surveys focused on evaluating potential for special-status species to occur on or adjacent to the project sites and be affected by project activities. The survey area included a 50-foot corridor along the pipeline routes and 100-foot buffer of the well sites.

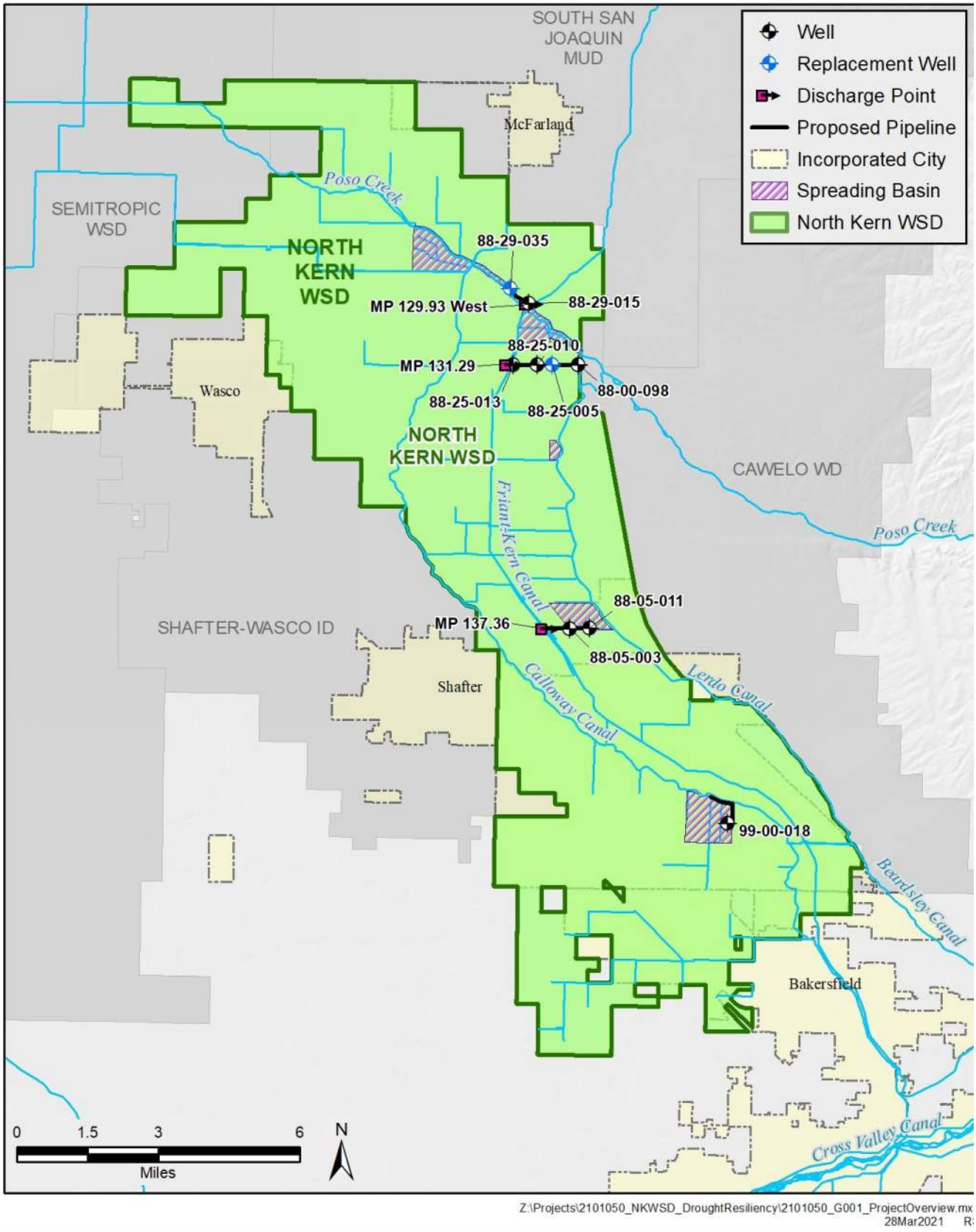
2. Environmental Setting

All four project sites and the surrounding areas are almost entirely comprised of agricultural land and associated facilities. Topography is generally flat, with an average elevation of approximately 400 feet above mean sea level. Representative photographs of the project sites are provided in **Appendix B**.

2.1 Vegetation and Wildlife

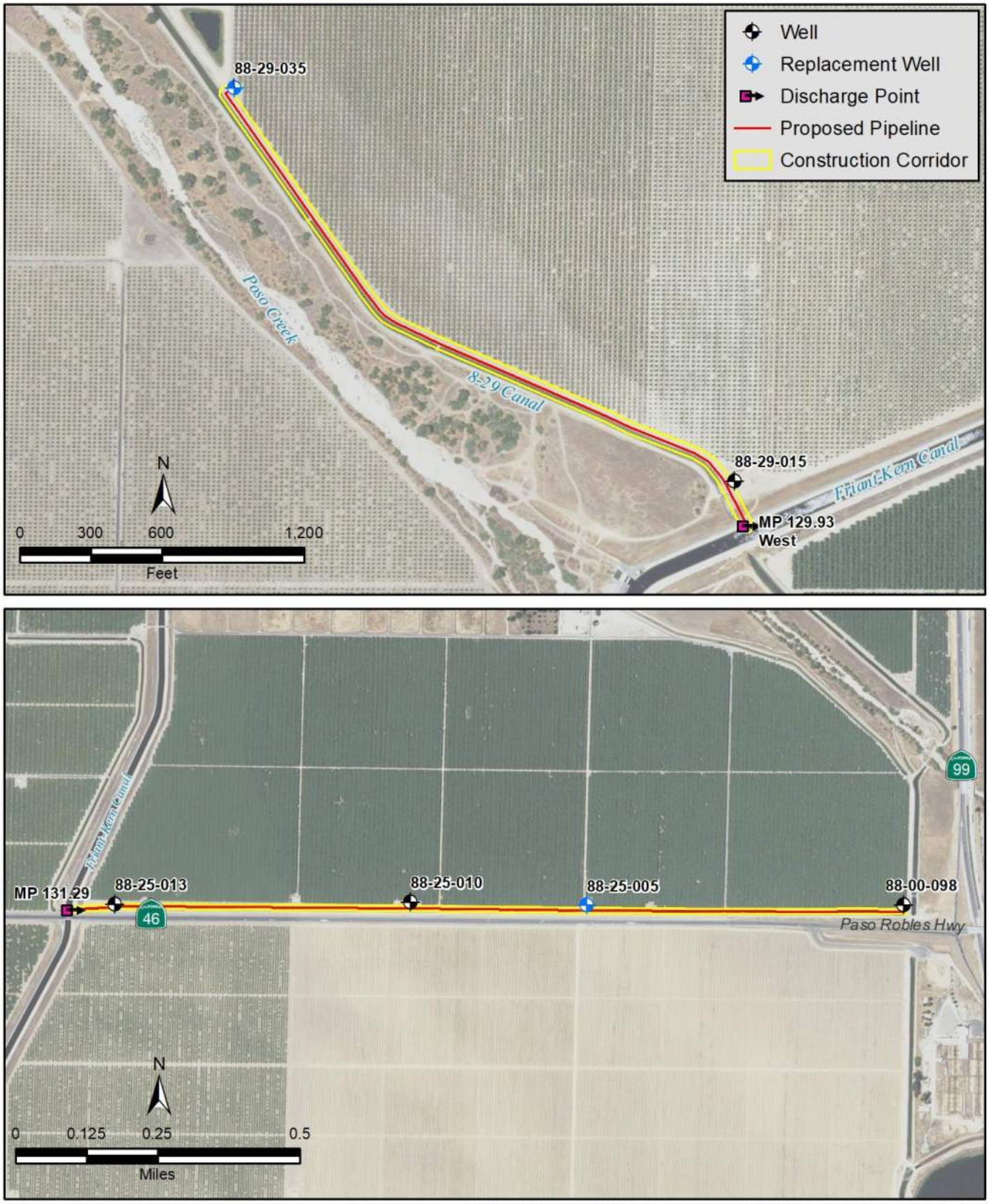
The only remnant natural habitat near the project sites is a small portion of the Poso Creek corridor, which is adjacent to but almost entirely separated from the northernmost site by a water delivery canal (*see* **Figure 2**, top). Ruderal habitat associated with formerly cultivated agricultural fields occurs at the southernmost project site (*see* **Figure 3**, bottom). Additional ruderal habitat occurs along some roadways and field margins in and adjacent to the project sites.

Figure 1. North Kern Water Storage District and Locations of Project Wells and Pipelines



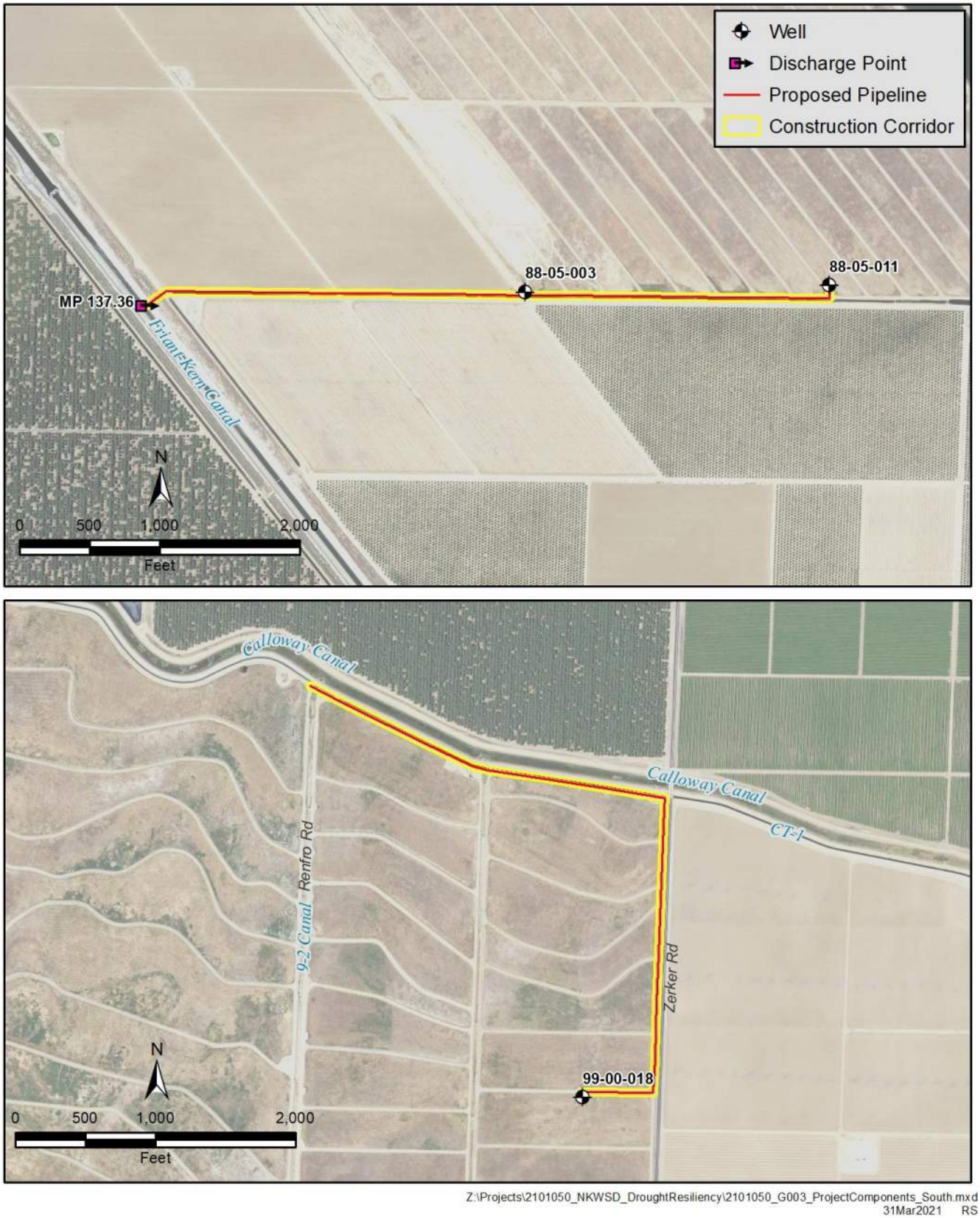
Source: North Kern Water Storage District 2019, adapted by GEI Consultants, Inc. in 2021

Figure 2. Project Wells and Pipelines



Source: North Kern Water Storage District 2019, adapted by GEI Consultants, Inc. in 2021

Figure 3. Project Wells and Pipelines (cont.)



Source: North Kern Water Storage District 2019, adapted by GEI Consultants, Inc. in 2021

Poso Creek is an ephemeral drainage that originates on the western slope of the Sierra Nevada. Under typical conditions, flows gradually dissipate soon after reaching the valley floor and do not extend to the action area. A series of sand dams between State Route 99 and State Highway 65 retain water to increase percolation and maximize groundwater recharge in the Cawelo Water District. Flows rarely reach as far as the northernmost project site, only when they are high enough to wash out the upstream sand dams. The portion of the Poso Creek corridor adjacent to the northernmost site is approximately 400 feet wide and includes a sparsely vegetated sandy channel and more densely vegetated channel banks, which support a low diversity of native shrubs and trees, such as mulefat (*Baccharis salicifolia*), coyote brush (*B. pilularis*), Fremont cottonwood (*Populus fremontii*), dusky willow (*Salix melanopis*), red willow (*S. laevigata*), narrowleaf willow (*S. exigua*), California sagebrush (*Artimisia californica*), and big saltbrush (*Atriplex lentiformis*).

Agricultural and ruderal habitats on and adjacent to the project sites likely support a relatively low diversity of wildlife species that are adapted to these intensely managed and relatively disturbed environments. Because the project sites are completely comprised of actively cultivated and ruderal lands and primarily surrounded by similar habitats, only the most mobile species (e.g., birds and mammals with large home ranges) that typically use highly altered habitats are likely to occur on the project sites. A higher diversity of wildlife is likely to occur adjacent to the northernmost site, because of its proximity to Poso Creek. However, most species that use the Poso Creek corridor are unlikely to venture onto the project site, unless they are species that typically occur in agricultural habitats.

2.2 Special-status Species

Special-status species are plants and animals that fall into any of the following categories:

- species officially listed by the Federal government or the State of California as endangered, threatened, or rare;
- candidate species for Federal or State listing as endangered or threatened;
- species proposed for Federal or State listing as endangered or threatened;
- taxa (i.e., taxonomic categories or groups) that meet the criteria for listing;
- wildlife species identified by CDFW as species of special concern and plant taxa considered by CDFW to be "rare, threatened, or endangered in California;"
- species listed as Fully Protected under the California Fish and Game Code (FGC); or
- species afforded protection under local or regional planning documents.

Plant taxa are assigned by CDFW to one of the following six California Rare Plant Ranks (CRPR):

- CRPR 1A—Plants presumed to be extinct in California;
- CRPR 1B—Plants that are rare, threatened, or endangered in California and elsewhere;
- CRPR 2A—Plants that are presumed extirpated in California, but are more common elsewhere;
- CRPR 2B—Plants that are rare, threatened, or endangered in California but more common elsewhere;
- CRPR 3—Plants about which more information is needed (a review list); or
- CRPR 4—Plants of limited distribution (a watch list).

All plants with a CRPR are considered "special plants" by CDFW. The term "special plants" is a broad term used by CDFW to refer to all plant taxa inventoried in the CNDDB, regardless of their legal or protection status. As indicated above, only plant taxa considered by CDFW to be "rare, threatened, or endangered in California" (i.e., CRPR 1B and 2B plants) are considered special-status in this analysis.

Table 1 provides information on each special-status plant that was included in the CNDDB or CNPS inventory search results or on the USFWS species list. Some of these species have been documented within 5 miles of at least one of the project sites; however, nearly all of the nearby plant occurrences are considered extirpated. Based on observations made during the field survey, habitat for special-status plants is absent from the project sites, and none of the species listed in **Table 1** were determined to have potential to occur on or adjacent to any of the project sites.

Table 2 provides information on each special-status animal that was included in the CNDDB search results, on the USFWS species list, or was otherwise determined to have potential to occur on or adjacent to the project sites. Some of these species have been documented within 5 miles of at least one of the project sites; however, many of the animal occurrences are more than 40 years old. Based on the review of existing documentation, habitat requirements of each species, and habitat evaluations made during field survey, most of these species have no potential to occur on or adjacent to the project sites. Because the project sites do not support natural vegetation or aquatic habitat, suitable habitat for most of the species considered is absent. Despite the poor habitat conditions for most wildlife species, several have some low degree of potential to occur on or near the project sites, particularly the northernmost site, because of its adjacency to Poso Creek. These species are discussed further below. No special-status wildlife species were observed during the field surveys.

Table 1. Special-status Plants Evaluated for Potential to Occur on the Project Sites

Species	Blooming Period	Status[1]		Habitat Associations	Potential to Occur on Project Site
		Federal	State		
Horn's milk-vetch *Astralagus hornii* var. hornii	May–October	–	1B.1	Alkaline lake margins, meadows and seeps, and playas	None; no suitable habitat is present on or adjacent to the project sites.
Earlimart orache *Atriplex cordulata* var. *erecticaulis*	August–November	–	1B.2	Valley and foothill grassland	None; no suitable habitat is present on or adjacent to the project sites.
California jewelflower *Caulanthus californicus*	February–May	E	E/1B.1	Meadows and seeps, playas, and valley and foothill grassland	None; no suitable habitat is present on or adjacent to the project sites.
Hispid birds-beak *Chloropyron mole* ssp. *hispidium*	June–September	–	1B.1	Chenopod scrub, riparian scrub, and marshes, swamps, and sloughs	None; no suitable habitat is present on or adjacent to the project sites.
Recurved larkspur *Delphinium recurvatum*	March–June	–	1B.2	Alkaline soils in chenopod scrub, cismontane woodland, and valley and foothill grassland	None; no suitable habitat is present on or adjacent to the project sites.
Kern mallow *Eremalche parryi* ssp. *kernensis*	January–May	E	1B.2	Open sandy and clay soils, in chenopod scrub, pinyon and juniper woodland, and valley and foothill grassland	None; no suitable habitat is present on or adjacent to the project sites.

Hoover's eriastrum *Eriastrum hooveri*	March–May	–	4.2	Chenopod scrub, pinyon and juniper woodland, valley and foothill grassland, alkaline flats (sometimes gravelly)	None; no suitable habitat is present on or adjacent to the project sites.
Spiny-sepaled button-celery *Eryngium spinosepalum*	April–June	–	1B.2	Vernal pools in valley and foothill grassland	None; no suitable habitat is present on or adjacent to the project sites.
California satintail *Imperata brevifolia*	September – May	_	2B.1	Chaparral, coastal scrub, Mojaveen desert scrub, meadows and seeps, riparian scrub	None; no suitable habitat is present on or adjacent to the project sites.
Munz's tidy-tips *Layia munzii*	March–April	–	1B.2	Alkaline clay soils in chenopod scrub and valley and foothill grassland	None; no suitable habitat is present on or adjacent to the project sites.
San Joaquin wooly-threads *Monolopia congdonii*	February–May	E	1B.2	Sandy soils in chenopod scrub, valley and foothill grassland	None; no suitable habitat is present on or adjacent to the project sites.
Bakersfield cactus *Opuntia basilaris* var. *treleasei*	April–May	E	E 1B.2	Sandy and gravelly soils in chenopod scrub, cismontane woodland, and valley and foothill grassland	None; no suitable habitat is present on or adjacent to the project sites.
Mason's neststraw *Stylocline masonii*	March–May	–	1B.1	Sandy soils in chenopod scrub and pinyon and juniper woodland	None; no suitable habitat is present on or adjacent to the project sites.

Notes: CRPR = California Rare Plant Rank
[1] **Status Definitions**
Legal Status
E = Listed as Endangered under the Federal or State Endangered Species Act
California Rare Plant Ranks
1B = Plant species considered rare or endangered in California and elsewhere (but not legally protected).
2B = Plants rare, threatened, or endangered in California but common elsewhere.
4 = Plants of limited distribution, a watch list.
California Rare Plant Rank Extensions
.1 = Seriously endangered in California (greater than 80 percent of occurrences are threatened and/or have a high degree and immediacy of threat).
.2 = Fairly endangered in California (20 to 80 percent of occurrences are threatened and/or have a moderate degree and immediacy of threat).
– = no status
Sources: CDFW 2021; CNPS 2021; USFWS 2021; GEI Consultants, Inc. field survey observations

Table 2. Special-status Animals Evaluated for Potential to Occur on the Project Sites

Species	Status		Habitat Associations	Potential to Occur on the Project Sites
	Federal	State		
Fish				
Delta smelt *Hypomesus transpacificus*	T	E	Typically restricted to the Sacramento-San Joaquin River Delta and lower Sacramento River	None; no suitable habitat is present on or adjacent to the project sites, which are outside the range of this species.
Invertebrates				
Kern shoulderband *Helminthoglypta callistoderma*	_	_	Aquatic. Sacramento and San Joaquin flowing waters.	None; no suitable habitat is present on or adjacent to the project sites, which are outside the range of this species.

Table 2. Special-status Animals Evaluated for Potential to Occur on the Project Sites

Species	Status		Habitat Associations	Potential to Occur on the Project Sites
	Federal	State		
Crotch bumble bee *Bombus crotchii*	–	C	Open grassland and scrub habitats; primarily nests underground	None; project sites are outside the current range of this species, which appears to have been extirpated from the San Joaquin Valley floor.
Vernal pool fairy shrimp *Branchinecta lynchi*	T	–	Vernal pools/seasonal wetlands, including a wide range of sizes and depths.	None; no suitable habitat is present on or adjacent to the project sites.
Amphibians				
California red-legged frog *Rana draytonii*	T	SSC	Lowlands and foothill areas, in or near permanent deep water with dense, shrubby or emergent riparian vegetation	None; no suitable habitat is present on or adjacent to the project sites, which are outside the current range of this species.
Western spadefoot *Spea hammondii*	–	SSC	Vernal pools/seasonal wetlands in grassland and open woodland	None; no suitable habitat is present on or adjacent to the project sites.
Reptiles				
Bakersfield legless lizard *Anniella grinnelli*	–	SSC	Sandy soils in sparsely vegetated dunes, chaparral, pine-oak woodland, desert scrub, sandy washes, and stream terraces	Very low; marginally suitable habitat occurs along Poso Creek, adjacent to the northernmost project site, but on-site habitat is poor.
California glossy snake *Arizona elegans occidentalis*	–	SSC	Wide variety of habitats, including grassland and scrub, often with loose or sandy soils	Very low; marginally suitable habitat occurs along Poso Creek, adjacent to the northernmost project site, but on-site habitat is poor.
Blunt-nosed leopard lizard *Gambelia silus*	E	E, FP	Sparsely vegetated and relatively flat grassland and alkali and desert scrub habitats	Very low; marginally suitable habitat occurs along Poso Creek, adjacent to the northernmost project site, but on-site habitat is poor; nearest CNDDB occurrences are more than 5 miles from this site and nearly 50 years old.
Coast horned lizard *Phrynosoma blainvillii*	–	SSC	Most commonly along sandy washes with scattered low bushes	Very low; marginally suitable habitat occurs along Poso Creek, adjacent to the northernmost project site, but on-site habitat is poor.
Birds				
Burrowing owl *Athene cunicularia*	–	SSC	Nests and forages in grasslands, agricultural lands, and other open habitats with natural or artificial burrows or friable soils	Very low; uncultivated fields near the northern and southern project sites provide marginally suitable foraging habitat; nearest CNDDB occurrence is from grassland at the north end of the airport, approximately 3 miles east of the southernmost project site.
Swainson's hawk *Buteo swainsoni*	–	T	Nests in riparian forest and scattered trees; forages in grasslands and agricultural fields	Low; uncultivated fields near the northern and southern project sites provide marginally suitable foraging habitat, but no nests are known from the nearby portion of Poso Creek, and the nearest recent nest sites are from the Kern River, more than 5 miles south of the southernmost project site.

Table 2. Special-status Animals Evaluated for Potential to Occur on the Project Sites

Species	Status		Habitat Associations	Potential to Occur on the Project Sites
	Federal	State		
Tricolored blackbird *Agelaius tricolor*	–	C	Nests in dense cattails and tules, riparian scrub, grain crops, and other low dense vegetation; forages in grasslands and agricultural fields	Very low; uncultivated fields near the northern and southern project sites provide marginally suitable foraging habitat, but no nesting habitat was present on or adjacent to the project sites during the field surveys.
Mammals				
Giant kangaroo rat *Dipodomys ingens*	E	E	Dry grasslands and alkali scrub with sandy loam soils	None; project sites are outside the range of this species.
Tipton kangaroo rat *Dipodomys nitratoides*	E	E	Saltbrush and sink scrub vegetation with soft, friable soils	Very low; marginally suitable habitat occurs along Poso Creek, adjacent to the northernmost project site, but on-site habitat is very poor.
Western mastiff bat *Eumops perotis californicus*	–	SSC	Various open, semi-arid to arid habitats; roosts in cliff crevices, high buildings, tunnels, and trees	Very low; individuals could occasionally forage in the vicinity, but potential roosting habitat is very limited.
American badger *Taxidea taxus*	–	SSC	Dry, open areas in various habitats with friable soils and uncultivated ground	Low; uncultivated fields near the northern and southern project sites provide marginally suitable habitat.
San Joaquin kit fox *Vulpes macrotis mutica*	E	T	Primarily grasslands and sparsely vegetated shrublands with loose-textured soils; can also use open agricultural habitats	Low; habitat on and adjacent to the project sites is marginally suitable.

Notes: CNDDB = California Natural Diversity Database
[1] **Status Definitions**
E = Listed as Endangered under the Federal or State Endangered Species Act
T = Listed as Threatened under the Federal or State Endangered Species Act
C = Candidate for listing as Threatened or Endangered under the State Endangered Species Act
FP = Fully Protected under the California Fish and Game Code
SSC = California Species of Special Concern
Sources: CDFW 2021; CNPS 2021; USFWS 2021a; GEI Consultants, Inc. field survey observations

Four special-status reptiles could occur along Poso Creek, adjacent to the northernmost project site: blunt-nosed leopard lizard *(Gambelia silus)*, Bakersfield legless lizard *(Anniella grinnelli)*, coast horned lizard *(Phrynosoma blainvillii)*, and California glossy snake *(Arizona elegans occidentalis)*. Potential for these species to occur on this project site is very low, because the site does not provide the appropriate habitat conditions for these species, such as sandy soils and appropriate vegetation, and there is no evidence that the species occur along this portion of Poso Creek. Several occurrences of blunt-nosed leopard lizard have been documented in the CNDDB from within 5 miles of the northernmost and southernmost project sites. However, these and other occurrences closest to the project sites are from more than 30 years ago, and occurrences in the larger region over the past 20 years are from remnant areas of valley floor natural habitat and oil field grasslands to the east, approximately 10 to 20 miles from the nearest project site. The CNDDB does not include any Bakersfield legless lizard occurrences as far north as the southernmost project site, and all coast horned lizard occurrences in the region are from large areas of remnant native habitat well east and west of the project sites. Glossy snake occurrences are known from within 5 miles of all the project sites, but these occurrences are from more than 80 years ago, when habitat conditions were very different.

Five special-status bird species have low or very low potential to occur on or adjacent to the northernmost and southernmost project sites: burrowing owl *(Athene cunicularia),* Swainson's hawk *(Buteo swainsonii),* and tricolored blackbird *(Agelaius tricolor)*. No suitable nesting habitat for tricolored blackbird was present on or adjacent to these sites during the field surveys. However, if grain crops or extensive areas of tall ruderal vegetation (e.g., in fallow fields) are present near these project sites during project activities, there is some potential for these species to nest in such habitat. Large trees along Poso Creek, provide marginally suitable nest sites for Swainson's hawk (as well as common raptor species), although neither species is known to nest along that section of the Creek. No potential nest trees are present on or near the other two project sites. In addition, Kern County is at the south end of the Swainson's hawk breeding range, and the species occurs sparsely in this region. Potentially suitable habitat for burrowing owl also is limited to uncultivated fields and ruderal habitat near the northernmost and southernmost project sites. No concentrations of ground squirrel burrows were observed during the field surveys, but scattered burrows were present in ruderal habitat adjacent to these sites and could be suitable for burrowing owl.

Four special-status mammals have low or very low potential to occur on or adjacent to the northernmost or southernmost project sites: Tipton kangaroo rat *(Dipodomys nitratoides),* San Joaquin kit fox *(Vulpes macrotis mutica),* American badger *(Taxidea taxus),* and western mastiff bat (*Eumops perotis californicus).* Tipton kangaroo rat has been documented in the CNDDB as occurring along FKC, north and south of Poso Creek, and near the northernmost project site. This apparently isolated population of Tipton kangaroo rat was documented more than 25 years ago, when much of the adjacent habitat was in non-orchard crops and fallow/open fields. Since then, all adjacent agricultural lands have been planted in orchards. All other occurrences of this species that are documented in the CNDDB are at least 8 miles from the project sites and most are from farther away. Potential for Tipton kangaroo rat to occur on the northernmost project site is very low, because the site does not provide the appropriate habitat conditions for this species. Several occurrences of San Joaquin kit fox have been documented within 5 miles of the project sites. Most of these occurrences are from more than 40 years ago. The nearest occurrence to the action area was a sighting in 1993, approximately 0.5 miles northeast of the Project site along the left bank of the FKC. The nearest relatively recent occurrence of badger in the area is from 1989, in saltbush scrub along Poso Creek, approximately 10 miles southwest of the northernmost project site. Occurrences of western mastiff bat in the region are generally from the valley floor margins, adjacent to hills that likely provide suitable natural roost sites. Because there is no suitable natural roosting habitat within at least 5 miles, and the project vicinity provides poor artificial roost sites, these bats have very low potential to occur on or adjacent to project sites.

2.3 Sensitive Habitats

Sensitive habitats include those that are of special concern to resource agencies or are afforded specific consideration through the California Environmental Quality Act, the federal Endangered Species Act, FGC Section 1602, Section 404 of the Federal Clean Water Act (CWA), and the Porter-Cologne Water Quality Control Act. Sensitive habitats may be of special concern for a variety of reasons, including their locally or regionally declining status, or because they provide important habitat for special-status species.

2.3.1 Critical Habitat

Critical habitat is a geographic area containing features determined to be essential to the conservation of a species listed as threatened or endangered under the federal Endangered Species Act. No designated or proposed critical habitat is present on or adjacent to the project sites.

2.3.2 Other Habitats Protected under Federal or State Regulations

Under Section 404 of the CWA, the U.S. Army Corps of Engineers regulates discharge of dredged or fill material into aquatic features that qualify as waters of the United States; wetlands that support hydrophytic vegetation, hydric soil types, and wetland hydrology may also qualify for U.S. Army Corps of Engineers jurisdiction under Section 404 of the CWA. Under Section 401 of the CWA, the Central Valley Regional Water Quality Control Board (RWQCB) regulates discharge of dredged or fill material into waters of the United States that drain to the Central Valley, to ensure such activities do not violate State or Federal water quality standards; the Central Valley RWQCB also regulates waters of the State, in compliance with the Porter-Cologne Act. In addition, all diversions, obstruction, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources is subject to the regulatory approval of CDFW pursuant to FGC Section 1602.

Because canals on the project sites are used solely for irrigation delivery and do not have a significant nexus to traditionally navigable waters, they do not qualify as potentially jurisdictional waters of the United States and are not subject to regulation under CWA Sections 401 and 404. Because the canals are not considered to be rivers or streams under FGC Section 1600, a streambed alteration notification is not required. Because the project would not affect the quality of the waters of the state, a waste discharge requirement is not needed from RWQCB (Porter-Cologne Act Section 13260[1][1]).

2.3.3 Natural Communities of Special Concern

CDFW maintains a list of terrestrial natural communities that are native to California, the List of Vegetation Alliances and Associations (CDFG 2010). Within that list, CDFW identifies and ranks natural communities of special concern considered to be highly imperiled. The project sites do not support any natural communities of special concern.

3. Potential Impacts

Implementing the project would temporarily disturb the margins of existing canals, dirt roads, orchards, and agricultural fields. Pipeline installation would primarily be limited to barren ground, and no natural habitat would be affected by any project activities. The impact discussions below focus on resources determined to have potential to be affected by implementing the project. Therefore, special-status species that do not have potential to occur on or near the project sites (i.e., because suitable habitat is absent or the project sites are outside the species' current range) are not addressed in these discussions.

3.1 Special-status Wildlife

3.1.1 Reptiles

Potential for special-status reptiles to be impacted by the project is minimal. Because project activities would be limited to existing roadways and canal and orchard/field margins, nearly the entire disturbance is barren. Less than 0.1 acre of poor-quality ruderal habitat at the northernmost project site would be disturbed by project activities, additional 0.1 acre of ruderal habitat is present at the southernmost project site. Therefore, it is very unlikely that an individual of any special-status reptile species would be present on these project sites and vulnerable to being injured or killed by project activities. Project activities are also very unlikely to disturb individuals that may be present in adjacent habitat, because

project disturbance levels would be similar to those of on-going agricultural activities, canal maintenance, and off-road recreation that occur under existing conditions. Based on the very small area of poor-quality habitat that would be affected and very low probability for a very few, if any, individuals of these species to be impacted, this would not have a substantial adverse effect on Bakersfield legless lizard, coast horned lizard, or California glossy snake. However, because of the endangered and fully protected status of blunt-nosed leopard lizard, potential to injure or kill even one individual could be considered a substantial adverse effect.

3.1.2 Birds

All the special-status bird species that could be impacted by project activities are known or likely to occur in the general region, but habitat on and adjacent to the project sites is only marginally suitable for them. Areas adjacent to the northernmost and southernmost project sites currently provide marginal foraging and nesting habitat for burrowing owl and Swainson's hawk. Suitable nesting habitat for tricolored blackbird could also be present during project implementation, depending on habitat conditions of agricultural fields at the time. Because project activities would be limited to existing roadways and canal and orchard/field margins, there is no potential for nests of these species to be directly destroyed. In addition, most of the project sites are subject to regular disturbance from existing agricultural activities and/or road traffic, and project disturbance would be similar in intensity to agricultural activities. Therefore, potential for project-related disturbance to result in nest failure or burrow abandonment is low. However, if an active nest or occupied burrow is present very close to a project site, project activities could result in burrow or nest abandonment, reduced care of eggs or young, or premature fledging. Depending on the species and number of individuals that are affected, burrow abandonment or nest failure could be considered a substantial adverse effect.

3.1.3 Mammals

As discussed above for special-status reptiles, less than 0.2 acre of poor-quality ruderal habitat would be disturbed by project activities at the northernmost and southernmost project sites; this habitat provides potential habitat for Tipton kangaroo rat. It is very unlikely that an individual would be present on these project sites and vulnerable to being injured or killed by project activities. Further, project activities are also very unlikely to disturb individuals that may be present in adjacent habitat, because project disturbance levels would be similar to those of on-going agricultural activities, canal maintenance, and off-road recreation that occur under existing conditions. Based on the very small area of poor-quality habitat that would be affected, the probability for Tipton kangaroo rat to be adversely affected by the project is very low. However, because of the endangered status of the species, potential to injure or kill even one individual could be considered a substantial adverse effect.

Based on the current agricultural land use and observations made during the field surveys, San Joaquin kit fox and American badger are very unlikely to den on any of the project sites. However, because the Poso Creek corridor and FKC right-of-way could provide travel corridors, there is potential for individuals to occasionally disperse through the sites. Additionally, both species could travel through agricultural areas. If a kit fox or badger is present during project activities, it could be injured or killed if struck by a project vehicle or project equipment or become trapped in pipes or trenches. In the very unlikely event that an occupied den is present adjacent to a project site, project-related disturbance could result in den abandonment. Very few individuals, if any, would be affected. This is unlikely to have a substantial adverse effect on the regional badger population, but potential to injure or kill even one San Joaquin kit fox could be considered a substantial adverse effect, because of its threatened and endangered status.

Foraging activities of mastiff bats that may use the project sites are very unlikely to be disturbed by construction activities, and there is no potential for roosts to occur on or near enough to any of the project sites to be susceptible to disturbance. Therefore, project activities would not have a substantial effect on this species.

3.2 Other Potential Impacts on Biological Resources

The project sites are part of a much larger extent of agricultural lands and do not serve as a corridor or other primary route for wildlife movement. Although terrestrial wildlife likely travel along FKC and other canals at the project sites, agricultural lands adjacent to the canals typically provide equally suitable movement opportunities adjacent to most of the project sites. In addition, project activities would only occur during the day, while most wildlife movement would likely be at night, and disturbance of the canal corridor would be relatively minor. The project sites also are not known or anticipated to serve as a nursery site for any wildlife species. Therefore, implementing the proposed project would not substantially interfere with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites.

The 2004 Kern County General Plan, which is currently being updated, includes several policies and implementation measures designed to protect and conserve threatened and endangered species and oak trees (Kern County 2004). No oak trees are present on the project sites, and the project has no potential to conflict with Kern County's General Plans oak retention policy. The Plan requires discretionary projects to consider effects to biological resources and wildlife agency comments during the CEQA process; this is consistent with the CEQA process being implemented by the District for the proposed project. Therefore, implementing the proposed Project would not conflict with any local policies or ordinances protecting biological resources and this impact would be no impact.

The project sites are within the area anticipated to be covered by the Kern County Valley Floor Habitat Conservation Plan. A draft of the plan was issued many years ago (Kern County Planning Department 2006), but a final plan has not been released. The project sites are within an extensive area of "White Zone," which is of lower conservation concern and not identified for acquisition of preserve areas. Therefore, implementing the proposed project would not conflict with any provisions, guidelines, goals, or objectives related to biological resources anticipated to be included in a potential final and adopted version of this plan.

A low diversity of common birds that use agricultural and ruderal habitats could nest on or adjacent to the project sites. Because the pipelines would primarily be installed within existing barren corridors, there is minimal potential for the project to result in direct destruction of active nests. Implementing recommended impact avoidance and minimization measures described below would avoid direct loss of active bird nests. If active nests are present on or very near a project site, pipeline installation could result in nest abandonment, reduced care of eggs or young, or premature fledging. However, potential indirect loss of active nests of common species would not substantially reduce their abundance or cause any species to drop below self-sustaining levels.

4. Recommended Impact Avoidance and Minimization Measures

The measures described below are recommended to avoid or minimize impacts on special-status wildlife and other biological resources that are protected under State and Federal laws and regulations.

- An Environmental Awareness Program will be presented to all project personnel working in the field before project activities begin. The program will be presented by a qualified biologist with knowledge of special-status wildlife that could occur on the project sites. The program will address each species biology and habitat needs; status of each species and their regulatory protections; and measures required to reduce impacts to the species during project construction.

- To prevent wildlife entrapment during construction, all excavated, steep-walled holes or trenches more than 2 feet deep will be covered with plywood or similar material at the end of each workday. If the trenches cannot be closed, one or more escape ramps of no more than a 45-degree slope will be constructed of earthen fill or created with wooden planks. All covered or uncovered excavations will be inspected at the beginning, middle, and end of each day. Before trenches are filled, they will be inspected for trapped animals. If a trapped or injured animal is discovered, project activities will stop, and escape ramps or structures will be installed immediately to allow the animal(s) to escape.

- All construction pipes, culverts, or similar structures with a diameter of 4 inches or more that are stored at a construction site for one or more overnight period will be thoroughly inspected for wildlife before the pipe is buried, capped, or otherwise used or moved in any way. Pipes laid in trenches overnight will be capped. If an animal is discovered inside a pipe, the pipe will not be moved, and the animal will be allowed to leave on its own.

- All food-related trash items such as wrappers, cans, bottles or food scraps generated during project activities will be disposed of in closed containers and removed daily from the project site. No deliberate feeding of wildlife will be allowed, and no domestic pets associated with project personnel will be permitted on the project site.

- No more than 30 days before project activities begin, a qualified biologist will conduct a pre-construction survey to determine the potential for blunt-nosed leopard lizard, Tipton kangaroo rat and San Joaquin kit fox to occur in the action area. If potential dens for San Joaquin kit fox are found, exclusion zones will be established and maintained, in accordance with the *Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox* (USFWS 2011). If burrows that show evidence of occupation by Tipton kangaroo rat or blunt-nosed leopard lizard are identified, a qualified biologist will determine an appropriate exclusion zone that will be maintained to prevent disturbance of the burrows and occupants.

- In accordance with the *Staff Report on Burrowing Owl Mitigation* (CDFG 2012), a qualified biologist will assess burrowing owl habitat suitability in the area subject to direct impact and adjacent areas within 500 feet. If suitable habitat or sign of burrowing owl presence is observed, a take avoidance survey will be conducted within 14 days before project activities begin. If any occupied burrows are observed, protective buffers will be established and implemented. A qualified biologist will monitor the occupied burrows during project activities to confirm effectiveness of the

buffers. The size of the buffer will depend on type and intensity of project disturbance, presence of visual buffers, and other variables that could affect susceptibility of the owls to disturbance.

- If it is not feasible to implement a buffer of adequate size around an occupied burrowing owl burrow, and it is determined, in consultation with CDFW, that passive exclusion of owls from the project site is an appropriate means of minimizing impacts, an exclusion and relocation plan will be developed and implemented in coordination with CDFW. However, passive exclusion cannot be conducted during the breeding season (February 1–August 31), unless a qualified biologist verifies through noninvasive means that either (1) the birds have not begun egg laying or (2) juveniles from the occupied burrows are foraging independently and are capable of independent survival.

- A qualified biologist will conduct surveys of potential Swainson's hawk nesting trees within 0.25 mile of the project sites. To the extent practicable, depending on timing of project initiation, surveys will be conducted in accordance with the *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (Swainson's Hawk Technical Advisory Committee 2000). At a minimum, a survey will be conducted within 14 days before project activities begin near suitable nest trees during the nesting season (April–August).

- If an active Swainson's hawk nest is observed, a protective buffer will be established and implemented until the nest is no longer active. A qualified biologist will monitor the nest during project activities to confirm effectiveness of the buffer. The size of the buffer will depend on type and intensity of project disturbance, presence of visual buffers, and other variables that could affect susceptibility of the nest to disturbance.

- A qualified biologist will conduct surveys of suitable nesting habitat that would be directly disturbed by project activities and suitable nesting habitat for tricolored blackbird, and common raptors, if present within 500 feet of project activities. Surveys will be conducted within 14 days before project activities begin near suitable nesting habitat during the nesting season (February-August).

- If any active bird nests are documented in the area that would be directly disturbed by project activities or active nests of tricolored blackbird and common raptors are documented within 500 feet, protective buffers will be established and implemented until the nests are no longer active. A qualified biologist will monitor the nests during project activities to confirm effectiveness of the buffers. The size of the buffers will depend on type and intensity of project disturbance, presence of visual buffers, and other variables that could affect susceptibility of the nest to disturbance.

5. References

CDFG (California Department of Fish and Game). 2010. List of Vegetation Alliances and Associations. Sacramento, CA.

———. 2012. Staff Report on Burrowing Owl Mitigation. State of California Natural Resources Agency, Sacramento, CA.

CDFW (California Department of Fish and Wildlife). 2021. Results of electronic database search for sensitive species occurrences. Version 5. Biogeographic Data Branch. Available at https://apps.wildlife. ca.gov/myaccount/login?ReturnUrl=%2frarefind%2fview%2fRareFind.aspx. Accessed July 14, 2021

CNPS (California Native Plant Society). 2021. *Inventory of Rare and Endangered Plants*. Online edition, v8-03 0.38. Sacramento, CA. Available at http://www.rareplants.cnps.org. Accessed July 14, 2021

Kern County. 2004. *General Plan*. Available: https://psbweb.co.kern.ca.us/planning/pdfs/kcgp/KCGP.pdf. Accessed: March 2, 2020.

Kern County Planning Department. 2006 (December). *First Public Draft, Kern County Valley Floor Habitat Conservation Plan*. Prepared by Garcia and Associates, Lompoc, CA.

Swainson's Hawk Technical Advisory Committee. 2000. Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley. Available at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83990&inline.

USFWS (U.S. Fish and Wildlife Service). 2011. *Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox Prior to or During Ground Disturbance*. Sacramento Fish and Wildlife Office, Sacramento, CA.

_____. 2021a. IPaC Resoure List. Sacramento Fish and Wildlife Office, Sacramento, CA.

_____. 2021b. Critical Habitat for Threatened and Endangered Species. Available at: https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e265ad4fe09893cf75b8dbfb77. Accessed July 14, 2021

Appendix A. Special-status Species Query Results

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Pond (3511963) OR McFarland (3511962) OR Wasco (3511953) OR Famoso (3511952) OR Rio Bravo (3511943) OR Rosedale (3511942) OR Oildale (3511941))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Threatened	G1G2	S1S2	SSC
Anniella grinnelli Bakersfield legless lizard	ARACC01050	None	None	G2G3	S2S3	SSC
Arizona elegans occidentalis California glossy snake	ARADB01017	None	None	G5T2	S2	SSC
Astragalus hornii var. hornii Horn's milk-vetch	PDFAB0F421	None	None	GUT1	S1	1B.1
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S3	SSC
Atriplex cordulata var. erecticaulis Earlimart orache	PDCHE042V0	None	None	G3T1	S1	1B.2
Bombus crotchii Crotch bumble bee	IIHYM24480	None	Candidate Endangered	G3G4	S1S2	
Buteo swainsoni Swainson's hawk	ABNKC19070	None	Threatened	G5	S3	
Caulanthus californicus California jewelflower	PDBRA31010	Endangered	Endangered	G1	S1	1B.1
Chloropyron molle ssp. hispidum hispid salty bird's-beak	PDSCR0J0D1	None	None	G2T1	S1	1B.1
Delphinium recurvatum recurved larkspur	PDRAN0B1J0	None	None	G2?	S2?	1B.2
Dipodomys nitratoides nitratoides Tipton kangaroo rat	AMAFD03152	Endangered	Endangered	G3T1T2	S1S2	
Eremalche parryi ssp. kernensis Kern mallow	PDMAL0C031	Endangered	None	G3G4T3	S3	1B.2
Eremophila alpestris actia California horned lark	ABPAT02011	None	None	G5T4Q	S4	WL
Eriastrum hooveri Hoover's eriastrum	PDPLM03070	Delisted	None	G3	S3	4.2
Eryngium spinosepalum spiny-sepaled button-celery	PDAPI0Z0Y0	None	None	G2	S2	1B.2
Eumops perotis californicus western mastiff bat	AMACD02011	None	None	G4G5T4	S3S4	SSC
Gambelia sila blunt-nosed leopard lizard	ARACF07010	Endangered	Endangered	G1	S1	FP
Helminthoglypta callistoderma Kern shoulderband	IMGASC2080	None	None	G1	S1	

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Imperata brevifolia California satintail	PMPOA3D020	None	None	G4	S3	2B.1
Lasiurus cinereus hoary bat	AMACC05030	None	None	G3G4	S4	
Layia munzii Munz's tidy-tips	PDAST5N0B0	None	None	G2	S2	1B.2
Monolopia congdonii San Joaquin woollythreads	PDASTA8010	Endangered	None	G2	S2	1B.2
Opuntia basilaris var. treleasei Bakersfield cactus	PDCAC0D055	Endangered	Endangered	G5T1	S1	1B.1
Perognathus inornatus San Joaquin pocket mouse	AMAFD01060	None	None	G2G3	S2S3	
Phrynosoma blainvillii coast horned lizard	ARACF12100	None	None	G3G4	S3S4	SSC
Spea hammondii western spadefoot	AAABF02020	None	None	G2G3	S3	SSC
Stylocline masonii Mason's neststraw	PDAST8Y080	None	None	G1	S1	1B.1
Taxidea taxus American badger	AMAJF04010	None	None	G5	S3	SSC
Valley Saltbush Scrub Valley Saltbush Scrub	CTT36220CA	None	None	G2	S2.1	
Vulpes macrotis mutica San Joaquin kit fox	AMAJA03041	Endangered	Threatened	G4T2	S2	

Record Count: 31

Inventory of Rare and Endangered Plants of California

Search Results

Back Export Results

18 matches found. Click on scientific name for details

Search Criteria: Quad is one of [**3511963,3511962,3511953,3511952,3511943,3511942,3511941**]

Scientific Name | Common Name | Family | Lifeform | Blooming Period | Fed List | State List | Global Rank | State Rank | CA Rare Plant Rank | General Habitats | Micro Habitats | Lowest Elevation | Highest Elevation | CA Endemic | Date Added | Photo

Search:

▲ SCIENTIFIC NAME	COMMON NAME	FAMILY	LIFEFORM	BLOOMING PERIOD	FED LIST	STATE LIST	CA RARE PLANT RANK	GENERAL HABITATS
Astragalus hornii var. *hornii*	Horn's milk-vetch	Fabaceae	annual herb	May-Oct	None	None	1B.1	Meadows and seeps, Playas
Atriplex cordulata var. *erecticaulis*	Earlimart orache	Chenopodiaceae	annual herb	Aug-Sep(Nov)	None	None	1B.2	Valley and foothill grassland
Atriplex coronata var. *coronata*	crownscale	Chenopodiaceae	annual herb	Mar-Oct	None	None	4.2	Chenopod scrub, Valley and foothill grassland, Vernal pools
Atriplex subtilis	subtle orache	Chenopodiaceae	annual herb	(Apr)Jun-Sep(Oct)	None	None	1B.2	Valley and foothill grassland
Caulanthus californicus	California jewelflower	Brassicaceae	annual herb	Feb-May	FE	CE	1B.1	Chenopod scrub, Pinyon and juniper woodland, Valley and foothill grassland
Chloropyron molle ssp. *hispidum*	hispid salty bird's-beak	Orobanchaceae	annual herb (hemiparasitic)	Jun-Sep	None	None	1B.1	Meadows and seeps, Playas, Valley and foothill grassland
Delphinium recurvatum	recurved larkspur	Ranunculaceae	perennial herb	Mar-Jun	None	None	1B.2	Chenopod scrub, Cismontane woodland, Valley and foothill grassland
Eremalche parryi ssp. *kernensis*	Kern mallow	Malvaceae	annual herb	Jan(Feb)Mar-May	FE	None	1B.2	Chenopod scrub, Pinyon and juniper woodland, Valley and foothill grassland
Eriastrum hooveri	Hoover's eriastrum	Polemoniaceae	annual herb	Mar-Jul	FD	None	4.2	Chenopod scrub, Pinyon and juniper woodland, Valley and foothill grassland
Eriogonum	cottony	Polygonaceae	annual herb	Mar-Sep	None	None	4.2	Chenopod scrub, Valley

gossypinum	buckwheat							and foothill grassland
▲ SCIENTIFIC NAME	COMMON NAME	FAMILY	LIFEFORM	BLOOMING PERIOD	FED LIST	STATE LIST	CA RARE PLANT RANK	GENERAL HABITATS
Eryngium spinosepalum	spiny-sepaled button-celery	Apiaceae	annual/perennial herb	Apr-Jun	None	None	1B.2	Valley and foothill grassland, Vernal pools
Imperata brevifolia	California satintail	Poaceae	perennial rhizomatous herb	Sep-May	None	None	2B.1	Chaparral, Coastal scrub, Meadows and seeps, Mojavean desert scrub, Riparian scrub
Lasthenia ferrisiae	Ferris' goldfields	Asteraceae	annual herb	Feb-May	None	None	4.2	Vernal pools
Layia munzii	Munz's tidy-tips	Asteraceae	annual herb	Mar-Apr	None	None	1B.2	Chenopod scrub, Valley and foothill grassland
Monolopia congdonii	San Joaquin woollythreads	Asteraceae	annual herb	Feb-May	FE	None	1B.2	Chenopod scrub, Valley and foothill grassland
Opuntia basilaris var. *treleasei*	Bakersfield cactus	Cactaceae	perennial stem	Apr-May	FE	CE	1B.1	Chenopod scrub, Cismontane woodland, Valley and foothill grassland
Stylocline masonii	Mason's neststraw	Asteraceae	annual herb	Mar-May	None	None	1B.1	Chenopod scrub, Pinyon and juniper woodland
Trichostema ovatum	San Joaquin bluecurls	Lamiaceae	annual herb	(Apr-Jun)Jul-Oct	None	None	4.2	Chenopod scrub, Valley and foothill grassland

Showing 1 to 18 of 18 entries

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Kern County, California

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Giant Kangaroo Rat Dipodomys ingens Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6051	Endangered
San Joaquin Kit Fox Vulpes macrotis mutica Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2873	Endangered
Tipton Kangaroo Rat Dipodomys nitratoides nitratoides Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7247	Endangered

Reptiles

NAME	STATUS
Blunt-nosed Leopard Lizard Gambelia silus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/625	Endangered

Giant Garter Snake Thamnophis gigas — Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4482

Amphibians

NAME	STATUS

California Red-legged Frog Rana draytonii — Threatened
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/2891

Fishes

NAME	STATUS

Delta Smelt Hypomesus transpacificus — Threatened
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/321

Crustaceans

NAME	STATUS

Vernal Pool Fairy Shrimp Branchinecta lynchi — Threatened
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/498

Flowering Plants

NAME	STATUS
San Joaquin Wooly-threads Monolopia (=Lembertia) congdonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/3746	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/

conservation-measures.php

- Nationwide conservation measures for birds
  http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
Costa's Hummingbird Calypte costae This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9470	Breeds Jan 15 to Jun 10

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

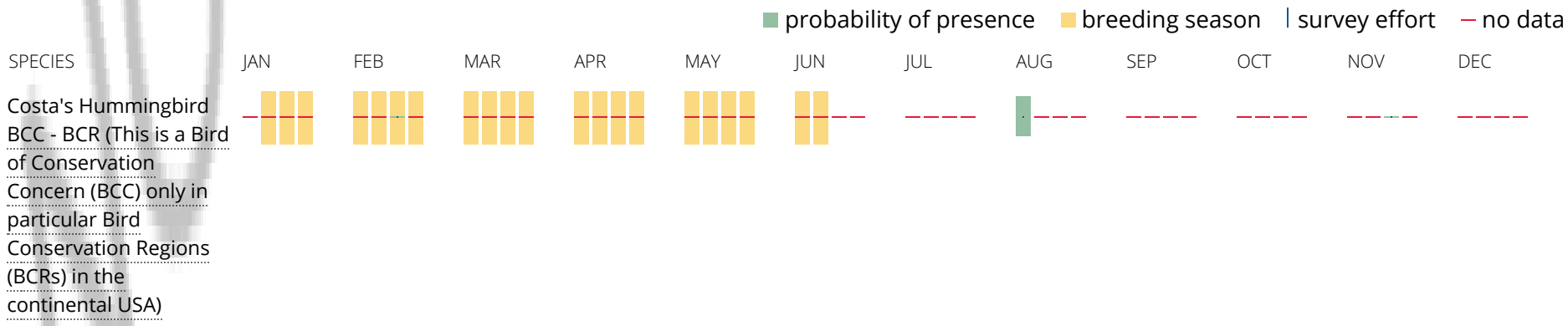
Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER POND

PABFx

RIVERINE

R4SBCx
R2UBHx
R5UBFx

R5UBF

A full description for each wetland code can be found at the National Wetlands Inventory website

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Appendix B. Representative Photographs of the Project Site

Photo 1: Rosedale spreading basin, north facing south (April 2021).

Photo 2: Calloway Canal adjacent to Rosedale spreading basin, east facing west (April 2021).

Photo 3: Proposed pipeline route to well 88-29-035 (facing northwest from Friant-Kern Canal tie-in location, with 8-29 Canal on the left).

Photo 4: Proposed pipeline route to well 88-29-035 (facing northwest with 8-29 Canal on the left and well 88-29-035 on the right in background).

Photo 5: Proposed pipeline route to wells 88-25-013, 88-25-010, 88-25-005, and 88-00-98 (facing east from Friant-Kern Canal, well 88-25-013 in distance).

Photo 6: Proposed pipeline route between wells 88-25-013 and 88-25-010 (facing west).

Photo 7: Well 88-25-010, on right in background (facing west).

Photo 8: Well 88-25-005 (facing west).

Photo 9: Proposed pipeline route between Calloway Canal and Friant-Kern Canal (facing east).

Photo 10: An example of a standard turn-in and small delivery gate (center) at Friant-Kern Canal.

Photo 11: Well 88-00-015 and adjacent canal (April 2021).

Photo 12: Canal adjacent to well 88-05-003 (April 2021).

Photo 13: Gopher burrows adjacent to well location 88-05-011 (April 2021).

Photo 14: Canal void of vegetation and burrows adjacent to well 88-00-098 (April 2021).

Appendix C – Proposed Water Quality Ledger Program

NOTICE OF SPECIAL BOARD OF DIRECTORS MEETING

FRIANT-KERN CANAL WATER QUALITY POLICY WORKSHOP

JUNE 17, 2020
10:00 AM
VIA WEBEX TELECONFERENCE

The Friant Water Authority and Friant-Kern Canal Water Quality Ad hoc Committee (Ad Hoc Committee) will hold a workshop to garner feedback on a comprehensive Friant-Kern Canal Water Quality Policy (Policy) for the Friant Division. This Policy is being developed in response to concerns regarding the implementation of programs and projects that could introduce water of lesser quality to the Friant-Kern Canal, when compared to water quality of historic deliveries from Millerton Lake.

The Ad Hoc Committee is made up of Friant Contractor directors and district managers from Arvin-Edison Water Storage District, Delano-Earlimart Irrigation District, Kern-Tulare Water District, Lindsay Strathmore ID, Lower Tule River ID, Pixley ID, Porterville ID, Shafter-Wasco ID, Saucelito ID, and Terra Bella ID.

In accordance with the Governor's Executive Order (N-29-20) and the declared State of Emergency, including social distancing directives as a result of the threat of the COVID-19 virus, this workshop will be held remotely via WebEx. This special meeting notice is being provided as a majority of the FWA Board of the Directors may participate in the workshop.

Members of the public may participate in the workshop using the information below:

WEBEX VIDEOCONFERENCE:

Join by phone
Tap to call in from a mobile device (attendees only)
+1-415-655-0001 US Toll
Global call-in numbers

Join from a video system or application
Dial 1332212429@friantwater.webex.com
You can also dial 173.243.2.68 and enter your meeting number.

Meeting password: ymMEF3VM5i3 (96633386 from phones)

Meeting number (access code): 133 221 2429,

-or-

AUDIO ONLY: **1-415-655-0001** (Enter meeting code **133 221 2429**)

Public Participation Information

Under the Americans with Disabilities Act, if you require a disability-related modification or accommodation to participate in this workshop, including auxiliary aids or services, please contact Toni Marie at 559-562-6305.

Friant
WATER AUTHORITY

Friant-Kern Canal Water Quality Policy

Draft

This page left blank intentionally.

CONTENTS

FIGURES

TABLES

ATTACHMENTS

ACRONYMS

µS/cm	microsiemens per centimeter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)
AF	acre-feet
Ad hoc Committee	Ad hoc Water Quality Committee
CV-SALTS	Central Valley Salinity Alternatives for Long-term Sustainability
EC	electrical conductivity
FKC	Friant-Kern Canal
Friant Division	Friant Division of the Central Valley Project
FWA	Friant Water Authority
mg/L	milligrams per liter
Policy	Friant-Kern Canal Water Quality Policy
TDS	total dissolved solids
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
RWA	Recovered Water Account

BACKGROUND

The Ad hoc Water Quality Committee (Ad hoc Committee) is working to develop a comprehensive Friant-Kern Canal Water Quality policy (Policy) to be adopted by the Friant Division of the Central Valley Project (Friant Division). This Policy is in response to concerns regarding the implementation of programs and projects that could introduce water of a lesser quality to the Friant-Kern Canal (FKC), when compared to water quality of historic deliveries from Millerton Lake. This Policy would also be referenced in FKC projects as well as other projects that envision introducing water into the FKC. The Ad hoc Committee is composed of water district directors and managers from Arvin-Edison Water Storage District, Delano-Earlimart Irrigation District, Kern-Tulare Water District, Lindsay-Strathmore Irrigation District, Lower Tule River Irrigation District, Pixley Irrigation District, Porterville Irrigation District, Saucelito Irrigation District, Shafter-Wasco Irrigation District, and Terra Bella Irrigation District. The Ad hoc Committee is proposing a ledger mechanism to determine the required mitigation for introducing water of lesser quality into the FKC. This document describes the Draft Policy, which includes the Water Quality Mitigation Ledger, Water Quality Monitoring Program, and Water Quality Model.

WATER QUALITY MITIGATION LEDGER

The Water Quality Mitigation Ledger tracks and accounts for all inflows into and diversions from the FKC in order to determine appropriate mitigation for impacted water quality (attributable to the introduced water [or "Put"] and the corresponding distribution thereof [or "Take"]). The volume of additional surface water needed for mitigation, expressed as a percentage of the introduced water, or Put, is determined using an established mitigation rating curve. The mitigation rating curve is based on (1) constituent concentrations, and (2) agronomic principles that focus on leaching requirements in order to prevent constituent accumulation in the rootzone and resulting impacts on crops. This approach aims to balance concerns related to long-term groundwater quality with a multi-layered assessment of agronomic impacts as a durable solution. The process for developing the agronomic impacts evaluation and mitigation rating curve can be found in *Attachment A – Agronomic Impacts and Mitigation.*

The Water Quality Mitigation Ledger was developed utilizing a preliminary FKC water quality model that simulates water quality changes in the canal accounting for inflows, diversions, and various respective water quality conditions. A detailed example showing the ledger process is provided in Attachment B.

The principles of the Water Quality Mitigation Ledger and ledger process are detailed below:

1. The Water Quality Mitigation Ledger accounts for <u>all</u> inflows and diversions into and from the FKC, including diversions from Millerton Lake, groundwater and surface water pump-in and pump-back water, and all deliveries from the FKC.

2. The Water Quality Mitigation Ledger quantifies mitigation for Friant Division Long-Term Contractors that have an expectation to receive water consistent with quality conditions of Millerton Lake. Specifically, mitigation applies to the Take of Friant Division Class 1, Class 2, Recovered Water Account (RWA [Paragraph 16b]), and Unreleased Restoration Flows supplies. Friant Division Long-Term Contractors and third parties with supplies not delivered to the headworks of the FKC are not eligible to receive mitigation.

3. Mitigation is based on the water quality concentration of inflows above the established baseline. The mitigation rating curve is used to determine the volumetric percentage of introduced water, or Put, that each contractor that introduces water into the FKC, or "Contributor," owes. The mitigation rating curve (Figure 1) was developed using agronomic leaching factors described in Attachment A. Existing FKC inlet drains are exempt from providing mitigation.

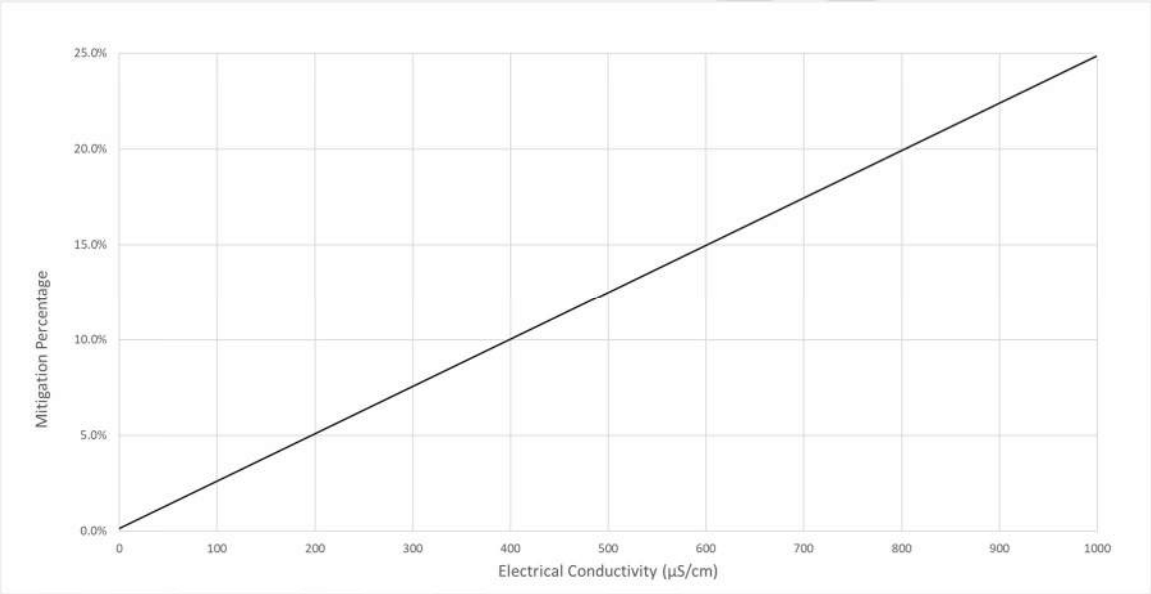
4. The established baseline is based on assumptions of current, minimum leaching practices by water users, or growers, in the region. Consistent with good agricultural practices, it is assumed that

growers are currently applying at least a 5 percent leaching fraction. Under the mitigation rating curve, this corresponds to an approximate electrical conductivity (EC) of 200 microsiemens per centimeter (µS/cm). It is assumed that growers are already managing the effects of applied water quality conditions up to 200 µS/cm of EC, and mitigation is only required for water quality conditions with incremental EC that exceed the baseline EC threshold of 200 µS/cm.

5. Mitigation volumes for each Put are distributed to each Friant Division Long-Term Contractor receiving an eligible Take, or "Taker," downstream based on the volumetric proportion of the Take on a weekly basis.

6. Mitigation occurs in real time by the Contributor and offsets a like volume of each Taker's supply at the end of a reporting period. Additional mitigation is not be required due to the water quality conditions of the mitigation.

7. Water quality conditions and flows are tracked daily. The ledger and required mitigation are balanced weekly and reported and transferred monthly.



Key:
µS/cm = microsiemens per centimeter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)

Figure 1. Proposed Mitigation Rating Curve based on Boron Sensitivity and Normalized to Electrical Conductivity

POLICY PRINCIPLES

The principles for the Policy are detailed below:

1. The Water Quality Mitigation Ledger will apply to all programs beginning upon U.S. Department of the Interior, Bureau of Reclamation (Reclamation) approval of the Policy.

2. Friant Water Authority (FWA) will appoint the Water Quality Committee of Friant Division Long-Term Contractors and include representatives of all Friant Division contractor Contributors and impacted parties. This advisory committee will provide recommendations to FWA and Reclamation on operations and monitoring requirements of the FKC.

3. When the Friant Division Class 1 contract allocation is less than or equal to 25 percent, the Water Quality Committee of Friant Contractors will evaluate the current year operations as they relate to the Water Quality Mitigation Ledger.

4. The value of additional surface water provided by the mitigation rating curve is inclusive of additional costs for any changes in soil amendments needed to manage the incremental difference of water quality conditions.

5. The costs to implement and manage the Policy, including the Water Quality Mitigation Ledger, Water Quality Monitoring Plan (Attachment C), and Water Quality Model will be paid by the Contributors as determined and charged by FWA. Detailed information regarding the costs to implement and manage the Policy can be found in Attachment D.

6. If a future regulatory cost or equivalent fee (including but not limited to any fees or assessments by the California Department of Water Resources or the State Water Resources Control Board via one of its programs such as CV SALTS) is imposed on impacted Friant Division Long-Term Contractors and a portion of such fee can reasonably be attributed to the incremental difference of water quality conditions due to the Contributor's actions, then the Water Quality Committee of Friant Contractors will address the matter. The Water Quality Committee of Friant Contractors shall determine potential impacts due to the Policy and make as-needed adjustments to reflect the additional regulations.

7. Defined Policy requirements may be re-evaluated if there is significant, scientifically-based justification (e.g., agronomic effects) and three out of five southern contractors (Arvin-Edison Water Storage District, Shafter-Wasco Irrigation District, Delano-Earlimart Irrigation District, South San Joaquin Municipal Utility District, or Kern-Tulare Water District) agree to re-open discussions.

OPERATIONS CRITERIA

Pump-in and pump-back operations will be governed by the following criteria:

1. FKC in-prism water quality that exceeds any of the following thresholds will require systematic ceasing of pump-in and pump-back operations, prioritizing the greatest Contributors until water quality conditions are below the threshold:

    a. Title 22. The Domestic Water Quality and Monitoring Regulations specified by the State of California Health and Safety Code (Sections 4010-4037), and Administrative Code (Sections 64401 et seq.), as amended.

    b. Water quality thresholds defined in Table 1. Table 1 accounts for constituent thresholds of sensitive crops, leaching requirements, regulated deficit irrigation during almond hull split from July 1 through August 31, and also provides flexibility in the second half of the contract year depending on observed water quality from March 1 through June 30.

        i. Table 1 presents alternative water quality thresholds for Period 3 (September 1 – February 28) that are dependent on the measured water quality during Period 1 (March 1 – June 30). If the measured average chloride concentration for Period 1 exceeds 70 mg/L, the chloride threshold remains at 102 mg/L for Period 3a. If the measured average chloride concentrations for Period 1 are less than or equal to 70 milligrams per liter (mg/L), the allowable chloride concentration increases from 102 mg/L to 123 mg/L for Period 3b.

        ii. It is estimated that an average of one week is required for in-prism water quality to turnover. Prior to the onset of the defined hull split period requirements (July 1), FWA will evaluate current canal operations and water quality conditions to determine if this one-week period should be adjusted.

Table 1. Friant-Kern Canal In-Prism Water Quality Thresholds

Period	Salinity Threshold expressed as EC (µS/cm)	Chloride Threshold (mg/L)	Boron Threshold (mg/L)[1]	SAR
Period 1 March 1 – June 30	1,000[2]	102[3]	0.4	3
Period 2 July 1 – August 31	500[4]	55[4]	0.4	3
Period 3a September 1 – February 28	1,000[2]	102[3]	0.4	3
Period 3b September 1 – February 28	1,000[2]	123[5]	0.4	3

Notes:
Thresholds adapted from Grieve, C.M., S.R. Grattan and E.V. Maas. 2012. Plant salt tolerance. In. (W.W. Wallender and K.K. Tanji, eds). Agricultural Salinity Assessment and Management (2nd edition). ASCE pp 405-459; and Ayers, R.S. and D.W. Westcot 1985. Water quality for agriculture. FAO Irrigation and Drainage Paper 29 (rev 1). Food and Agriculture Organization of the United Nations. Rome

For addition detail, see Attachment A - Agronomic Impacts and Mitigation.

When Friant-Kern Canal in-prism water quality conditions in this table are exceeded, Friant Division Long-Term Contractors will work together to seek 1:1, unleveraged, and cost-neutral exchanges for pump-in and pump-back programs. This does not apply to spot-market or third-party exchanges.

[1] Grapes are used as a representative crop for boron sensitivity and are prevalent in the Friant Division. They are used as a surrogate for many other sensitive crop types such as apricots, figs, and grapefruits. Threshold assumes conventional irrigation with minimum 20 percent leaching fraction applied.

[2] Threshold assumes minimum of 20 percent leaching requirement applied and adjusted to account for regulated deficit irrigation during almond hull split period (July 1 – August 31) in order to not exceed maximum EC_{et}. Almonds on Nemaguard rootstock are used as a representative crop for salinity sensitivity and are prevalent in the Friant Division. They are used as a surrogate for many other sensitive crop types such as apples, cherries, pears, pistachios, and walnuts.

[3] Threshold assumes minimum of 20 percent leaching requirement applied and then adjusted to account for regulated deficit irrigation during almond hull split period (July 1 – August 31) in order to not exceed maximum Cl-et. Almonds on Nemaguard rootstock used as a representative crop for chloride sensitivity. They are used as a surrogate for other sensitive crops including cherries, pistachios, and walnuts.

[4] Threshold applies to almond hull split period when regulated deficit irrigation is applied to avoid hull rot. This threshold is used assuming irrigation applications are reduced to 50 percent of the tree water requirement and subsequently thresholds applied for the remainder of the year have been adjusted to account for additional salt accumulation. This threshold was developed with consideration of existing program operations, historical water quality data, and absolute water quality thresholds.

[5] If the measured average chloride concentration in Period 1 (March 1 – June 30) is less than or equal to 70 mg/L, the allowable chloride threshold for Period 3 (September 1 – February 28) is increased to 123 mg/L.

Key:
µS/cm = microsiemens per centimeter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)
ASCE = American Society of Civil Engineers
Cl^-_{et} = maximum chloride threshold of the saturated soil paste
EC = electrical conductivity of applied water
EC_{et} = Soil salinity threshold for a given crop
FAO = Food and Agriculture Organization of the United Nations
Friant Division = Friant Division of the Central Valley Project
mg/L = milligrams per liter
SAR = sodium adsorption ratio
TDS = total dissolved solids

2. Pump-in or pump-back programs will not be introduced to the FKC during the Friant Division uncontrolled season as declared by Reclamation unless the program can assist in alleviating an FKC prorate or is below the baseline and therefore does not require mitigation.

3. Friant Division Long-Term Contractors will cooperate to maximize conveyance of additional, beneficial surface water supplies while still meeting water quality requirements and thresholds in the FKC. When FKC in-prism water quality conditions in Table 1 are exceeded, Friant Division Long-Term Contractors will work together to seek 1:1, unleveraged, and cost-neutral exchanges for pump-in and pump-back programs. This does not apply to spot-market or third-party exchanges.

ADDITIONAL IMPLEMENTATION REQUIREMENTS

In addition to the Policy Principles and Operations Criteria described above, several programmatic challenges were identified that will continue to be evaluated and addressed, and are as follows:

1. Identify all existing programs and pump-ins and determine which are exempt from the Policy (e.g., handling of City of Orange Cove flood flow pump-ins).

2. Address FWA's authority to implement the Policy. FWA's role is limited to complying with Federal and State laws and cannot adopt its own regulations, but could endorse or possibly adopt the Policy as "guidelines" and incorporate significant aspects of the proposed Policy as part of its CEQA approval for the Long-Term Recapture and Recirculation of Restoration Flows and FKC Pump-Back projects.

3. Coordinate with Reclamation in updating the *2008 Policy for Accepting Non-Project Water into the Friant-Kern and Madera Canals* and work with Reclamation regarding the potential adoptions of the Policy.

4. Define standard operating procedures to account for mitigation and its administration, including contractual requirements with Reclamation (e.g., transfer agreements, Warren Act contracts); Water Quality Mitigation Ledger; and water quality threshold management.

5. Finalize the FKC Water Quality Monitoring Program and Water Quality Model.

Friant
WATER AUTHORITY

Friant-Kern Canal Water Quality Policy

Draft Attachment A – Agronomic Impacts and Mitigation

CONTENTS

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

µmhos/cm	micromhos per centimeter (1 µmhos/cm = 1 µS/cm = 1/1,000 dS/m)
µS/cm	microsiemens per centimeter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)
Ad hoc Committee	Ad hoc Water Quality Committee
AEWSD	Arvin-Edison Water Storage District
ATP	adenosine triphosphate
AW	applied water
B	boron
B_e	boron concentration of the saturated soil paste (rootzone boron)
B_{et}	maximum boron threshold of the saturated soil paste
B_w	boron concentration of applied irrigation water
B_{sw}	boron threshold for soil water concentration
Ca	calcium
Ca^{2+}	calcium ion
$CaCO_3$	calcite or calcium carbonate
cfs	cubic feet per second
Check 21	Check Structure 21 at milepost 172,40 on the California Aqueduct
Cl^-	chloride ion
Cl^-_e	chloride concentration of the saturated soil paste (rootzone chloride)
Cl^-_{et}	maximum chloride threshold of the saturated soil paste
Cl^-_w	chloride concentration of applied irrigation water
CO_2	carbon dioxide
CO_3^{2-}	carbonate ion
CVC	Cross Valley Canal
DEID	Delano-Earlimart Irrigation District
dS/m	deciSiemens per meter (1 dS/m = 1,000 µmhos/cm = 1,000 µS/cm)
EC	electrical conductivity
EC_e	electrical conductivity of the saturated soil paste (rootzone salinity)
EC_{dw}	electrical conductivity/salinity of irrigation drainage water
EC_w	electrical conductivity/salinity of applied irrigation water
ET	evapotranspiration
F_c	concentration factor
FKC	Friant-Kern Canal
Friant Division	Friant Division of the Central Valley Project
FWA	Friant Water Authority

HCO_3^-	bicarbonate
Intermediate	Water quality representing the average of California Aqueduct Check 21 and Cross Valley Canal water qualities
KTWD	Kern Tulare Water District
LF	leaching fraction
LR	leaching requirement
Mg^{2+}	magnesium ion
Mg	magnesium
meq/L	milliequivalents per liter
mg/L	milligrams per liter (equivalent to ppm)
Na^+	sodium ion
Na	sodium
pH	Measure of acidity or alkalinity
Policy	Friant-Kern Canal Water Quality Policy
ppm	parts per million (equivalent to mg/L)
RDI	regulated deficit irrigation
SAR	sodium adsorption ratio
SAR_{adj}	adjusted sodium adsorption ratio
SID	Saucelito Irrigation District
SSJMUD	South San Joaquin Municipal Utility District
SWID	Shafter-Wasco Irrigation District
TDS	total dissolved solids

BACKGROUND

The Ad hoc Water Quality Committee (Ad hoc Committee) is working to develop a comprehensive Friant-Kern Canal Water Quality Policy (Policy) to be adopted by the Friant Division of the Central Valley Project (Friant Division). This policy is in response to concerns regarding the implementation of programs and projects that could introduce water of a lesser quality to the Friant-Kern Canal (FKC), when compared to water quality of historic deliveries from Millerton Lake. This Policy would also be referenced in FKC projects as well as other projects that envision introducing water into the FKC. The Ad hoc Committee is composed of water district directors and managers from Arvin-Edison Water Storage District (AEWSD), Delano-Earlimart Irrigation District (DEID), Kern-Tulare Water District (KTWD), Lindsay-Strathmore Irrigation District, Lower Tule River Irrigation District, Pixley Irrigation District, Porterville Irrigation District, Saucelito Irrigation District (SWID), Shafter-Wasco Irrigation District, and Terra Bella Irrigation District. The Ad hoc Committee is proposing a ledger mechanism to determine the required mitigation for introducing water of lesser quality into the FKC. This attachment to the Policy describes agronomic effects, mitigation requirements, maximum water quality thresholds for key constituents developed for the FKC. The thresholds are specific to irrigation periods that correspond to the growing season and agricultural management practices during the year.

AGRONOMIC EFFECTS

When assessing the suitability of water for irrigation, three main hazards or "agronomic thresholds" are considered (Ayers and Westcot, 1985): (1) the salinity hazard (electrical conductivity of the applied irrigation water [EC_w]), (2) the hazard posed by specific ions (chloride [Cl^-], boron [B], and sodium [Na^+]), and (3) the infiltration hazard (sodium adsorption ratio [SAR] and ECw). There are other parameters, such as acidity (pH) or alkalinity, sediments and nutrients that can affect calcite ($CaCO_3$) deposits, emitter clogging, crop development, and corrosion, but these do not fall under "agronomic thresholds."

The primary source of imported water is proposed to come from the Friant-Kern Canal Reverse Pump-Back Project. Water quality conditions from this project could range from existing conditions in the Cross Valley Canal (CVC) to that from the California Aqueduct, depending on respective canal operations. For the analysis presented herein, both CVC and California Aqueduct (measured at Check 21) water qualities were used, as well as a weighted average of those two sources (Intermediate) applied to show the range of potential imported water qualities. Source water quality concentrations are shown in Table 1 and Table 2.

Table 1. Average Concentrations of Various Irrigation Water Quality Constituents

LOCATION	WATER QUALITY CONSTITUENTS			
	TDS (/L)	EC_w (µS/cm)	Boron (B) (mg/L)	Chloride (Cl^-) (mg/L)
FKC[1, 2]	24	40	0.04	1.9
CVC[1, 3]	180	340	0.11	45.0
Intermediate[4]	232	420	0.16	63.2
Check 21[5]	283	500	0.21[6]	81.3

Note:
[1] Water quality data from AEWSD grab samples lab data from 2010 – 2019. Averages exclude months when mixing occurred.
[2] Sample taken at terminus of FKC.
[3] Sample taken at AEWSD CVC, Pumping Plant 6 or 6B Forebay.
[4] Weighted average of CVC and Check 21 water quality.
[5] California Aqueduct measured at Check 21 from 2009-2017.
[6] Check 21 Boron measurements only available for years 1967 – 1976.
Key:
AEWSD = Arvin Edison Water Storage District
Check 21 = Check Structure 21 at milepost 172,40 on the California Aqueduct
CVC = Cross Valley Canal
µS/cm = microsiemens per centimeter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)
EC_w = electrical conductivity of applied water
FKC = Friant-Kern Canal
Intermediate = Water quality representing the average of California Aqueduct Check 21 and Cross Valley Canal water qualities
mg/L = milligrams per liter
TDS = total dissolved solids

Table 2. Average Monthly Electrical Conductivity, Chloride, and Boron Concentrations by Source and Year Type

MONTH	CVC[1]			CHECK 21[2]		
	Wet[3]	Average[4]	Dry[5]	Wet[6]	Average[4]	Critical[7]
Average Monthly Electrical Conductivity Concentrations by Source and Year Type (µS/cm)						
January	431	369	287	309	523	598
February	570	433	378	269	551	680
March	261	273	275	248	545	671
April	240	270	277	255	500	616
May	--	306	306	195	479	575
June	385	384	383	174	471	597
July	257	292	307	206	385	542
August	286	308	335	249	425	643
September	323	326	329	247	524	689
October	429	360	315	539	573	628
November	396	356	330	480	529	614
December	368	349	337	532	554	624
Average Monthly Chloride Concentrations by Source and Year Type (mg/L)						
January	74.5	54.4	27.7	34.0	84.5	99.0
February	104.0	63.0	46.6	31.5	87.4	104.3
March	21.0	21.8	22.0	27.5	82.9	104.3
April	19.0	21.4	22.0	33.5	72.1	100.0
May	--	31.4	31.4	25.0	73.0	88.7
June	48.5	46.1	45.2	19.0	73.4	98.3
July	28.5	33.7	35.8	25.5	55.8	84.0
August	39.6	40.7	42.0	31.0	70.3	109.0
September	53.0	48.4	43.8	22.0	92.6	116.7
October	76.0	55.0	41.0	105.5	101.6	106.7
November	68.5	54.8	45.7	90.5	86.8	95.7
December	55.5	46.7	40.8	101.0	95.5	103.0
Average Monthly Boron Concentrations by Source and Year Type (mg/L)[8]						
January	0.12	0.11	0.10	0.23	0.20	0.20
February	0.16	0.15	0.14	0.30	0.26	0.25
March	0.10	0.11	0.11	0.33	0.31	0.30
April	0.11	0.12	0.12	0.30	0.29	0.10
May	--	0.12	0.12	0.27	0.25	0.20
June	0.16	0.15	0.14	0.20	0.18	0.20
July	0.11	0.11	0.12	0.13	0.16	0.20
August	0.09	0.10	0.12	0.10	0.19	0.20
September	0.08	0.09	0.11	0.10	0.16	0.10
October	0.11	0.10	0.09	0.25	0.19	0.15
November	0.11	0.11	0.11	0.20	0.18	0.15
December	0.11	0.11	0.12	0.20	0.19	0.15

Note:
[1] Water quality data from AEWSD grab samples lab data from 2010 – 2019.
[2] California Aqueduct measured at Check 21 from 2009-2017.
[3] CVC wet year averages represent the monthly average for San Joaquin Index year types below normal, above normal, and wet and excludes months where there is mixing.
[4] Average concentrations shown represent the average of all year types and excludes months where there is mixing.
[5] CVC dry year averages represent the monthly average for San Joaquin Index year types dry and critical and excludes months where there is mixing.
[6] Check 21 wet year averages represent the monthly average for San Joaquin Index wet year types only.
[7] Check 21 critical year averages represent the monthly average for San Joaquin Index critical years only.
[8] Check 21 Boron measurements represent years 1967 – 1976 per available data.
Key:
-- = no available data. CVC water quality in wet years during May were only mixed water quality.
AEWSD = Arvin-Edison Water Storage District
Check 21 = Check Structure 21 at milepost 172,40 on the California Aqueduct
CVC = Cross Valley Canal
µS/cm = microsiemens per centimeter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)
mg/L = milligrams per liter

SALINITY EFFECTS ON CROPS

The effects of salinity on crops are due to two separate properties in the saline media that can impact the crop individually but more often collectively (Läuchli and Grattan, 2012): (1) Salinity increases the electrical conductivity (EC) of the soil solution which reduces its the osmotic potential and (2) specific ions (I.e. Cl-, Na+ and B) in the soil solution can potentially be toxic to certain crops.

Osmotic effects occur when the concentration of salt in the soil solution is too high to allow for normal for crop growth. Dissolved salts reduce the osmotic potential of the soil solution. Plants must adjust osmotically through either the absorption of ions from the soil solution, or the synthesis and/or accumulation of organic solutes in the root cells. The synthesis of compatible organic solutes allows a plant to adjust osmotically and survive, but at the expense of plant growth (Munns and Tester, 2008). The synthesis of organic solutes requires a considerable amount of metabolic energy (i.e., adenosine triphosphate (ATP)) that is used for cell maintenance and osmotic adjustment that could otherwise be used for growth. As a result, salt-stressed plants are stunted, even though they may appear healthy in all other regards. Both processes of adjustment (accumulation of ions and synthesis of organic solutes) occur but the extent by which one process dominates depends on the type of crop and level of salinity (Läuchli and Grattan, 2012). And in a cell, compartmentalization is critical to keep toxic ions away from sensitive metabolic processes in the cytoplasm (Hasegawa et al., 2000). Such compartmentation is controlled by transport processes in the plasma membrane and tonoplast (i.e., vacuolar membrane). The efficiency of ion transport processes, as well as metabolic costs for organic-solute synthesis, differ from crop to crop and even within a species giving rise to different salinity tolerances.

TOXIC ION EFFECTS

Specific ions (i.e., Na^+, Cl^-, and B) in the soil solution can cause direct injury to crops, causing further crop damage from what occurs from osmotic effects. Typically, toxic ion effects are commonly found in woody perennials, such as tree and vine crops, while most annual row crops remain injury free unless salinity stress is severe. Woody perennial crops have little ability to exclude sodium or chloride from their leaves, and the plants are long-lived; hence, they often suffer toxicities at even moderate soil salinities. Typically, toxic ion effects become more critical to sensitive tree and vine crops over the years.

Chloride

Chloride and sodium toxicity can damage a plant/tree physically, biochemically and physiologically. As sodium and chloride move in the transpiration stream, they are deposited in the leaves. Older leaves have more water transpire from them and consequently have higher concentrations of sodium and chloride. Once accumulated in a leaf, sodium and chloride typically do not remobilize to other tissues. As the concentration in that leaf increases, the salts can physically desiccate cells causing injury in the form of leaf burn. Necrotic leaves no longer photosynthesize and produce carbohydrates for the tree, which in turn, will impact growth and production. But even before salts accumulate in leaves to levels that cause physical injury, those salts can reduce the chlorophyll content in leaves (Dejampour et al., 2012) and interfere with enzymatic activities affecting key metabolic pathways in both respiration and photosynthesis (Munns and Tester, 2008).

Boron

Although not a main “salinizing” constituent in applied irrigation water, boron can also cause injury to the crop. Boron is an essential micronutrient for plants, but the concentration range of plant-available boron in the soil solution optimal for growth for most crops is very narrow. Above this narrow range, toxicity occurs (Grieve et al., 2012). Boron toxicity, including how and where it is expressed in the plant, is related to the mobility of boron in the plant. Boron is thought to be immobile in most species where it accumulates in the margins and tips of the oldest leaves where injury occurs. However, boron can be re-mobilized by some species due to high concentrations of sugar alcohols (polyols) where they bind with boron and carry it to younger tissues (Brown and Shelp, 1997). These boron-mobile plants include almond, apple, grape, and most stone fruits. For these crops, boron concentrations are higher in younger tissue than in older tissue, and injury is expressed in young, developing tissues in the form of twig die back, gum exudation, and reduced

bud formation. Boron-immobile plants such as pistachio, tomato, and walnut do not have high concentrations of polyols, and the boron concentrates in the margins of older leaf tissues. Injury in these crops is expressed as the classical necrosis on leaf tips and margins.

Sodium

Sodium can be problematic to a crop in several ways. It can be directly toxic to the plant, it can interfere with the nutritional status of the plant (e.g., Na^+-induced calcium [Ca^{2+}] deficiency), or it can indirectly affect the crop due to its adverse effect on soil structure. Some trees are very sensitive and can develop Na^+ toxicity when concentrations of Na^+ are as low of 5 milliequivalents per liter (meq/L) (115 mg/L) in the soil water. However, this observation was made before scientists realized the importance of adequate Ca^{2+} in the soil water for root membrane stability to maintain their selectivity for ion uptake. With adequate Ca^{2+}, such as that provided by gypsum applications, sodium toxicity may never be observed in these sensitive trees at such low sodium concentrations. Therefore, rather than having a threshold for Na^+ per se, the sodium-calcium ratio in the soil solution is a better indicator of Na^+ toxicity. The SAR of the applied irrigation water has been used as a surrogate for the sodium-calcium ratio, and the general rule is an SAR < 3 is not problematic.

$$SAR = \frac{Na^+}{\sqrt{\frac{(Ca^{2+} + Mg^{2+})}{2}}}$$

Where Na^+, Ca^{2+}, and magnesium ion (Mg^{2+}) concentrations are expressed in meq/L.

This is different when assessing sodium's indirect effect on soil structural stability (see the Infiltration Hazard section that follows). Table 3 shows critical SAR of the applied irrigation water above which can cause injury or nutritional distress in sensitive crops. Table 4 shows the seasonal average SAR for various water sources.

Table 3. Critical SAR of Applied Irrigation Water

CROP[1]	CRITICAL SAR OF APPLIED IRRIGATION WATER
All Crops	< 3

Note:
[1] Many tree crops are sensitive to Na+ toxicity after several years when sapwood converts to heartwood releasing Na^+ from the root to the shoot. Most annual crops are insensitive to Na^+ per se provided there is sufficient Ca^{2+} in the soil solution to maintain membrane integrity and ion selectivity. Hence, the ratio of sodium to calcium is more critical (Grattan and Grieve, 1992).

Key
Ca^{2+} = calcium ions
Na^+ = sodium ions
SAR = sodium adsorption ratio

Table 4. Seasonal Average SAR for Various Water Sources

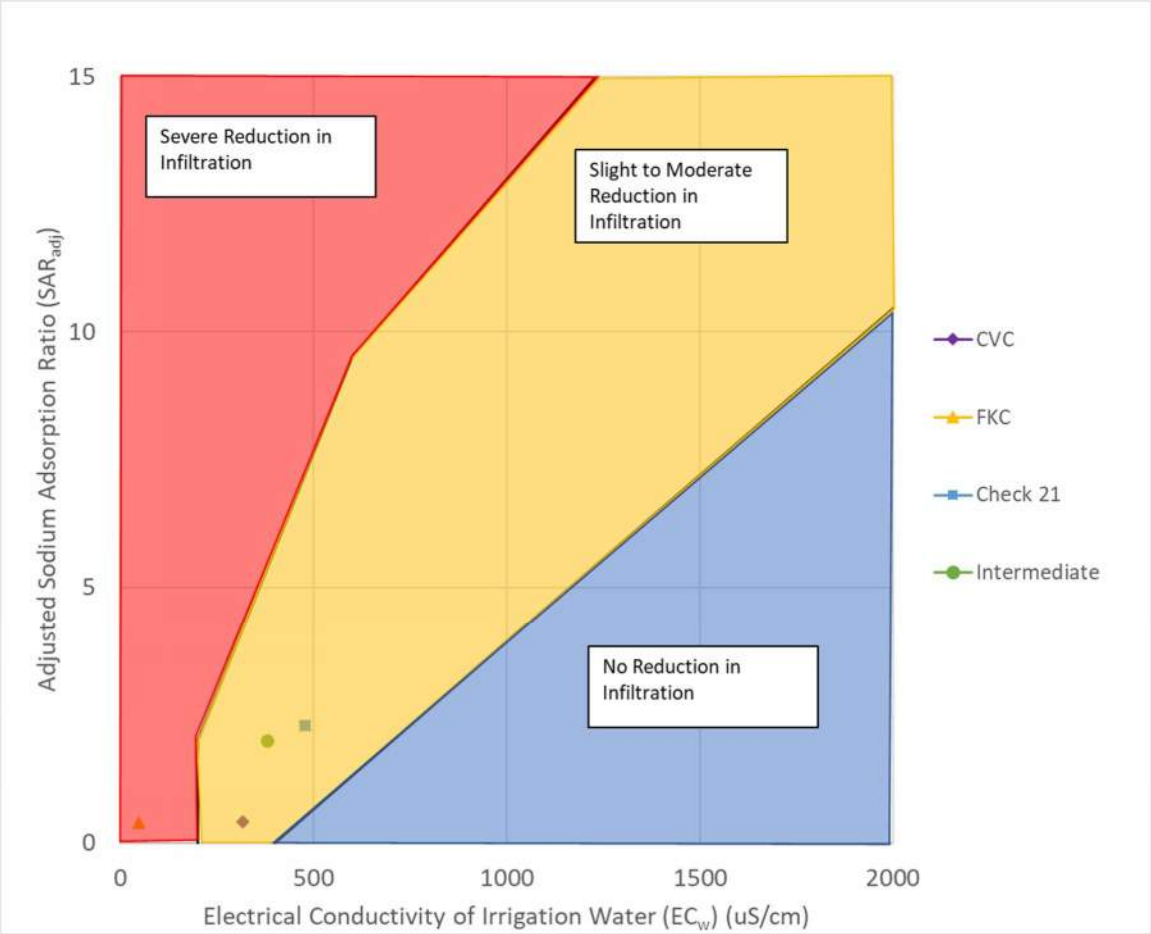
VALUE[1]	FKC[2, 3]	CVC[2, 4]	INTERMEDIATE[5]	CHECK 21[6]
Average	0.46	1.68	1.99	2.27
Maximum	0.87	2.04	2.46	2.96
Minimum	0.28	1.10	1.61	1.79

Note:
[1] March through October period.
[2] Water quality data from AEWSD grab samples lab data from 2011 – 2017.
[3] Sample taken at terminus of FKC.
[4] Sample taken at AEWSD CVC, Pumping Plant 6 or 6B Forebay.
[5] Weighted average of CVC and Check 21 water quality.
[6] California Aqueduct measured at Check 21 from 1968-2017.
Key
AEWSD = Arvin Edison Water Storage District
Check 21 = Check Structure 21 at milepost 172,40 on the California Aqueduct
CVC = Cross Valley Canal
FKC = Friant-Kern Canal
Intermediate = Water quality representing the average of California Aqueduct Check 21 and Cross Valley Canal water qualities
SAR = sodium adsorption ratio

INFILTRATION HAZARD

Sodium Adsorption Ratio

The SAR has been the standard used for assessing the infiltration hazard of applied irrigation water (Ayers and Westcot, 1985). But the actual infiltration hazard is assessed by balancing the opposite effects of salinity (EC_w) and sodicity (i.e., SAR) on aggregate stability. High salinity and low SAR are both important in maintaining adequate soil structure, which promotes better infiltration. Even though coarse-textured soils infiltrate faster than fine-textured soils, the hazard exists for all soil types. Typically, the adjusted SAR (SAR_{adj}) is used rather than the SAR as it more accurately accounts for $CaCO_3$, precipitation, and dissolution processes in the soil solution near the soil surface that control the free Ca^{2+} concentration. Figure 1 shows the relationship between the EC_w of the applied irrigation water and the SAR_{adj} as it relates to zones of "likely reductions" in infiltration rates (red), "slight to moderate reductions" in infiltration rates (yellow) and "no reductions" in infiltration rates (blue), adapted from Hanson et al., 2006. The threshold value is, therefore, variable and is considered to be the line that separates the "blue" and "yellow" zones on Figure 1. It is very important to note that low EC_w concentration (i.e., EC_w < 200 µS/cm) causes a reduction in water infiltration regardless of the SAR. Figure 1 also compares this relationship with various water sources. Note that FKC water falls in the red "severe reduction in infiltration" zone because of its low EC_w concentration, while water from the CVC or mixed with CVC water falls in the yellow "slight to moderate reduction in infiltration" zone. The addition of gypsum to FKC water increases the EC_w concentration, moving the point to the right and away from the "severe reduction in infiltration" zone while slightly reducing the SAR.



Key:
µS/cm = microsiemens per centimeter
Check 21 = California Aqueduct Check 21
CVC = Cross Valley Canal
FKC = Friant-Kern Canal
Intermediate = Water quality representing the average of California Aqueduct Check 21 and Cross Valley Canal water qualities

Figure 1. Comparison of Various Water Source Relationship between the Salinity of Applied Irrigation Water and the Adjusted Sodium Adsorption Ratio

Calcium-Magnesium Ratio

Calcium nutrition can be problematic under several conditions. Calcium deficiency can occur under low-saline conditions when the concentration of free calcium [Ca^{2+}] is $\leq$ 1-2 millimoles/L in the soil solution. Deficiency can also occur under high sodic conditions where the SAR exceeds 10-15 in sensitive plants due to high sodium-calcium ratios or in alkaline conditions where Ca^{2+} precipitates out of the soil solution as it forms $CaCO_3$. Due to competition in the plant between calcium and magnesium at the root membrane, calcium nutrition could potentially be compromised when the calcium-magnesium ratio is generally less than 1 (Rhoades, 1992). Table 5 shows the seasonal average calcium-magnesium ratio for various water sources. Note the ratios for both FKC and CVC water are considerably higher than 1, while the ratio at California Aqueduct Check 21 is very close to 1 but will likely increase in the soil solution as the infiltrating water dissolves existing gypsum in the soil from previous amendment use. Therefore, calcium deficiencies, using CVC or Check 21 water or any mixture of the two, are unlikely.

Table 5. Seasonal Average Calcium-Magnesium Ratio for Various Water Sources

VALUE[1]	FKC,[2 3]	CVC[2, 4]	INTERMEDIATE[5]	CHECK 21[6]
Average	3.54	4.37	1.55	0.92
Maximum	6.16	8.24	2.00	1.00
Minimum	0.17	2.14	1.20	0.77

Note:
Based on molar or equivalent concentrations.
[1] March through October period.
[2] Water quality data from AEWSD grab samples lab data from 2011 – 2017.
[3] Sample taken at terminus of FKC.
[4] Sample taken at AEWSD CVC, Pumping Plant 6 or 6B Forebay.
[5] Weighted average of CVC and Check 21 water quality.
[6] California Aqueduct measured at Check 21 from 1968-2017.
Key
AEWSD = Arvin Edison Water Storage District
Check 21 = Check Structure 21 at milepost 172,40 on the California Aqueduct
CVC = Cross Valley Canal
FKC = Friant-Kern Canal
Intermediate = Water quality representing the average of California Aqueduct Check 21 and Cross Valley Canal water qualities
SAR = sodium adsorption ratio

PH AND BICARBONATE EFFECTS

The pH of both the applied irrigation water and the soil solution are important factors that may affect either the suitability of water for irrigation or its effect on nutrient availability to the crop. And many of the adverse effects of pH are associated with combined high alkalinity (high concentrations of bicarbonate [HCO_3^-] and carbonate [CO_3^{-2}]). In slightly alkaline waters (pH 7- 8.3), the alkalinity is from bicarbonate. Only when the pH exceeds 8.3 does carbonate become present. The pH of the water is an indication of the activity of the hydrogen ion. The numerical pH value is expressed on a negative log scale such that a one-unit increase or decrease corresponds to a ten-fold increase or decrease in the hydrogen ion activity. Therefore, a change of soil pH from 6 to 8 corresponds to a hundred-fold decrease in the hydrogen ion activity.

The pH of applied irrigation water can affect irrigation equipment or cause calcite (i.e. lime) deposits on vegetation. Regarding irrigation equipment, the pH is one of several water quality factors than can influence corrosion of galvanized pipes or other metallic parts. The pH can also influence precipitation of calcite ($CaCO_3$) at the orifices of drip emitters or minisprinklers which will affect the system's overall performance. This can be problematic if alkaline irrigation water, combined with sufficiently high bicarbonate and calcium concentrations, is used over the long term without periodic acid flushes to reduce scale buildup. Calcite precipitation becomes more problematic if the pH of the applied irrigation water exceeds 8.5. In addition, if such water is sprinkler irrigated above the canopy, it can cause unsightly white deposits that form on leaves and fruit. While these deposits typically do not cause harm to the crop, they nonetheless can affect the aesthetic quality. Acid additions to the irrigation water will not only reduce the pH but will reduce the [HCO_3^-], reducing the potential for $CaCO_3$ precipitation. Acid additions convert bicarbonate to carbon dioxide (CO_2) gas.

As the applied irrigation water infiltrates the soil, it interacts with the soil minerals. Therefore, the pH of the infiltrating water will change as it interacts with soil minerals, but soils are typically well buffered, as are soils in the FWA service area. Well buffered soils resist large changes in pH in the soil solution. The seasonal average pH of the irrigation water ranges from 7.1 to 8.4 depending upon the mixture of FKC water and California Aqueduct water. Because of the buffering capacity of the soil, this range in applied irrigation water pH will make little impact of the pH of the soil solution.

The pH of the soil solution has a profound influence on plant nutrient availability, nutrient uptake and ion toxicity to plants. The vast majority of soils that are cultivated for crop production around the world fall within the neutral, slightly acid and slightly basic pH range (i.e. pH 6-8). This is the general range where nutrient availability is optimal. However, there are those soils where the pH falls far from this normal range and these,

if not corrected to an adequate range, can pose adverse effects on crops. Soils that are highly acidic (pH < 5.5) or highly alkaline (pH > 8.5) present a spectrum of challenges for the plant including nutrient availability, ion toxicities, and nutrient imbalances influencing the ion relations and nutrition within the plant itself (Läuchli and Grattan, 2012).

Most nutrients are not equally available to plants across the pH spectrum (Epstein and Bloom, 2005). Several mineral nutrients are severely affected in these non-optimal pH soils, particularly calcium, potassium, phosphorus, and iron. The reactions of plants to these nutrient elements under extreme soil pH conditions can affect plant growth, physiological processes and their morphological development (Läuchli and Grattan, 2012). The majority of the soils irrigated with waters from districts within the FWA, however, fall in the slightly alkaline range with the pH in the rootzone between 7.5 and 8.3 (UC Davis Soilweb https://casoilresource.lawr.ucdavis.edu/gmap/). Therefore, these soils are slightly alkaline, based largely on the natural abundance of calcite in the soil, and are at the upper end of the optimal pH range. Depending on the alkalinity of the soil water and [Ca^{2+}], some of the Ca^{2+} can precipitate out as $CaCO_3$ which decreases the calcium-magnesium ratio. Intermittent injection of acids in the applied irrigation water will reduce the pH and, consequently, the alkalinity of the water. Not only is this a maintenance measure to reduce calcite buildup on the orifices of drip emitters and minisprinklers, it drops the pH of the water which decreases bicarbonate, increases the [Ca^{2+}] and availability of other plant nutrients. Most growers in the San Joaquin Valley have some maintenance, acid-injection program in place. However, in Kern county, this may not be common practice in all districts. Acid applications, the residual gypsum in the soil and periodic applications of additional gypsum, are all a means of providing sufficient free Ca^{2+} in soils in Kern country. Moreover, increasing the [Ca^{2+}] in the soil water simultaneously improves the calcium-magnesium ratio.

Sprinkler irrigated fruit and vegetable crops (approximately 20% of studied districts) could be susceptible to formation of white deposits on leaves and fruit, or “white wash,” and reduced marketability if bicarbonate concentrations, or [HCO_3], in applied irrigation water are too high (> 1.5 meq/L, leaving a white residue on the crop surface. Bicarbonate concentrations in the California Aqueduct water theoretically could cause “white washing” under sprinkler irrigation, especially during dry and breezy conditions. “White washing” is a concern to some growers and has been seen by growers occasionally in the study area; however, it is not known what the exact cause of the “white washing” was, whether it was from undiluted California Aqueduct water or some other source. Bicarbonate levels of 1.5 meq/L or 92 mg/L and higher may increase formation of white deposits. The seasonal average for [HCO_3] of CVC water is 78.5 mg/L. While this concentration is less than 92 mg/L, special management practices may be needed to mitigate or avoid “white wash” impacts during periods of elevated bicarbonate levels. These may include blending with higher quality sources or changing irrigation methods away from sprinklers that wet the foliage (Provost & Pritchard, 2012).

CORROSION AND DEGRADATION OF MATERIALS

The comparison of corrosion potential of California Aqueduct water and FKC water from Millerton Lake was performed by Provost & Pritchard in 2012 on several chemical constituents and calculated indices including: pH, Langelier Index, Ryzner Index, EC, resistivity, sulfates, and chlorides. This comparison generally showed that FKC water has a slight tendency to degrade concrete structures by leaching out minerals, but metallic corrosion will be low. Comparatively, California Aqueduct water will have a lower tendency to leach out minerals from concrete, and will have a more corrosive effect on metals, although there is only a slight difference between the two water sources in either case (Provost and Pritchard, 2012).

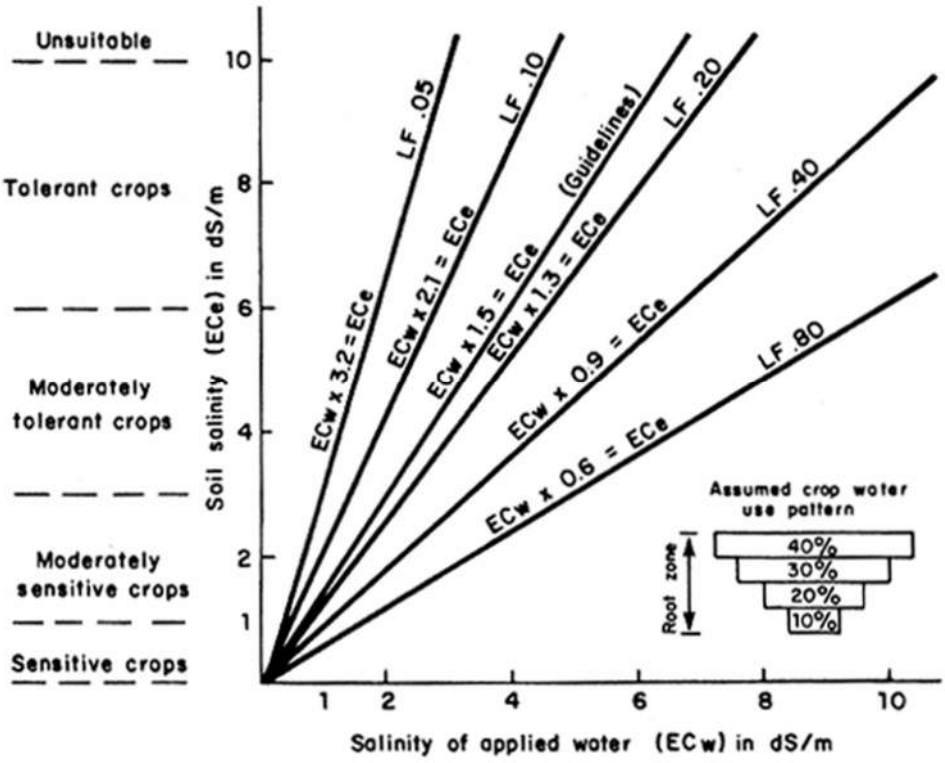
Materials such as brass, bronze, PVC, polyethylene, and stainless steel usually have a high corrosion tolerance, and therefore would not likely be affected by the exchange of source waters. The forecasted increase in corrosion from using more California Aqueduct water is likely manageable with the use of special coatings and proper selection of new materials and would likely result in minor increase in O&M costs (Provost and Pritchard, 2012).

AGRONOMIC LEACHING REQUIREMENTS

Agronomic leaching is the application of irrigation water in excess of the soil water holding capacity to neutralize the agronomic effects associated with increased salinity and ion toxicity in the crop rootzone. This approach aims to balance concerns related to long-term groundwater quality with a multi-layered assessment of agronomic impacts as a durable solution. The amount of leaching required, referred herein as maintenance leaching, depends upon the sensitivity of the crop to salinity and the irrigation water salinity. The higher the salinity of the applied irrigation water and the more sensitive the crop is to salinity, the greater the amount of leaching is required. This same leaching concept can also be applied to chloride and boron.

LEACHING FRACTION VS LEACHING REQUIREMENT

Often, leaching fraction (LF) and leaching requirement (LR) are used interchangeably. The two, in fact, are different. The LF is defined as the volume of water that drains below the rootzone divided by the volume of water that infiltrates the soil surface (equivalent to applied irrigation water assuming no surface runoff or evaporation). The LF can also be estimated based on the salinity of the applied irrigation water, or [EC_w], and that of the drainage water, or [EC_{dw}], where LF = EC_w/EC_{dw}. The crop roots extract water from the rootzone leaving the salts behind. If the crop rootzone is divided in quarters, typically the top quarter uses 40% of the water, the second quarter 30%, third quarter 20% and bottom quarter 10%. Therefore, the salt concentration increases with soil depth. The lower the LF, the more salts accumulate and concentrate at lower depths. Figure 2 is a representation of this relationship under conventional irrigation. The relationship between irrigation water salinity (EC_w) and soil salinity (EC_e) is linear but the slopes of the relationships are dependent upon the LF. The slopes decrease with increasing LF. The higher the LF, the higher the irrigation water salinity can be to maintain the yield of a crop. In Figure 2, note the dashed lines along the y-axis indicating the general salt tolerant categories as the salinity of the applied irrigation water changes.



Key:
dS/m = deciSiemens per meter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)
LF = leaching fraction

Figure 2. Relationship Between Soil Salinity (EC_e) and Salinity of the Applied Irrigation Water (EC_w) under a Series of Steady-State Leaching Fractions (0.05 to 0.80) (from Ayers and Westcot, 1985)

The LF concept is attractive in that it allows predictions of average rootzone salinity (EC_e) conditions from the applied irrigation water EC (EC_w) and assumed LF. Knowing the scientifically determined salinity threshold value (EC_{et}) for a particular crop, one can use this relationship to determine the maximum irrigation water salinity (EC_w) for a given LF. The relationship between EC_w, EC_e, and LF also depends on irrigation management. That is, EC_e = Concentration Factor (F_c) * EC_w where 'F_c' depends not only on the LF but the type of irrigation method. Applicable F_c values for conventional irrigation methods such as furrow or flood, and high frequency irrigation methods, such as drip and minisprinklers, are provided in Table 6.

Table 6. Concentration Factor Values for Conventional and High Frequency Irrigation (adapted from Suarez, 2012)

LEACHING FRACTION (LF)	CONCENTRATION FACTOR (F_C)	
	Conventional Irrigation	High Frequency Irrigation
0.05	2.79	1.79
0.10	1.88	1.35
0.20	1.29	1.03
0.30	1.03	0.87
0.40	0.87	0.77
0.50	0.77	0.70

The difference in F_c values between conventional and high frequency irrigation is largely based on how crop roots respond to the salinity in the rootzone. Under conventional irrigation, crops typically respond to the average rootzone salinity (i.e. the seasonal average of the four rootzone quarters of salinity). Under high frequency irrigation, crops respond to the water uptake weighted salinity (i.e. the salinity in the top quarter is weighted 40 percent, salinity in the second quarter is weighted 30 percent, and so on). Because the salinity in the top quarter is lower where evapotranspiration (ET) is higher and higher in bottom where ET is lower, the average rootzone salinity is lower under high frequency irrigation.

The LR, on the other hand, is the lowest LF needed to sustain maximum yield given the applied irrigation water salinity concentration, or [EC_w], and yield threshold for the given crop. In other words, it is the minimum leaching needed, given the crop type and water quality, to maintain the salinity (or chloride or boron), at the maximum rootzone concentration in the rootzone that the crop can tolerate. Any increase in rootzone concentration above this maximum level will cause injury or yield reductions. LR is an attractive concept because, given an irrigation water quality and crop sensitivity, the minimum leaching needed to sustain the rootzone salinity EC_e, rootzone chloride (Cl^-_e), or rootzone boron (B_e) at levels that would avoid or reduce damage or yield losses can be estimated.

LR can be estimated using the following equation (Rhoades and Merrill, 1976; Ayers and Westcot, 1985):

$$LR\% = \frac{EC_w}{5(EC_{et}) - EC_w}\ x\ 100$$

EC_w= Electrical conductivity of irrigation water
EC_{et}= Soil salinity threshold for a given crop

Note that the LR relationship can apply to chloride and boron by substituting their respective irrigation water concentrations (i.e. Cl^-_w or B_w) and their threshold values (Cl^-_{et} or B_{et}). The LR equation assumes that crops respond to an average rootzone salinity created by a 40-30-20-10% root water extraction pattern, similar to LF predictions using conventional irrigation. The difference is that LR predicts the minimal LF to achieve maximal yields whereas the LF approach assumes an LF first, then predicts what the EC_e will be given the EC_w of the irrigation water. Both are similar but solve the problem from different directions.

LIMITATIONS TO THE STEADY-STATE LEACHING CONCEPT

The leaching fraction or requirement is an attractive concept but has limitations. First, the leaching concept assumes steady-state conditions and thus has no time element. Therefore, there is no accounting for how long leaching will take, which will differ depending upon the permeability of the soils. Second, the evapotranspiration (ET) of the crop is assumed to be independent of the average rootzone salinity, but it is not (Letey and Feng, 2007). A salt-stressed crop will use less water than a non-stressed crop. Consequently, crop ET will be reduced, and leaching, with the same quantity of applied irrigation water, will be increased. And third, in drip irrigated fields, actual LFs are difficult to quantify because LF, soil salinity, soil water content, and root density all vary with distance and depth from the drip lines.

In light of these limitations, recent studies have shown that the EC_w and EC_e relations described by Ayers and Westcot (1985), which are based on steady-state LF conditions, tend to be too conservative and overestimate soil salinity and, therefore, overestimate yield losses in most cases (Corwin and Grattan, 2018; Letey et al., 2011). Transient-state models may more accurately predict soil salinity, as well as soil chloride, sodium and boron, but they are more complicated and require many more site-specific inputs and assumptions. Therefore, transient models are still too cumbersome and time consuming to replace steady-state models.

The LF and LR concepts are both steady-state, so they assume the amount of irrigation is not limiting. The amount of water needed for irrigation can be estimated as:

$$AW = ET/(1-LR)$$

AW = applied water
ET = evapotranspiration or crop water requirement
LR = leaching requirement

The units for applied water (AW) and ET or crop requirement are typically depths of water (i.e. inches or millimeters). But in many cases, the amount of water is limiting and therefore crops can be under-irrigated and therefore not achieve the required leaching. In this case, the salts in the crop rootzone will increase over time. At some point, depending upon the salinity of the imported water and crop sensitively, the salt content (or chloride or boron) can exceed the threshold level. Because the threshold values are based on seasonal averages, exceedances above the threshold are allowed to some degree without experiencing a reduction in yield. For example, if the average Cl^-_e was 100 mg/L for the first 2/3 the season and then reached 200 mg/L for the last 1/3 of the season due to insufficient leaching, almonds on "Nemaguard" rootstock would not be expected to be damaged because the seasonal average Cl^-_e would be 133 mg/L given the Cl^-_e threshold is 150 mg/L. Nevertheless, if the required leaching is not achieved, reclamation leaching would be required. Similarly, if the preseason soil salinity is over 150 mg/L and little to no leaching is applied during the season, injury would be expected to develop on almonds on "Nemaguard" rootstock. Therefore, the LR values for various crops and salinities are based on soils where the maintenance leaching fraction is achieved each irrigation. If the pre-existing soil salinity is initially high, then the soil is not at steady-state.

DIFFERENCE BETWEEN MAINTENANCE LEACHING AND RECLAMATION LEACHING

There is a distinct difference between maintenance leaching and reclamation leaching. Maintenance leaching occurs during each irrigation by applying more irrigation water than the soil can hold. This is the leaching fraction or requirement concept described above. Therefore, the AW is higher than the ET to accommodate the necessary leaching (see equation above). Reclamation leaching, on the other hand, occurs at the end of the irrigation season by applying excess irrigation water to flush the salts from the crop rootzone. Ideally, reclamation leaching would not be required if correct maintenance leaching is achieved each irrigation during the irrigation season. However, because some fields may not get the necessary leaching, salts can accumulate, and fields may require reclamation leaching at some time. In addition, low pressure systems such as drip and mini-sprinkler systems produce characteristic salt accumulation patterns in fields, even with sufficient downward leaching. Whether salts are building up in the rootzone or between drippers or

minisprinklers, reclamation leaching is a valuable preventative measure from time to time at the end of the irrigation season.

At the end of the irrigation season, salt can be removed by sprinkler irrigation (i.e equivalent to intermittent ponding). Figure 3 shows the extent of leaching needed to address rootzone salinity. For example, if the average rootzone salinity (ECe) at the end of the season is 3000 µS/cm and the goal is to reduce the salinity in the soil down to 600 µS/cm the salinity needs to be reduced to 600/3000 = 0.2 (y-axis) or 20% of what it was before leaching. Then the amount of sprinkler irrigation water to apply is 0.5 ft (x-axis) for every foot of soil to reclaim. If the goal is to reduce the top 2 feet, then 0.5 x 2ft = 1ft of water would be needed. This assumes the combined rainfall and applied reclamation leaching water needed.

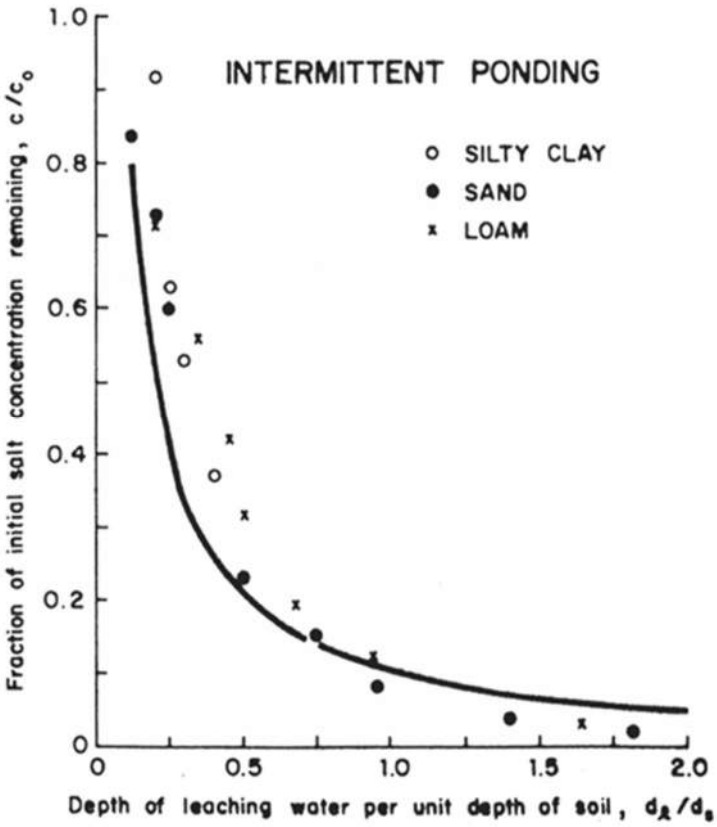


Figure 3. Reclamation Leaching Function under Sprinkler Irrigation or Intermittent Ponding (Ayers and Westcot, 1985).

The amount of reclamation leaching can be reduced by the amount of effective rainfall. To take advantage of rainfall, reclamation leaching should ideally take place after the rainfall season but before spring budding and leaf out begins, typically from October/November through March.

LEACHING AND NITROGEN MANAGEMENT

It is also important to address nitrogen management strategies combined with the salt leaching strategies. Unlike salts, nitrogen is very dynamic in the rootzone as it undergoes form changes from organic pools to inorganic fractions (primarily nitrate [NO_3^-] and ammonium [NH_4^+]). Ammonium, and particularly nitrate, are the forms primarily taken up by plants. Nitrate, being an anion, is relatively mobile in soils and is highly susceptible to leaching below the rootzone. Once nitrate leaches below the rootzone, chemical transformations are less likely to occur, and nitrate commonly continues leaching downward and eventually ends up in the aquifers. A 2002 study conducted by the Lawrence Livermore National Laboratory concluded that nitrate contamination in groundwater is “the number-one contaminant threat to California’s drinking water supply” (LLNL 2002).

Rootzone salinity control and nitrogen management is a conflicting problem. It is necessary to leach salt from the rootzone to avoid damage from salinity or ion toxicity, but nitrates will unavoidably be leaching below the

rootzone as well. If soil salinity is low at the beginning of the irrigation season (see reclamation versus maintenance leaching), then leaching at less than the critical LR is possible to avoid salt damage. Then, salinity in the profile will steadily build up over the season while soil nitrogen will be depleted due to crop uptake. At the end of the irrigation season, salinity will be the highest, and nitrate will be the lowest. Therefore, reclamation leaching can be implemented at the end of the irrigation season, and the process cycle repeats itself.

MITIGATION LEACHING REQUIREMENTS

ESTIMATING LEACHING REQUIREMENTS FOR MOST SENSITIVE CROPS

The most sensitive crops in the Friant Division were used for this analysis. Crops selected were based on their varied sensitivities to salinity, chloride, and boron. By using the most sensitive crops, all crops with higher tolerances should also be protected. The most salt-sensitive crops, or those with the lowest soil salinity threshold (EC_{et}), are beans, carrots, onions (seed), melons, and strawberries. All have an EC_{et} of 1000 µS/cm. For chloride, the most sensitive crops are almonds and other stone fruits on "Nemaguard" rootstock. The threshold Cl^-_{et}[1] is estimated to be 150 mg/L. The relationship between boron in the applied irrigation water and the saturated soil paste is more complicated because of boron's high affinity to adsorb onto the soil. Irrigation water with higher boron concentrations than predicted can be used until the boron saturates the soil adsorption sites. Because of this complexity, Ayers and Westcot (1985) concluded that the "...maximum concentration (of boron) in the irrigation water are approximately equal to these values (boron tolerance reported based on soil water bases) or slightly less," suggesting that applied irrigation water tolerances would be 0.5 – 0.75 mg/L which would protect the most sensitive crops.. However, over the long term (more than several years), boron will behave similarly to salts and chloride (D. Suarez, US Salinity Laboratory, personal communication). With the boron threshold for soil water ranging from 0.5 – 0.75 mg/L, the B_{et} is equivalent to half of the soil water concentration, or 0.25 – 0.375 mg/L. For more information on conversions from saturated soil paste to soil water concentrations, see Ayers and Westcot (1985). To be conservative, and based on the above tree and vine crop sensitivities, the B_w threshold is assumed to be 0.25 mg/L.

Table 7 shows the acreage and percentage of sensitive crops for representative water districts, and sensitivities to boron, chloride, and EC within each representative water district.

[1] It is important to note that most 'threshold' values for chloride and boron reported in literature (e.g. Grieve et al., 2012) are based on the soil water concentration. The saturated soil paste concentration (i.e. Cl^-_e or B_e) for most mineral soils is about half this value over the long-term (Ayers and Westcot 1985).

Table 7. Percentage and Area of Sensitive Crop Types within Representative Water Districts

	WATER DISTRICT											
	AEWSD		DEID		KTWD		SID		SSJMUD		SWID	
CROP TYPE	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres
Boron Sensitive[5]	**15%**	**18,883**	**5%**	**2,842**	**30%**	**5,969**	**6%**	**1,211**	**8%**	**4,629**	1%	**358**
Berries[1]	1%	761	2%	873	1%	200	n/a		<1%	63	n/a	
Cherries	2%	2,196	<1%	228	1%	160	<1%	22	<1%	211	1%	358
Citrus	11%	15,024	2%	1,301	28%	5,609	4%	825	7%	4,355	n/a	
Stone Fruits[4]	1%	902	1%	440	n/a		2%	364	n/a		n/a	
Chloride Sensitive[6]	**6%**	**7,593**	**22%**	**12,399**	**5%**	**1,040**	**17%**	**3,366**	**22%**	**13,577**	**56%**	**21,649**
Almonds (Nemaguard rootstock)	6%	7,593	22%	12,399	5%	1,040	17%	3,366	22%	13,577	56%	21,649
EC Sensitive[7]	**7%**	**8,490**	**<1%**	**175**	**n/a**		**<1%**	**50**	**1%**	**375**	**2%**	**862**
Carrots	3%	3,748	<1%	100	n/a		n/a		<1%	148	2%	784
Melons[2]	1%	777	<1%	74	n/a		<1%	50	n/a		<1%	75
Onions[3]	3%	3,961	n/a		n/a		n/a		<1%	228	<1%	1
Strawberries	<1%	4	n/a		n/a		n/a		n/a		<1%	2

Source: Data compiled from California Department of Water Resources Land Use Viewer (2017) developed by LandIQ using 2014 land use data. Districts provided updates to 2017 land use data where appropriate. DEID data was provided by the District, and data gaps were filled with LandIQ data.

Notes:

Grape Crops in DEID take up 43% (26,443 ac) of the District's land area.

"n/a" indicates that there is zero amount of a crop type in a district.

[1] Data Source lists Berries as "Bush Berries"

[2] Data Source groups Melons with Squash and Cucumbers

[3] Data Source groups Onions with Garlic

[4] Stone Fruits include Apricots, Nectarines, Peaches, Plums, and Prunes

[5] Boron Sensitive Crops include Berries, Citrus, and Stone Fruits

[6] Chloride Sensitive Crops include Almonds

[7] EC Sensitive Crops include Carrots, Melons, Onions, and Strawberries

Key:

% = percentage

AEWSD = Arvin-Edison Water Storage District

DEID = Delano-Earlimart Irrigation District

KTWD = Kern-Tulare Water District

n/a = not applicable

SID = Saucelito Irrigation District

SSJMUD = South San Joaquin Municipal Utility District

SWID = Shafter-Wasco Irrigation District

DEVELOPING MITIGATION LEACHING CURVES

This section describes quantification of mitigation based on leaching requirements for sensitive crops. This approach does not directly address the physical characteristics or dynamic nature of the rootzone, but rather is specific to sensitive crop types grown in the region and implementing sufficient leaching volumes to prevent crop injury. In addition, the volumetric mitigation quantified through this approach is not specific to a water district but is representative of all crops grown in the Friant Division.

For salinity, EC_{et} values were used to calculate LR values, as presented in Table 8 in percentages. For chloride or boron the same LR equation is used except irrigation water concentrations (i.e. Cl^-_w and B_w) in mg/L are used in place of EC_w and respective threshold Cl^-_e and B_e are used in place of EC_{et}. At each location, the quantified LR by water quality constituent is based on the most stringent LR, which assumes all water is applied to the most sensitive crop. Analysis shows a long-term LR between 5.2 and 19 percent, using the average, seasonal statistics for EC, chloride, and boron concentrations.

Table 8. Leaching Requirements for Various Sensitive Crops by Water Source and Water Quality Constituent

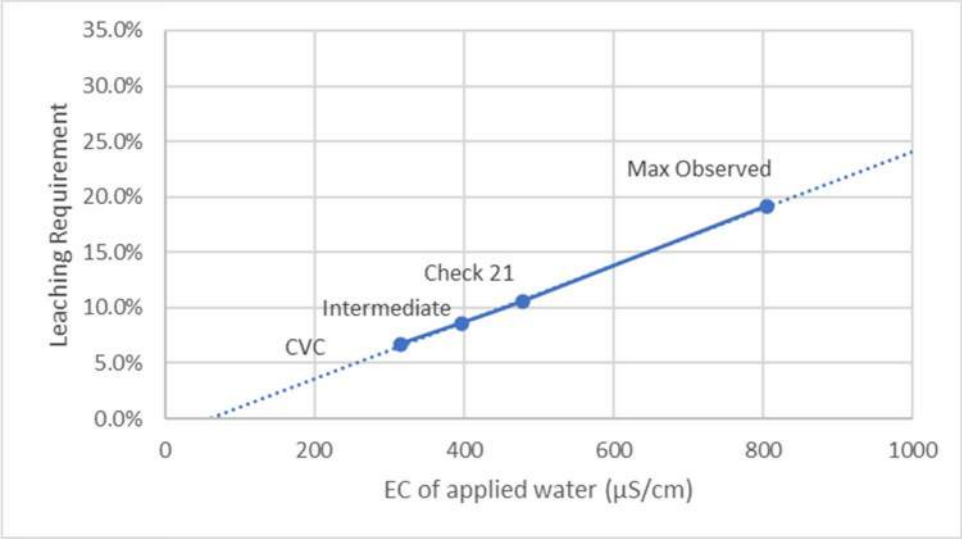
MOST SENSITIVE CROP	CVC			INTERMEDIATE			CHECK 21		
	EC	Cl^-	B	EC	Cl^-	B	EC	Cl^-	B
Carrots, onions, melons, strawberries	6.7%	-	-	8.6%	-	-	10.6%	-	-
Almonds (Nemaguard rootstock)	-	5.2%	-	-	8.1%	-	-	11.1%	-
Stone fruits, citrus, berries	-	-	8.0%	-	-	13.6%	-	-	19.0%

Key:
B = boron
Check 21 = Check Structure 21 at milepost 172,40 on the California Aqueduct
Cl^- = chloride
CVC = Cross Valley Canal
EC = electrical conductivity
Intermediate = Water quality representing the average of California Aqueduct Check 21 and Cross Valley Canal water qualities

Figures 4 through 6 show mitigation rating curves based on LR percentages, source water quality, and constituents of concern. Each mitigation rating curve was extended to show the maximum observed concentration from historical water quality data for both CVC and California Aqueduct Check 21 sources.

The LR percentages presented in Table 8 and Figures 4 through 6 represent quantified volumetric mitigation that would be applied as maintenance leaching. Maintenance leaching occurs at each irrigation by applying more water than the soil can hold, or in other words, the applied irrigation water is more than the crop requirement to accommodate the necessary leaching. The quantified LR assumes long-term steady-state conditions and does not account for leaching from rain or end-of-season reclamation practices. Any rain or end-of-season leaching will decrease the presented values.

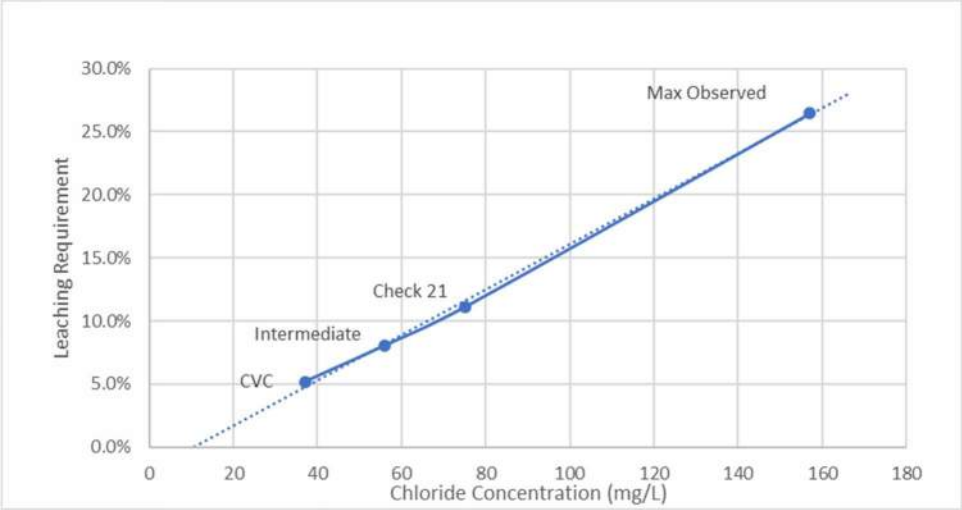
The quantified LR assumes mitigation water is delivered and applied at the same time as surface water delivery is taken. In addition, it assumes mitigation water is of the same water quality as the surface water delivery. Therefore, mitigation is only quantified for water of the same imported quality and not for both reverse flow pump-back and Millerton Lake supplies. If maintenance leaching practices are followed, reclamation leaching is unnecessary, except for in driest of years when surface supply does not meet irrigation demand or to leach salts that have accumulated between drip emitters and mini sprinklers. Using the most stringent LR, it is assumed all mitigation water is applied to the most sensitive crop.



Key:

Check 21 = California Aqueduct Check 21
CVC = Cross Valley Canal
EC = electrical conductivity
µS/cm = microsiemens per centimeter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)
Intermediate = Water quality representing the average of California Aqueduct Check 21 and Cross Valley Canal water qualities

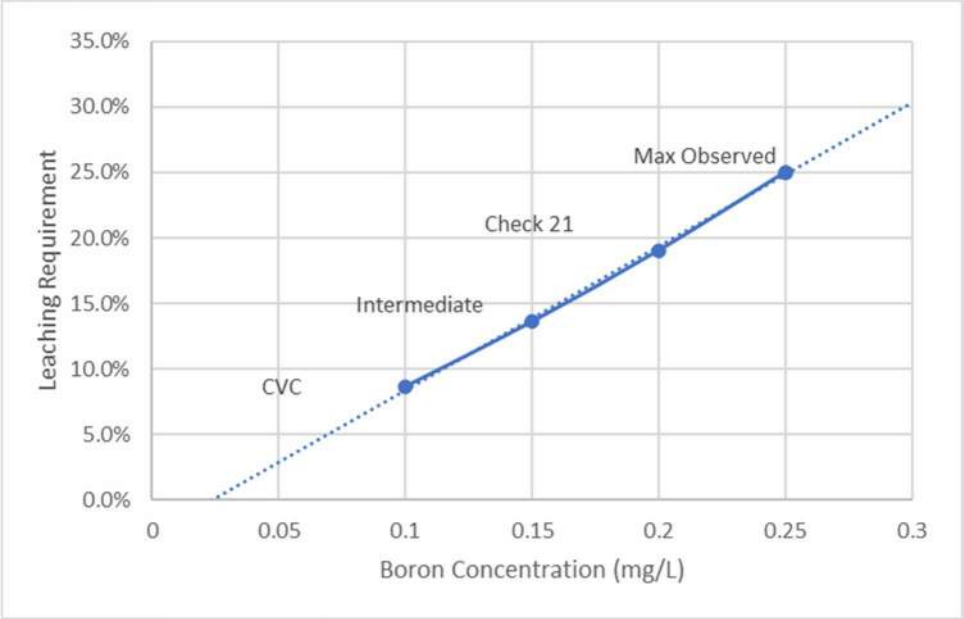
Figure 4. Leaching Requirement for Electrical Conductivity



Key:

Check 21 = California Aqueduct Check 21
CVC = Cross Valley Canal
EC = electrical conductivity
Intermediate = Water quality representing the average of California Aqueduct Check 21 and Cross Valley Canal water qualities
mg/L = milligrams per liter

Figure 5. Leaching Requirement for Chloride

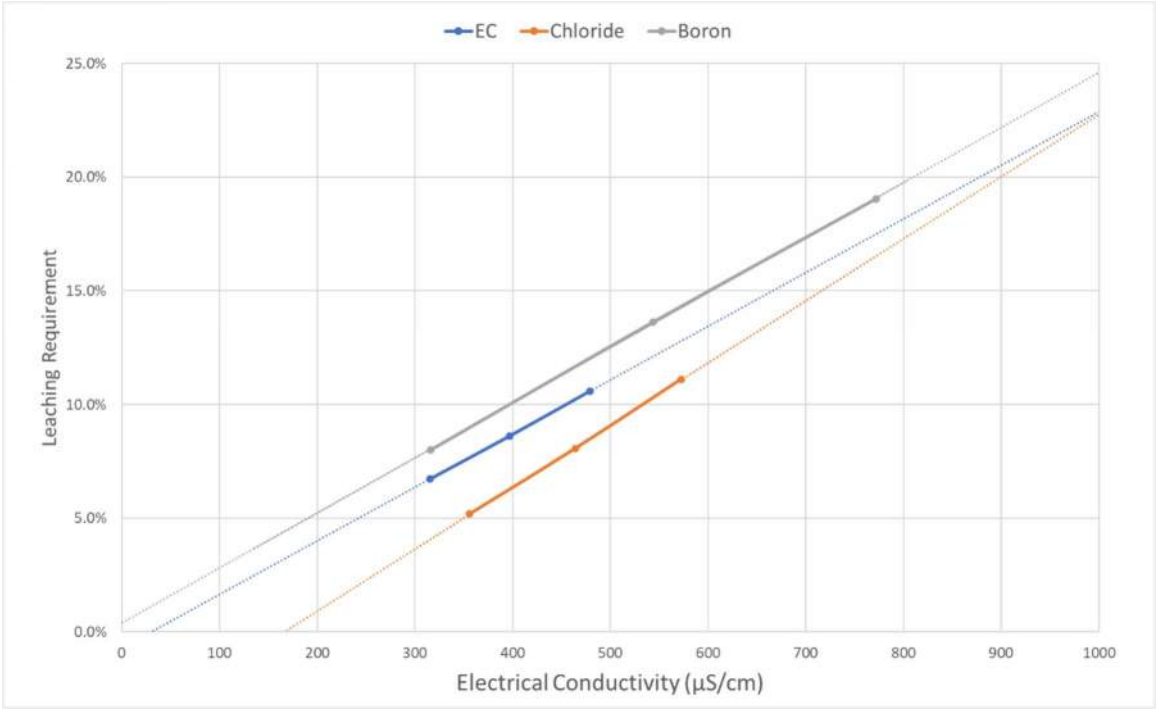


Key:
Check 21 = California Aqueduct Check 21
CVC = Cross Valley Canal
Intermediate = Water quality representing the average of California Aqueduct Check 21 and Cross Valley Canal water qualities
mg/L = milligrams per liter

Figure 6. Leaching Requirement for Boron

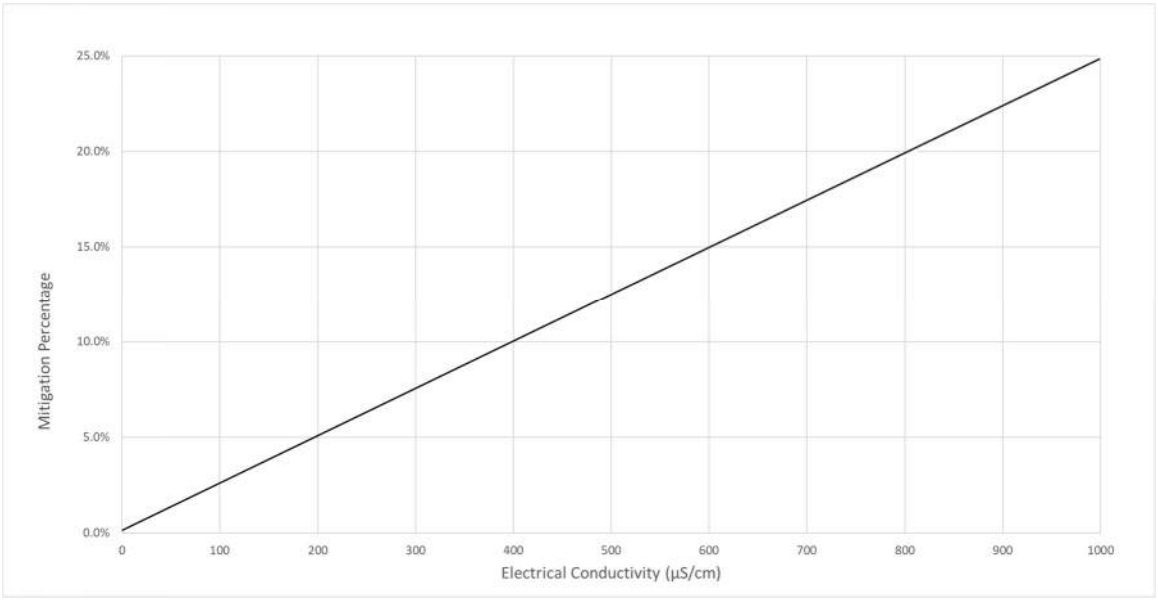
Leaching Requirement Normalization

In order to best understand the LR relationships amongst EC, chloride, and boron and to confirm the dominant constituent trend, individual rating curves were normalized to an EC concentration scale. The EC concentration was used as it can be easily measured in real-time. Figure 7 shows the stacked, normalized mitigation rating curves for all three constituents of concern. Boron is the dominant or driving constituent and has the highest LR, regardless of source water quality. The required leaching based on that curve would be sufficient to prevent crop injury due to increased EC or chloride concentrations in applied irrigation water, and, therefore, the boron curve is the proposed mitigation rating curve for the Water Quality Mitigation Ledger (Figure 8). The method for normalizing each constituent curve is described below.



Key:
µS/cm = microsiemens per centimeter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)
EC = electrical conductivity

Figure 7. Rootzone Leaching Curves for Electrical Conductivity, Chloride, and Boron Normalized to an Electrical Conductivity



Key:
µS/cm = microsiemens per centimeter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)

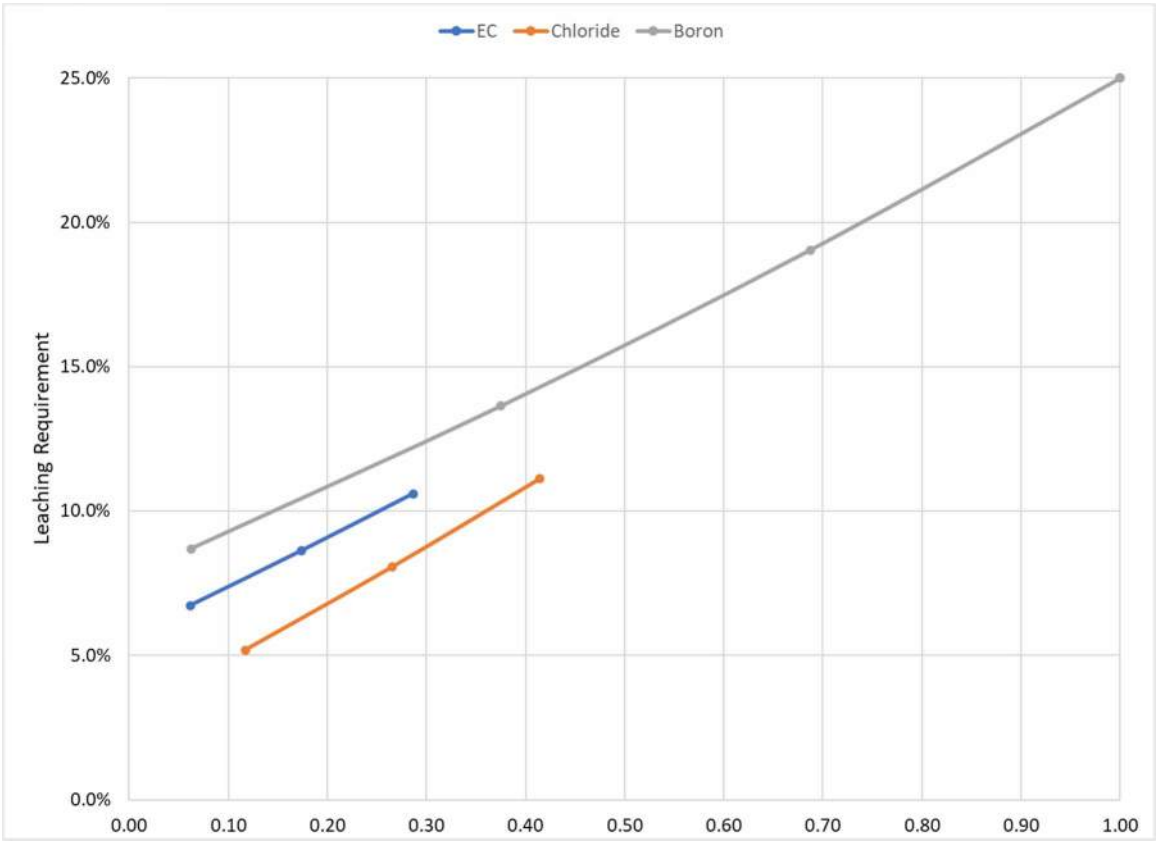
Figure 8. Proposed Mitigation Rating Curve based on Boron Sensitivity and Normalized to Electrical Conductivity

Normalization Method

As the three constituent curves have differing concentration scales and they do not show direct correlations to each other, the constituents were normalized to a common scale using the below equation.

$$X_{new} = \frac{X - X_{min}}{X_{max} - X_{min}}$$

In the equation, X represents the constituent concentration for EC, chloride, or boron. X_{min} is the minimum average, seasonal, observed concentration for a given constituent from either California Aqueduct Check 21 or CVC water quality data. The maximum observed concentration corresponded with varying leaching requirements for each of the constituents. To ensure that all constituents were normalized to the same scale and the full range of possible constituent concentrations was considered beyond the highest observed concentration for California Aqueduct Check 21 water, X_{max} represents the constituent concentration corresponding to a 25 percent LR. Figure 9 displays the normalized curves, and Table 9 presents the normalized data.



Key:
EC = electrical conductivity

Figure 9. Normalized Leaching Requirement curves for Electrical Conductivity, Chloride, and Boron

Normalized concentration values were then converted back to EC using the equation below, where X_{norm} represents the normalized concentration for chloride or boron. LR curves were then replotted using an EC scale (Figure 7).

$$EC = X_{norm}(EC_{max} - EC_{min}) + EC_{min}$$

Table 9. Constituent Normalization

SOURCE WATER	ELECTRICAL CONDUCTIVITY			CHLORIDE			BORON		
	Observed Concentration (µS/cm)	Normalized Value	Leaching Requirement	Observed Concentration (Seasonal Average) (mg/L)	Normalized Value	Leaching Requirement	Observed Concentration (Seasonal Average) (mg/L)	Normalized Value	Leaching Requirement
CVC	315	0.06	6.7%	37.00	0.12	5.2%	0.10	0.06	8.0%
Intermediate	397	0.17	8.6%	56.00	0.27	8.1%	0.15	0.38	13.6%
Check 21	479	0.29	10.6%	75.00	0.41	11.1%	0.20	0.69	19.0%
Maximum Observed	805	0.73	19.2%	157.00	1.05	26.5%	0.25	1.00	25.0%
Maximum normalization (25% Leaching Requirement)	1000	1.00	25.0%	150.00	1.00	25.0%	0.25	1.00	25.0%

Key:
CVC = Cross Valley Canal
µS/cm = microsiemens per centimeter
mg/L = milligrams per liter

APPLIED AGRONOMIC THRESHOLDS

The Policy includes maximum water quality thresholds for the FKC. Although the mitigation rating curve quantifies mitigation water to account for appropriate maintenance leaching, FKC water quality thresholds for EC, chloride, boron, and SAR were developed and are proposed herein. These thresholds aim to (1) balance supply reliability, water quality concerns, and agricultural practices, such as regulated deficit irrigation (RDI); and (2) ensure that the EC_{et}, Cl^{-}_{et}, or B_{et} limits are not exceeded for the most prevalent and sensitive crops in the Friant Division. The thresholds are specific to three irrigation periods that correspond to the growing season and agricultural management practices during the year:

- Period one represents the beginning of the growing season (March 1 – June 30);
- Period 2 represents timing of hull split and the duration of RDI practices in the Friant Division (July 1 – August 31); and
- Period 3 is inclusive of the remainder of the growing season and contract year (September 1 – February 28).

Table 10 shows the established water quality constituent thresholds for each period as defined in the Policy. The threshold variations in Period 3, shown as Periods 3a and 3b, are described in more detail in the Threshold Flexibility subsection below.

Sections below describe methods applied to account for annual RDI practices; development of water quality thresholds, including thresholds for RDI; and adjustments to water quality thresholds to accommodate flexibility for water management within the Friant Division.

Table 10. Friant-Kern Canal In-Prism Water Quality Thresholds

Period	Salinity Threshold expressed as EC (µS/cm)	Chloride Threshold (mg/L)	Boron Threshold (mg/L)[1]	SAR
Period 1 March 1 – June 30	1,000[2]	102[3]	0.4	3
Period 2 July 1 – August 31	500[4]	55[4]	0.4	3
Period 3a September 1 – February 28	1,000[2]	102[3]	0.4	3
Period 3b September 1 – February 28	1,000[2]	123[5]	0.4	3

Notes:

Thresholds adapted from Grieve, C.M., S.R. Grattan and E.V. Maas. 2012. Plant salt tolerance. In. (W.W. Wallender and K.K. Tanji, eds). Agricultural Salinity Assessment and Management (2nd edition). ASCE pp 405-459; and Ayers, R.S. and D.W. Westcot 1985. Water quality for agriculture. FAO Irrigation and Drainage Paper 29 (rev 1). Food and Agriculture Organization of the United Nations. Rome

For addition detail, see *Attachment A - Agronomic Impacts and Mitigation.*

When Friant-Kern Canal in-prism water quality conditions in this table are exceeded, Friant Division Long-Term Contractors will work together to seek 1:1, unleveraged, and cost-neutral exchanges for pump-in and pump-back programs. This does not apply to spot-market or third-party exchanges.

[1] Grapes are used as a representative crop for boron sensitivity and are prevalent in the Friant Division. They are used as a surrogate for many other sensitive crop types such as apricots, figs, and grapefruits. Threshold assumes conventional irrigation with minimum 20 percent leaching fraction applied.

[2] Threshold assumes minimum of 20 percent leaching requirement applied and adjusted to account for regulated deficit irrigation during almond hull split period (July 1 – August 31) in order to not exceed maximum EC_{et}. Almonds on Nemaguard rootstock are used as a representative crop for salinity sensitivity and are prevalent in the Friant Division. They are used as a surrogate for many other sensitive crop types such as apples, cherries, pears, pistachios, and walnuts.

[3] Threshold assumes minimum of 20 percent leaching requirement applied and then adjusted to account for regulated deficit irrigation during almond hull split period (July 1 – August 31) in order to not exceed maximum Cl^-_{et}. Almonds on Nemaguard rootstock used as a representative crop for chloride sensitivity. They are used as a surrogate for other sensitive crops including cherries, pistachios, and walnuts.

[4] Threshold applies to almond hull split period when regulated deficit irrigation is applied to avoid hull rot. This threshold is used assuming irrigation applications are reduced to 50 percent of the tree water requirement and subsequently thresholds applied for the remainder of the year have been adjusted to account for additional salt accumulation. This threshold was developed with consideration of existing program operations, historical water quality data, and absolute water quality thresholds.

[5] If the measured average chloride concentration in Period 1 (March 1 – June 30) is less than or equal to 70 mg/L, the allowable chloride threshold for Period 3 (September 1 – February 28) is increased to 123 mg/L.

Key:
µS/cm = microsiemens per centimeter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)
ASCE = American Society of Civil Engineers
Cl^-_{et} = maximum chloride threshold of the saturated soil paste
EC = electrical conductivity of applied water
EC_{et} = Soil salinity threshold for a given crop
FAO = Food and Agriculture Organization of the United Nations
Friant Division = Friant Division of the Central Valley Project
mg/L = milligrams per liter
SAR = sodium adsorption ratio
TDS = total dissolved solids

REGULATED DEFICIT IRRIGATION

This section describes methods applied to account for annual RDI practices in the Friant Division for EC and chloride agronomic thresholds, specific to almonds. Note, grapes may also be deficit irrigated during the blooming period; however, the deficit irrigation period for grapes is not aligned with that of almonds, and grapes are most prone to boron toxicities. Consequently, a similar RDI analysis and threshold adjustment is unnecessary for grapes. See Boron Thresholds subsection in Water Quality Thresholds section for additional discussion on applied boron thresholds for grapes in the Friant Division.

Hull Rot Control

Hull rot is problematic in almond orchards in the San Joaquin Valley, and trees are particularly sensitive during the hull split period. Hull split is where 1 percent of the almonds exhibit split, and it typically lasts one to two weeks. The initiation of hull split depends on the almond variety, weather conditions, and tree stress. Although variety has the largest influence on hull-split timing, the temperature 90 days after flowering also affects the hull split initiation. Unseasonably cool temperatures delay hull split while unseasonably warm weather accelerates it.

Hull rot occurs due to infestation by one of two types of fungi, *Monilinia fructicola* or *Rhizopus stolonifera* (Holtz, 2009). Some almond varieties, particularly Nonpareil and Monterey, are more susceptible to fungal attack than are other varieties. High nitrogen application to an orchard combined with full irrigation, or irrigation to completely meet tree ET demands, at the time of hull split can make trees considerably more vulnerable to hull rot.

Hull rot can be largely controlled through a combination of nitrogen management, water management, and antifungal sprays. It is best controlled by RDI practices. A 2001 study showed that by cutting back irrigation to 50 percent of the trees' water requirements between June 1 to July 31 (70 percent regulated) or July 1 to July 15 (85 percent regulated), hull rot was substantially reduced as evidenced by fewer dead leaf clusters and fewer dead spurs and branches (Teviotdale et al., 2001). Such mild to moderate water stress results in drier hull conditions, making trees less vulnerable to fungal attack. Many almond growers in the San Joaquin Valley have adopted RDI practices to help synchronize hull split timing and reduce potential for hull rot. To monitor the degree of tree stress, these growers have implemented the University of California recommendation of trying to maintain a stem water potential between -14 to -16 bars using pressure chambers by drying down the soil rootzone (B. Sanden, Personal communication, April 5-6, 2020). The more negative the number, the more stress the tree experiences. It could take between one to six weeks to achieve this stress level, depending on soil type and irrigation systems (B. Lampinen, personal communication, April 7, 2020). Growers should take care to not to stress trees too much because that could compromise kernel size as kernels continue to grow at the onset of hull split (Doll and Shackel, 2015). After almond harvest, irrigation is critical to maximize floral bud development for the subsequent season.

During the RDI period when there is no effective leaching, irrigation application is reduced to 50 percent of the tree water requirement, and some additional salts and chlorides accumulate in the rootzone. Absent leaching, the steady-state model breaks down because the salt content in the applied water would need to be zero to maintain the same rootzone salinity. In this situation, preseason irrigation management should target an adjusted soil salinity to maintain the appropriate soil salinity thresholds and avoid crop injury.

Regulated Deficit Irrigation Analysis

The RDI analysis applied a predictive model based on timing of flowering to estimate hull split for various types of almond varieties in different parts of the Central Valley (UC Fruit & Nut Research & Information Center, 2020). From the model and historical California Irrigation Management Information System (CIMIS) data from the AEWSD weather station, hull split was determined to typically initiate around the end of June or beginning of July and, depending upon the variety, continue through mid-August (B. Sanden, personal communication, April 6, 2020). To account for potential variances in hull split initiation in the Friant Division, an 8-week period (July 1 to August 31) was assumed for this RDI analysis. Determination of water quality thresholds during the RDI practices period, or Period 2, also considered effective rootzone depth, applied irrigation water quality, soil capacity, and irrigation requirements. The RDI analysis is considered to be conservative because: (1) rainfall was not considered; (2) surface irrigation was assumed, despite the fact that crops under high frequency drip irrigation (typical for most water districts in the Friant Division) are able to tolerate higher salinity for the same assumed LF; and (3) steady-state models typically overestimate rootzone salinity (Corwin and Grattan, 2018).

The RDI analysis was completed for both EC and chloride. Salt accumulation was quantified as a percentage increase, and then rootzone and applied irrigation water thresholds (assuming 20 percent maintenance leaching) were adjusted to maintain maximum EC_{et} or Cl^{-}_{et} through the season. Assuming steady-state

leaching, the analysis targeted maintenance of rootzone salinity at soil salinity thresholds of 150 mg/L for chloride, and 1,500 µS/cm for EC, resulting in adjustments to Cl^-_w and EC_w thresholds.

The RDI calculation assumed the effective rootzone to be between three and five feet (UC Almond Rootzone Workgroup, 2015). Soil was considered to be at field capacity meaning that volumetric soil moisture content was 25 percent, based on monthly average ET or irrigation water requirements for mature almonds in Kern County during months of July and August, 9.5 inches and 8.8 inches, respectively (Sanden, personal communication, April 6, 2020; Goldhamer 2012). The RDI calculation included soil water concentration thresholds of 300 mg/L for Cl^-_{sw}, and 3,000 µS/cm for EC_{sw}, or twice that of the thresholds expressed on a saturated soil paste basis.

During the RDI period, water was assumed to be applied at 50 percent ET_c. The total amount of irrigation water required for 100 percent irrigation application, in inches, was calculated but then halved to account for 50 percent deficit irrigation. The amount of irrigation water during RDI periods was then multiplied by the irrigation water concentrations of salt and chloride to determine the percentage increase above the salt and chloride concentrations in the rootzone. Calculating the percentage increase of chloride in the rootzone meant first determining irrigation water and soil water amounts.

For example, 50 percent of the total ET for July and August was 9.1 inches, and the total water in the effective rootzone was 15 inches (rootzone depth (5 ft, or 60 inches) * 25 percent water content = 1.25 feet, or 15 inches). The 15 inches of soil water had 300 mg/L chloride at the beginning of the RDI period. After 9.1 inches of water was applied, adding salts to the soil water in the rootzone, the irrigation water concentration was 55 mg/L. The percentage of additional salt was determined by calculating the ratio of the salt added in the deficit irrigation water to that in the soil water, (9.1 inches x 55 mg/L) / (15 inches x 300 mg/L) = 11 percent. If the salt level in the rootzone remained at critical soil threshold levels at the end of the RDI period, the Cl^-_e at the beginning of RDI period would have needed to be proportionally lower than the critical soil salinity threshold of 150 mg/L, such that the 150 mg/L threshold concentration would be achieved at the end of the season. Thus, the Cl^-_{et} is reduced to 122 mg/L and the corresponding Cl^-_w becomes 102 mg/L.

WATER QUALITY THRESHOLDS

This section presents the RDI analysis-based chloride and EC thresholds, boron thresholds, and adjustments to water quality thresholds to provide water management flexibility in the Friant Division.

Chloride and Electrical Conductivity Thresholds

Tables 11a and 11b show the RDI analysis for a variety of applied irrigation water qualities for chloride and EC, respectively. In consideration of historical water quality data representative of Kern-Fan or CVC programs that currently introduce water into the FKC, as well as temporal water quality trends, an applied irrigation water threshold for the RDI period was selected to be 55 mg/L Cl^-_w. The Cl^-_w value of 55 mg/L during the RDI period correlated to an adjusted Cl^-_w of 102 mg/L for the remainder of the year, assuming a three-foot (36 inch) effective rootzone – a conservative assumption as the effective rootzone is assumed to be three to five feet (Table 12a).

The same logic described above for Cl^-_w thresholds was applied to determine RDI EC_w and adjusted EC_w thresholds. The chloride threshold for the RDI period (55 mg/L) was approximately 49 percent greater than the average historical water quality of representative Kern-Fan programs for all year types during months of July and August (37 mg/L). The average EC_w during July and August for all year types representative of Kern-Fan programs was 300 µS/cm, and a 49 percent increase is 447 µS/cm. Rounding up, the RDI threshold for EC_w is 500 µS/cm, and, in order to maintain an EC_{et} of 1,500 µS/cm, the adjusted EC_w for the remainder of the year was 1,000 µS/cm.

Table 11a. Regulated Deficit Irrigation Analysis for Chloride

Cl^-_w (mg/L)	Effective Rootzone (in)	Sum ET_c Average (in)[1]	RDI %	RDI Water (in)	Rootzone Water (in)[2]	% Cl^- Increase	Adjusted Cl^-_e Needed (mg/L)	Adjusted Cl^-_w (mg/L)
10	36	18.3	50%	9.2	9	3.4%	145	121
10	60	18.3	50%	9.2	15	2.0%	147	122
20	36	18.3	50%	9.2	9	6.8%	140	117
20	60	18.3	50%	9.2	15	4.1%	144	120
30	36	18.3	50%	9.2	9	10.2%	135	112
30	60	18.3	50%	9.2	15	6.1%	141	117
40	36	18.3	50%	9.2	9	13.6%	130	108
40	60	18.3	50%	9.2	15	8.1%	138	115
50	36	18.3	50%	9.2	9	16.9%	125	104
50	60	18.3	50%	9.2	15	10.2%	135	112
55	36	18.3	50%	9.2	9	18.6%	122	102
55	60	18.3	50%	9.2	15	11.2%	133	111

Notes:
[1] ETc averages from Sanden and Goldhamer based on water use of mature almond trees in Wasco area for July and August (Goldhamer and Girona 2012).
[2] Rootzone at field capacity is 25 percent by volume.
Key:
Cl^- = chloride
Cl^-_e = chloride concentration in saturated soil paste or rootzone chloride
Cl^-_w = chloride concentration in applied irrigation water
ET_c = evapotranspiration or tree water use
in = inches
mg/L = milligrams per liter
RDI = regulated deficit irrigation

Table 11b. Regulated Deficit Irrigation Analysis for Electrical Conductivity

EC_w (µS/cm)	Effective Rootzone (in)	Sum ET_c Average (in)[1]	RDI %	RDI Water (in)	Rootzone Water (in)[2]	% EC Increase	Adjusted EC_e Needed (µS/cm)	Adjusted EC_w (µS/cm)
200	36	18.3	50%	9.2	9	6.8%	1,400	1,120
200	60	18.3	50%	9.2	15	4.1%	1,440	1,150
300	36	18.3	50%	9.2	9	10.2%	1,350	1,080
300	60	18.3	50%	9.2	15	6.1%	1,410	1,130
400	36	18.3	50%	9.2	9	13.6%	1,300	1,040
400	60	18.3	50%	9.2	15	8.1%	1,380	1,100
500	36	18.3	50%	9.2	9	16.9%	1,250	1,000
500	60	18.3	50%	9.2	15	10.2%	1,350	1,080
600	36	18.3	50%	9.2	9	20.3%	1,200	960
600	60	18.3	50%	9.2	15	12.2%	1,320	1,050

Notes:
[1] ET_c averages from Sanden and Goldhamer based on water use of mature almond trees in Wasco area for July and August (Goldhamer and Girona 2012).
[2] Rootzone at field capacity is 25 percent by volume.
Key:
µS/cm = microsiemens per centimeter
EC = electrical conductivity
EC_e = electrical conductivity of saturated soil paste or rootzone salinity
EC_w = electrical conductivity of applied irrigation water
ET_c = evapotranspiration or tree water use
in = inches
RDI = regulated deficit irrigation

By adjusting the Cl^{-}_{e} and EC_e thresholds for non-RDI irrigation periods, LR volumes for the assumed 20 percent leaching were adjusted by default, as LR is a function of the saturated soil paste concentration. Adjusted LR volumes and constituent thresholds affect the mitigation curve slope for each constituent. The adjusted curves for chloride and EC were plotted and were below the governing line, so the mitigation curve remained unchanged and further confirmed the conservative nature of the mitigation curve in ensuring that all constituents would be sufficiently mitigated.

Boron Thresholds

Table 12 shows B_w thresholds for tree and vine crops above which injury occurs under differing irrigation management practices, or LF values of 10 and 20 percent. Grapes have a boron tolerance of 0.4 mg/L when the LF is between 10 to 25 percent (Grattan et al., 2015). The actual boron threshold tolerance range is 0.3-0.5 mg/L if one considers different combinations of the soil water threshold (B_{sw}) tolerance (0.5 - 0.75 mg/L) and LF (10 - 25%).

The maximum in-prism water quality threshold for boron was set at 0.4 mg/L for all three irrigation periods (Periods 1, 2, and 3). Grapes were used as the representative crop for boron sensitivity because of their prevalence in the Friant Division, serving as a surrogate for other sensitive crop types, such as apricot, fig, and most citrus. The applied threshold assumed conventional irrigation with a LF minimum of 20 percent applied. This threshold applied to the LF concept, rather than the LR concept that was used in development of the mitigation curves.

Table 12. Boron Tolerance of Various Crops

CROP	BORON CONCENTRATION OF APPLIED WATER (B_w) (mg/L)	
	Leaching Fraction 10%	Leaching Fraction 25%
Alfalfa	2.0	2.8
Apricot	0.4	0.4
Asparagus	4.8	6.7
Barley	1.4	1.9
Bean (kidney, lima, mung)	0.4	0.6
Bean, snap	0.5	0.6
Beet, red	2.0	2.8
Bluegrass, Kentucky	1.2	1.7
Broccoli	0.5	0.6
Cabbage	1.2	1.7
Carrot	0.7	0.9
Cauliflower	1.6	2.2
Celery	3.8	5.3
Cherry	0.4	0.4
Clover, sweet	1.2	1.7
Corn	1.2	1.7
Cotton	3.1	4.3
Cucumber	0.7	0.9
Fig, Kadota	0.4	0.4
Garlic	1.7	2.4
Grape	0.4	0.4
Grapefruit	0.4	0.4
Lemon	<0.3	<0.4
Lettuce	0.6	0.8

Note: Adapted from data in Grattan, S.R., F.J. Diaz, F. Pedrero and G.A. Vivaldi. 2015. Assessing the suitability of saline waste waters for irrigation of citrus: Emphasis on boron and specific ions interactions. Agric Water Manag. 157:48-58.

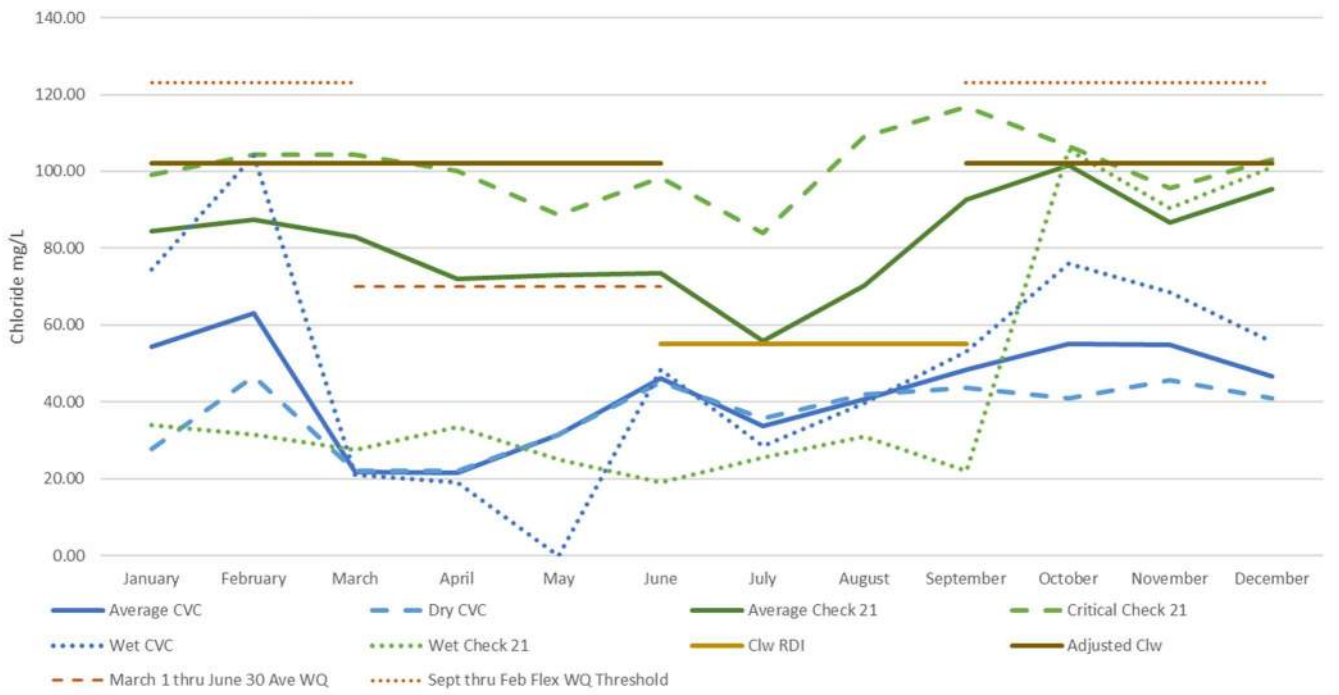
Key:
mg/L = milligrams per liter

In addition, the applied B_w threshold of 0.4 mg/L was far more conservative than those defined in literature by Ayers and Westcot (1985). This analysis indicated that B_{sw} could be used as protective irrigation water thresholds (B_e) because of the complexities related to boron adsorption and equilibrium concentrations with the soil water. Historical water quality data also indicate that CVC or California Aqueduct water would be below this threshold.

Threshold Flexibility

In evaluating and comparing the developed, in-prism water quality thresholds with temporal water quality trends during Period 1 (March 1 to June 30), or prior to the RDI period (July 1 to August 31), observed average constituent concentrations were typically below the proposed thresholds. If water with lower constituent concentrations was applied to a crop for the first four months of the growing season, assuming that the rootzone concentration was properly maintained, the rootzone concentration would decrease below the threshold and, even with reductions in irrigation and LFs, could allow the application of higher irrigation water concentrations during the post-RDI period. The period following RDI, or Period 3 (September 1 to February 28), is often used for reclamation leaching; however, it is also the period in which new sources of water may be available for the Friant Division. Thus, having flexibility in the allowable irrigation water quality could be opportune for increasing supply reliability for the region.

Based on the RDI analysis and evaluation of water quality temporal trends, the Policy proposes an alternative water quality threshold for chloride for Period 3 to provide flexibility for irrigation management. Determination of whether the alternative chloride threshold for Period 3 is applied is based on the average chloride concentration of the irrigation water during Period 1. The alternative value was developed considering historical, temporal water quality trends and applying a weighted average calculation to meet the targeted rootzone chloride threshold. If the average measured chloride concentration for Period 1 is less than or equal to 70 mg/L, the allowable chloride concentration threshold increases from 102 mg/L to 123 mg/L for Period 3. If the measured average chloride concentrations for Period 1 exceed 70 mg/L, the chloride threshold remains at 102 mg/L for Period 3. Figure 10 shows the proposed thresholds compared to the chloride water quality trends for CVC and California Aqueduct water sources by year type.



Key:
Average = Average of all San Joaquin Index year types and excludes months where there is mixing.
Cl^-_w = chloride concentration of applied irrigation water
CVC = Cross Valley Canal
Dry= Monthly average for San Joaquin Index year types dry and critical and excludes months where there is mixing.
mg/L = milligrams per liter
RDI = regulated deficit irrigation
Wet = Monthly average for San Joaquin Index year types below normal, above normal, and wet and excludes months where there is mixing.

Figure 10. Chloride water quality trends by source water and year type with proposed water quality thresholds

Because the average water quality for Kern-Fan or CVC programs for Period 1 (March 1 to June 30) was approximately 30 mg/L (see Table 2), 70 mg/L was chosen as a midpoint between the adjusted Cl^-_w threshold determined in the RDI analysis and the average historic water quality. Using a weighted average approach, if 70 mg/L water was applied for the four months in Period 1, assuming an LR of 20 percent, the resulting Cl^-_e would be 84 mg/L. With the target weighted average for Cl^-_e of 122 mg/L, the necessary Cl^-_e for Period 3, the six months post-RDI (September 1 – February 28) was determined using the following equation:

$$84\frac{mg}{L} * .4 + Cl_e * .6 = 122$$

The resulting Cl^-_e was 147 mg/L, correlating to a Cl^-_w of 123 mg/L with an assumed 20 percent LR. This approach was conservative in that observed chloride concentrations for Kern-Fan programs were significantly lower than 70 mg/L, and these calculations did not consider rainfall or any reclamation leaching applied in addition to the assumed 20 percent maintenance leaching.

Note that adjusting the Cl^-_e thresholds for non-RDI irrigation periods (Period 1 and Period 3) would adjust the LR volumes for the assumed 20 percent leaching provided by the mitigation curve. Adjusted curves were plotted and it was confirmed that even with a reduced Cl^-_e, the established mitigation curve would provide adequate mitigation.

REFERENCES

Ayers, R.S. and D.W. Westcot. 1985. Water quality for agriculture. FAO Irrigation and Drainage Paper 29 (rev 1). Food and Agriculture Organization of the United Nations. Rome

Brown, P.H. and B.J. Shelp. 1997. Boron mobility in plants. Plant and Soil 193:85-101.

California Department of Water Resources. 2017. Land Use Viewer. Available at: https://gis.water.ca.gov/app/CADWRLandUseViewer/

Corwin, D.L and S.R. Grattan. 2018. Are existing irrigation salinity leaching requirement guidelines overly conservative or obsolete? J Irrig. and Drain. Eng. ASCE 144(8):02518001.

Dejampour, J., N. Aliasgharzad, M. Zeinalabedini, M.R. Niya and E. Hervan. 2012.Evaluation of salt tolerance in almond [Prunus dulcis (L.) Batsch] rootstocks. African J of Biotech. 11(56):11907-11912

DeJong, T. Almond hull split prediction model. University of California, Davis. Available at: http://fruitsandnuts.ucdavis.edu/Weather_Services/almond_hullsplit_prediction/

Doll, D. and Shackel, K. 2015. Drought management for California almonds. UC Drought Tips. University of California Agriculture and Natural Resources (UC ANR) Publication No. 8515

Epstein, E. and A.J Bloom. 2005. Mineral nutrition of plants: Principles and perspectives. 2nd ed. Sinauer Associates. Sunderland, MA 4

Goldhamer, D. and Girona, J. 2012. Almond. In Crop Yield Response to Water. P. Steduto, T.C. Hsiao, E. Fereres, and D. Raes, eds. FAO Irrigation and Drainage Paper No. 66. Food and Agriculture Organization of the United Nations, Rome, Italy, pp. 246-296.

Grattan, S.R. and C.M. Grieve. 1992. Mineral element acquisition and growth response of plants grown in saline environments. Agric., Ecosys. Environ. 38:275-300.

Grattan, S.R., F.J. Diaz, F. Pedrero and G.A. Vivaldi. 2015. Assessing the suitability of saline waste waters for irrigation of citrus: Emphasis on boron and specific ions interactions. Agric Water Manag. 157:48-58.

Grieve, C.M., S.R. Grattan and E.V. Maas. 2012. Plant salt tolerance. In. (W.W. Wallender and K.K. Tanji, eds). Agricultural Salinity Assessment and Management (2nd edition). ASCE pp. 405-459.

Hanson, B.R., S.R. Grattan, and A. Fulton. 2006. Agricultural salinity and drainage. University of California Agricultura and Natural Resources (UC ANR) Publication No. 3375. University of California, Davis.

Hasegawa, P.M., Bressan, R.A., Zhu, J.-K and H.J. Bohnert. 2000. Plant cellular and molecular responses to high salinity. Annu. Rev. Plant Physiology and Molecular Biol. 51:463-499.

Holtz, B. 2009. Hull split Part 2: Hull rot of almond. Almond doctor newsletter. University of California Agriculture and Natural Resources (UC ANR). Available at: http://thealmonddoctor.com/2009/06/30/hull-split-part-2-hull-rot-of-almond/

Lauchli, A. and S.R. Grattan. 2012. Plant response to saline and sodic conditions. Agricultural Salinity Assessment and Management (W.W. Wallender and K.K. Tanji, eds.). ASCE Manuals and Reports and Engineering Practice No. 71. American Assoc. of Civil Engineers, Reston, VA USA Pp 169-205

Läuchli, A and S.R. Grattan. 2012. Plant stress under non-optimal soil pH. In: Plant Stress Physiology. S. Shabala, ed. CAB International. pp. 194-209.

Lawrence Livermore National Laboratory (LLNL) Nitrate Working Group. 2002. Nitrate Contamination in California Groundwater: An Integrated Approach to Basin Assessment and Resource Protection. December 10, 2002. Available at: www.swrcb.ca.gov/gama/docs/llnl_nitrate_wp_ucrl-151454.pdf

Letey, J., G.J. Hoffman, J.W. Hopmans, S.R. Grattan, D. Suarez, D.L. Corwin, J.D. Oster, L. Wu, and C. Amrhein. 2011. Evaluation of soil salinity leaching requirement guidelines. Agric Water Manag. 98: pp. 502-506

Letey, J. and G.L. Feng. 2007. Dynamic versus steady-state approaches to evaluate irrigation management of saline waters. Agric. Water Manag. 91: pp. 1-10

Munns, R. and M. Tester. 2008. Mechanisms of salinity tolerance. 2008. Annu. Rev. Plant Biol. 59:651-681

Provost and Pritchard Consulting Group. 2012. Friant Water Authority Evaluation of Impacts from Use of Re-Circulated San Joaquin River Water. Clovis, CA.

Ragab, R., N. Malash, G. Abdel Gawad, A. Arslan, and A. Ghaibeh. 2005. A holistic generic integrated approach for irrigation, crop and field management: 1. The SALTMED model and its application using field data from Egypt and Syria. International Journal of Agricultural Water Management, 78(1-2): pp. 67-88.

Rhoades, J.D., A. Kandiah, A. and A.M. Marshall. 1992. The use of saline waters for crop production. FAO Irrigation and Drainage Paper 48. Food and Agricultural Organization (FAO) of the United Nations. Rome

Rhoades, J.D. and S.D. Merrill. 1976. Assessing the suitability of water for irrigation: Theoretical and empirical approaches. In: Prognosis of salinity and alkalinity. FAO Aoils Bulletin 31. FAO. Rome pp 69-110.

Soil Web. 2019. Division of Agriculture and Natural Resources. University of California, Davis. Professor A. O'Geen, Department of LAWR contact person. Available at: https://casoilresource.lawr.ucdavis.edu/gmap/

Suarez, D.L. and J. Simunek. 1997. UNSATCHEM: unsaturated water and solute transport model with equilibrium and kinetic chemistry. Soil Sci Soc. Am. J 61: pp. 1633-1646.

Teviotdale, B.L. Goldhamer, D.A., and Viveros, M. 2001. Effects of deficit irrigation on hull rot disease of almond trees cause by *Monilinia fructicola* and *Rhizopus stolonifera*. Plant Dis. 85:399-403.

University of California Fruit & Nut Research & Information Center. 2020. Available at: http://fruitsandnuts.ucdavis.edu/

Friant
WATER AUTHORITY

Friant-Kern Canal Water Quality Policy

Draft Attachment B – Water Quality Mitigation Ledger Example

This page left blank intentionally.

CONTENTS

FIGURES

TABLES

ACRONYMS

µmhos/cm	micromho per centimeter (1 µmhos/cm = 1 µS/cm = 1/1,000 dS/m)
µS/cm	microsiemens per centimeter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)
AF	acre-feet
Ad hoc Committee	Ad hoc Water Quality Committee
dS/m	deciSiemens per meter (1 dS/m = 1,000 µmhos/cm = 1,000 µS/cm)
EC	electrical conductivity
FKC	Friant-Kern Canal
Friant Division	Friant Division of the Central Valley Project
FWA	Friant Water Authority
Ledger	Water Quality Mitigation Ledger
mg/L	milligrams per liter
Policy	Friant-Kern Canal Water Quality Policy
TDS	total dissolved solids
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
RWA	Recovered Water Account

BACKGROUND

The Ad hoc Water Quality Committee (Ad hoc Committee) is working to develop a comprehensive Friant-Kern Canal Water Quality policy (Policy) to be adopted by the Friant Division of the Central Valley Project (Friant Division). This Policy is in response to concerns regarding the implementation of programs and projects that could introduce water of a lesser quality to the Friant-Kern Canal (FKC), when compared to water quality of historic deliveries from Millerton Lake. As detailed in the Friant-Kern Canal Water Quality Policy, the Ad hoc Committee is proposing a ledger mechanism to determine the required mitigation for introducing water of lesser quality into the FKC. This attachment to the Policy describes the process to quantify mitigation using the Water Quality Mitigation Ledger (Ledger). The Ledger tracks and accounts for all inflows into and diversions from the FKC in order to determine appropriate mitigation for impacted water quality (attributable to the introduced water [or "Put"] and the corresponding distribution thereof [or "Take"]).

QUANTIFYING MITIGATION

Percent mitigation is based on the measured electrical conductivity (EC) of the non-Millerton Lake water introduced into the FKC, or Put. Using the developed mitigation rating curve (see Attachment A for additional information on development of the mitigation rating curve), a mitigation percentage is determined for each contractor that introduces water, or Put, into the FKC, or "Contributor." Based on the total Put volume and mitigation percentage, a mitigation volume is calculated and then proportioned and distributed to downstream Takes. The sections below describe the six step process for calculating mitigation requirements. Table 1 provides definitions for variables used in quantifying mitigation requirements.

Table 1. Variable Definitions for Quantifying Mitigation

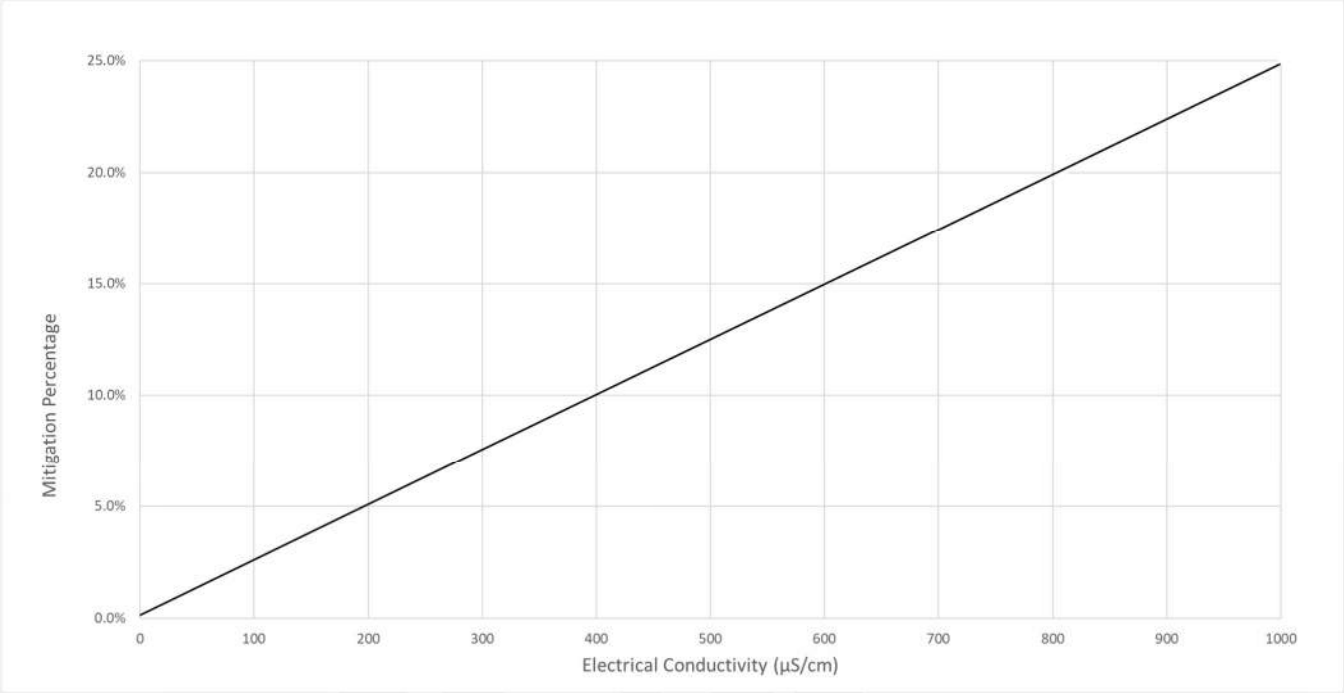
Variable[1]	Definition
EC	Electrical conductivity, measured as µS/cm
$M_{Baseline}$	Mitigation percentage for established baseline (5%)
$M_{Put\%}$	Mitigation percentage based on measured EC of Put
$M_{adj\%}$	Adjusted mitigation percentage to account for incremental impact above established baseline
$M_{vol,paid}$	Mitigation volume paid (AF)
$M_{vol,received}$	Mitigation volume received (AF)
Put_{vol}	Volume of Put by district (AF)
RF_{vol}	Volume contribution from reverse flow at the interface (AF)
$Take_{Put\%}$	Proportion by volume of each Take by Put district
$Take_{vol}$	Total volume of the Take by district (AF)
$Take_{vol,m}$	Volume of the Take that is eligible for mitigation (AF)
$Take_{vol,nm}$	Volume of the Take that is not eligible for mitigation (AF)

Note:
[1] Applicable water districts are represented by superscript letters following variables.
Key:
µS/cm = microsiemens per centimeter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)
AF = acre-feet

CALCULATING MITIGATION PAID

Step 1: Determine mitigation percentage based on measured electrical conductivity of Put

Using the mitigation rating curve (Figure 1), determine the required mitigation percentage on the y-axis based on measured EC of the Put on the x-axis.



Key:
µS/cm = microsiemens per centimeter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)

Figure 1. Mitigation Rating Curve, showing percent mitigation based on measured EC of the Put

Step 2: Calculate the adjusted mitigation percentage

The adjusted mitigation percentage represents the impact of the Put on the canal water quality above the established baseline. The established baseline water quality condition is an EC concentration of 200 µS/cm and represents a 5 percent maintenance leaching fraction (Figure 2). It is assumed that water users are already applying a 5 percent maintenance leaching fraction on all crops, regardless of type or sensitivity, so mitigation would only be required for impacts beyond the baseline condition.

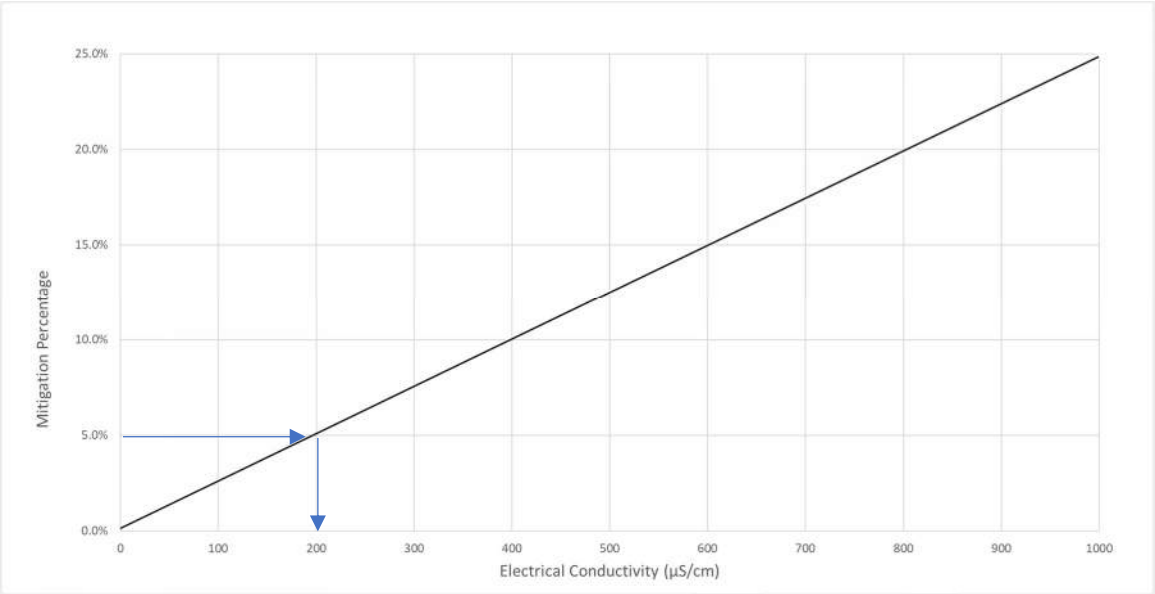


Figure 2. Mitigation Rating Curve, showing established baseline and correlating percent mitigation

$M_{Baseline}$= Mitigation percentage for established baseline (5%)

$M_{adj\%}$ = Adjusted mitigation percentage to account for incremental impact above established baseline EC

$M_{Put\%}$ = Mitigation percentage based on measured EC of Put

$$M_{adj\%} = M_{Put\%} - M_{Baseline}$$

Step 3: Calculate mitigation volume paid

Mitigation volume paid, or the volume of water owed by a Contributor based on the water quality of the introduced water, is calculated by multiplying the total volume of the Put (Put_{vol}) by the adjusted mitigation percentage ($M_{adj\%}$).

$M_{vol,paid}$ = Mitigation volume paid (acre-feet)

Put_{vol} = Volume of Put by district (acre-feet)

$$M_{vol,paid} = Put_{vol} * M_{adj\%}$$

CALCULATING MITIGATION RECEIVED

Mitigation volumes paid by each Contributor are proportioned based on volume of Takes downstream from each Put. Proportion calculations are done in a sequential process to accurately determine the individual impact of each Put on the system. In addition, when the FKC is operating under reverse flow or pump-back conditions, the portions of the FKC operating in gravity flow, reverse flow, and the Interface, or location where gravity flow and reverse flow meet, are all calculated separately.

Step 4: Determine the volume of Take to be mitigated

Mitigation applies to the Take of Friant Division Class 1 and Class 2 deliveries, Recovered Water Account (RWA [Paragraph 16b]) supplies, and supplies from Unreleased Restoration Flows. Friant Division Long-Term Contractors and third parties whose supply is not delivered to the headworks of the FKC are not eligible to receive mitigation and, thus, the total volume of each contractor's Take may not be fully mitigated if a portion of the Take is met by a water supply not eligible for mitigation. In addition, a water district that is both a contributor and recipient of an eligible Take, or "Taker," is not required to mitigate themselves. The variable,

$Take_{vol,nm}$, represents the volume of a Take that is ineligible for mitigation. This variable represents any portion of the Take volume that represents supply not delivered to the headworks of the FKC or a volume of a district's Take that is met by the volume of their own Put.

In order to calculate the volume of the Take eligible for mitigation ($Take_{vol,m}$), the volume of water supply not eligible for mitigation ($Take_{vol,nm}$) is subtracted from the total volume of the Take ($Take_{vol}$).

$Take_{vol}$ = Total volume of the Take by district (acre-feet)

$Take_{vol,nm}$ = Volume of the Take that is not eligible for mitigation (acre-feet)

$Take_{vol,m}$ = Volume of the Take eligible for mitigation (acre-feet)

$$Take_{vol,m} = Take_{vol} - Take_{vol,nm}$$

Step 5: Determine volume proportion of each Take by Put

The volume of each Take is proportioned based on its downstream location in relation to each Put. Take proportions are calculated in a stepwise process by individual Put, and then Take proportions by Put are multiplied by the contributed mitigation volume as shown in Step 6.

$\Sigma Take_{vol,m}$= Sum volume of all Takes eligible for mitigation in relation to each Put (acre-feet)

RF_{vol} = Volume contribution from reverse flow at the Interface (acre-feet)

$$RF_{vol} = \frac{Reverse\ Flow\ Put_{vol} - Reverse\ Flow\ Take_{vol}}{Interface\ Take_{vol}} \times Interface\ Take_{vol,m}$$

$Take_{Put\%}$ = Proportion by volume of each Take by Put district (e.g., for the proportion by volume of Take A from Put A, ${}^{A}Take_{Put\%}^{A}$).

The proportion by volume calculation varies depending on the direction of flow in the canal at the location of the Take. The four equations below describe the necessary calculation depending on Take location and flow region. If the Take is located in a Gravity Flow region of the canal, equation 1 is used. If the Take is located in a Reverse Flow region, equation 2 is used. If the Take is located at the Interface of gravity and reverse flow, equations 3 or 4 are used depending on the volume proportion coming from each direction, respectively.

(1) Take located in the portion of FKC operating in **Gravity Flow**: $$Take_{Put\%} = \frac{Take_{vol,m}}{\sum Take_{vol,m} - RF_{vol}}$$

(2) Take located in the portion of FKC operating in **Reverse Flow**: $$Take_{Put\%} = \frac{Take_{vol,m}}{\sum Take_{vol,m} + RF_{vol}}$$

(3) Take located at **Interface** (proportion from Gravity Flow region of FKC): $$Take_{Put\%} = \frac{Take_{vol,m} - RF_{vol}}{\sum Take_{vol,m} - RF_{vol}}$$

(4) Take located at **Interface** (proportion from Reverse Flow region of FKC): $$Take_{Put\%} = \frac{RF_{vol}}{\sum Take_{vol\,m} + RF_{vol}}$$

Step 6: Determine volume of mitigation received by each Take

Once the volume of each Take is proportioned by Put, Take proportions by Put are used to calculate the total volume of mitigation water received by each Take.

$M_{vol,received}$= Mitigation volume received (acre-feet)

$$M_{vol,received} = \Sigma\ Take_{Put\%} * M_{vol,paid}$$

LEDGER EXAMPLE WITH CALCULATIONS

This section walks through an example scenario to illustrate the six steps to calculate mitigation requirements. This example is purely hypothetical and is included to show the process for calculating mitigation using the proposed Ledger. Table 2 provides example inputs including flow region, water quality conditions, and flow and volume for Puts and Takes. Figure 3 is a schematic of the example scenario showing Puts and Takes by district and location on the FKC.

Table 2. Ledger Example Inputs

Milepost Location	District	Put/Take	Direction of Flow	Flow (cfs)	Put Water Quality (µS/cm)	Volume (AF)	Volume of Take Eligible for Mitigation (AF)
69.15	A	Put	Gravity	65	500	902	--
94.92	A	Take	Gravity	65	--	902	0
95.5	B	Take	Gravity	50	--	694	0
102.72	B	Put	Gravity	50	300	694	--
111.56	C	Take	Gravity	150	--	2,083	347
117.44	D	Take	Gravity	255	--	3,540	3,540
125	E	Take	Interface	100	--	1,388	347
137.17	F	Take	Reverse Flow	65	--	902	902
151.8	G	Take	Reverse Flow	100	--	1,388	1,388
151.8	C	Put	Reverse Flow	125	500	1,736	--
151.8	E	Put	Reverse Flow	75	500	1,041	--

Key:
AF = acre-feet
cfs = cubic feet per second
µS/cm= microsiemens per centimeter

This example scenario only includes calculations for District A. Pump-Back is operational in this example scenario. Mitigation for the portion of the FKC operating by gravity and the portion of the FKC operating in reverse flow is calculated separately using the same method demonstrated in this example scenario, but not shown in this example. When necessary, separate calculations are done for the Interface location as it is influenced by flows from both the upper (gravity flow) and lower (reverse flow) portions of the canal. On the following pages, the calculations completed for this example scenario are shown in green text.

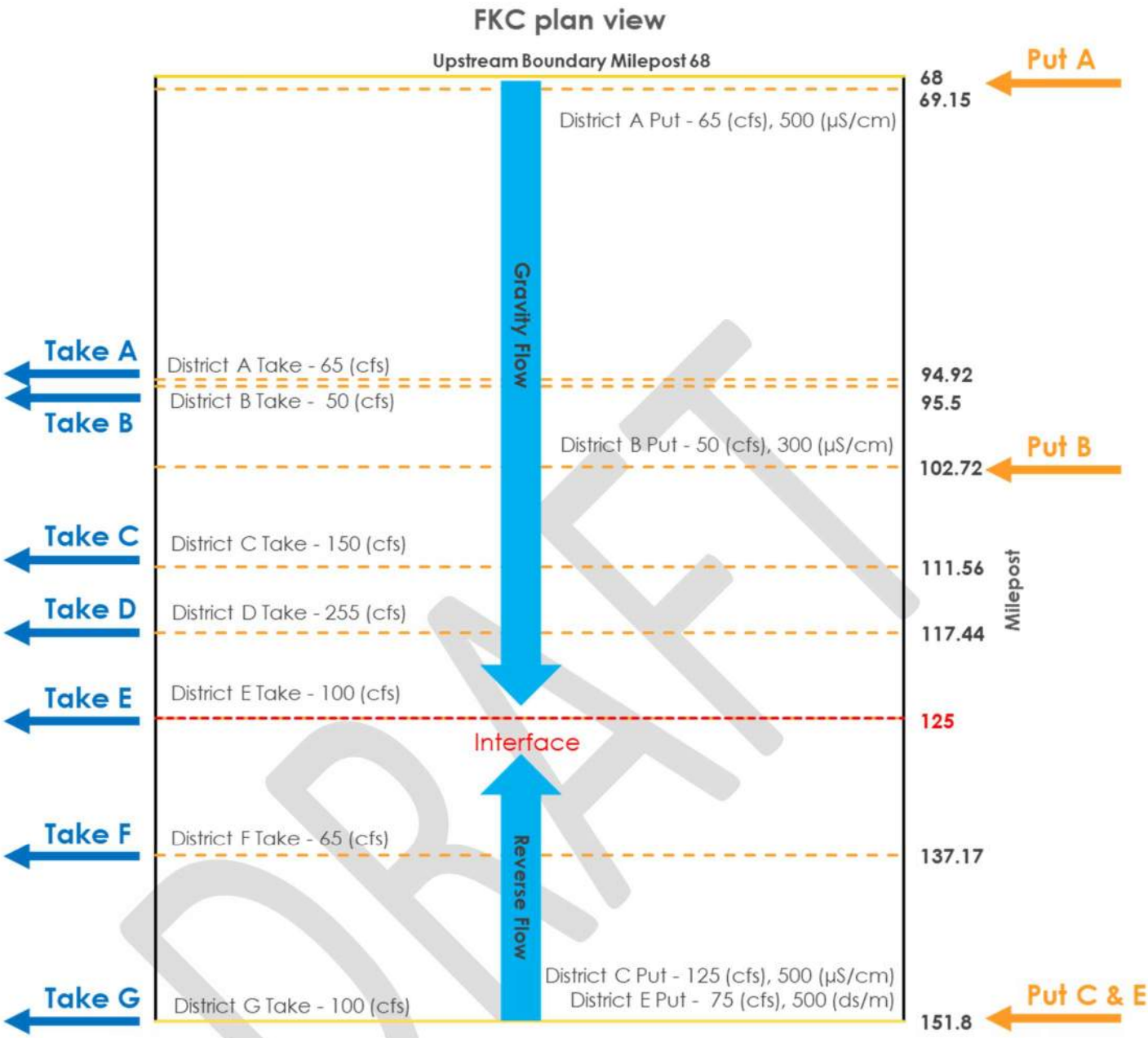


Figure 3. Schematic of Puts and Takes by district and location on the Friant-Kern Canal.

CALCULATING MITIGATION PAID

Step 1: Determine percent mitigation based on measured EC of Put

Using the mitigation rating curve, the measured electrical conductivity of the Put is found on the x-axis and is used to find the correlating required mitigation percentage on the y-axis.

As shown in Table 2, Put A has a measured EC of 500 µS/cm. Using the Mitigation Rating Curve shown below, the measured EC corresponds to a mitigation percentage of approximately 12.5% (Figure 4).

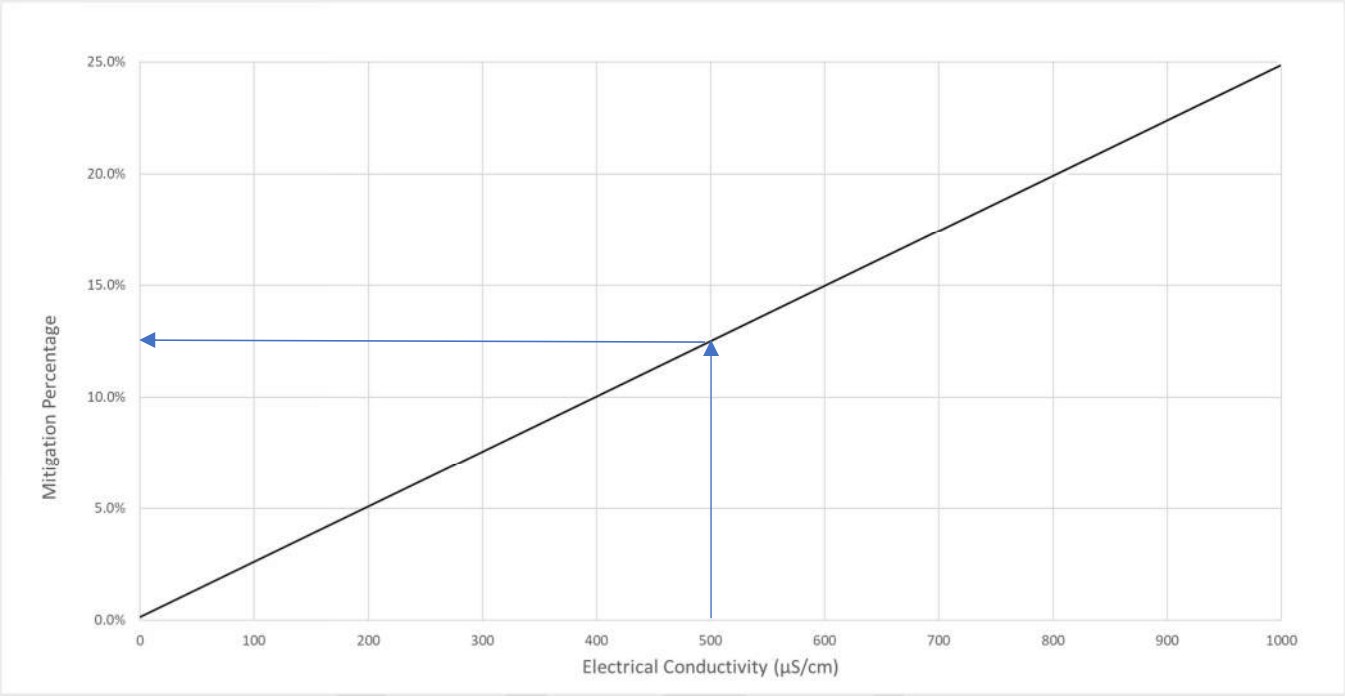


Figure 4. Mitigation Rating Curve, showing percent mitigation based on measured water quality (EC) of the Put

Step 2: Calculate the adjusted mitigation percentage

As shown in Figure 2, the mitigation baseline ($M_{Baseline}$) is 5 percent, correlating the established baseline EC concentration of 200 µS/cm to a 5 percent maintenance leaching fraction. Using the required mitigation percentage based on measured EC of Put ($M_{Put\%}$) calculated in Step 1, 12.5 percent, and the below formula, the adjusted mitigation percentage ($M_{adj\%}$) for Put A is calculated.

The established baseline water quality condition is an EC concentration of 200 µS/cm and represents a 5 percent maintenance leaching fraction

$$M_{adj\%}^{A} = M_{Put\%}^{A} - M_{Baseline}$$

$$M_{adj\%}^{A} = 12.5\% \cdot 5\% = 7.5\%$$

Step 3: Calculate mitigation volume paid

Mitigation volume paid ($M_{vol,paid}$) is calculated by multiplying the total volume of Put A (Put_{vol}^{A}) of 902 AF (see Table 2) by the adjusted mitigation percentage ($M_{adj\%}$) of 7.5 percent calculated in Step 2.

$$M_{vol,paid}^{A} = Put_{vol}^{A} * M_{adj\%}^{A}$$

$$M_{vol,paid}^{A} = 902\ AF * 7.5\% = 68\ AF$$

CALCULATING MITIGATION RECEIVED

For this example, only the proportion of mitigation volume for each Take downstream of Put A is calculated. The total mitigation received by each Taker is calculated by summing the proportion of mitigation volume for each Put. Proportional results for all other Takes in this example are provided in the Water Quality Ledger Example Summary section below.

Step 4: Determine the volume of Take to be mitigated

In this example, the Puts are from programs being implemented by different water districts to meet all or a portion of their Take. It is assumed that all Takes are eligible for mitigation and, thus, the Take volumes to be mitigated are only reduced if the water district is also a Contributor. In this example, Put A is a program implemented by District A at Take A. Using the volume of Take A ($Take_{vol}^{A}$) of 902 AF and volume not eligible for mitigation ($Take_{vol,nm}^{A}$) of 902 AF from District A, which, in this example is the same as Put A (Put_{vol}^{A}) (see Table 2), the volume of Take eligible for mitigation for District A (Takevol,mA) is calculated.

$$Take_{vol,m}^{A} = Take_{vol}^{A} - Take_{vol,nm}^{A}$$

$$Take_{vol,m}^{A} = 902\ AF - 902\ AF = 0\ AF$$

Since District A is delivering an equivalent volume of their program at Put A, they have no volume of Take to be mitigated.

Step 5: Determine volume proportion of each Take by Put

For this example, the volume of each Take is proportioned based on its downstream location in relation to Put A. Takes A through E are downstream of Put A. Take E is the location of the Interface and influenced by both the gravity and reverse flow portion of the FKC (see Figure 3), thus Take F and G downstream of the Interface are removed from the proportion calculations. To complete the proportion calculations, the volume contribution from the reverse flow at the Interface (RF_{vol}) is determined using the formula below. Values used for Put and Take volumes are found in Table 2.

$$RF_{vol} = \frac{\Sigma Reverse\ Flow\ Put_{vol} - \Sigma Reverse\ Flow\ Take_{vol}}{Interface\ Take_{vol}} \times Interface\ Take_{vol,m}$$

$$RF_{vol} = \frac{(Reverse\ Flow\ Put_{vol}^{E} + Reverse\ Flow\ Put_{vol}^{C}) - (Reverse\ Flow\ Take_{vol}^{F} + Reverse\ Flow\ Take_{vol}^{G})}{Interface\ Take_{vol}^{E}} \times Interface\ Take_{vol,m}^{E}$$

$$RF_{vol} = \frac{(1{,}041\ AF + 1{,}736\ AF) - (1{,}388\ AF + 902\ AF)}{1{,}388\ AF} \times 347\ AF = 122\ AF$$

The proportion by volume calculation varies depending on the direction of flow in the canal at the location of the Take. Since Takes A through D are located in the Gravity Flow region on the FKC, the equation below was used to calculate the proportion by volume of Takes A through D for Put A ($Take_{put\%}^{A}$). Please note that the volume of Take eligible for mitigation ($Take_{vol,m}$) was only calculated for District A, but not B, C, and D in this example using Step 4, therefore the volume of Take eligible for mitigation ($Take_{vol,m}$) for Districts B, C, and D are found in Table 2 and 3.

$$Take_{Put\%} = \frac{Take_{vol,m}}{\sum Take_{vol.m-R\ vol}}$$

Σ $Take_{vol,m}$ = $Take_{vol,m}{}^{A}$ + $Take_{vol,m}{}^{B}$ + $Take_{vol,m}{}^{C}$ + $Take_{vol,m}{}^{D}$ + $Take_{vol,m}{}^{E}$

Σ $Take_{vol,m}$ = 0 AF + 0 AF + 347 AF + 3,540 F + 347 AF = 4,234 AF

$Take^{A}{}_{Put\%}{}^{A}$ = 0 AF / (4,234 AF – 122 AF) = 0%

$Take^{B}{}_{Put\%}{}^{A}$ = 0 AF / (4,234 AF – 122 AF) = 0%

$Take^{C}{}_{Put\%}{}^{A}$ = 347 AF / (4,234 AF – 122 AF) = 8.4%

$Take^{D}{}_{Put\%}{}^{A}$ = 3,540 AF/(4,234 AF – 122 AF) = 86.1%

Proportions representing gravity and reverse flow influences at the Interface are calculated separately.

Take E represents the Interface in this example. Because only Put A is being considered, the example only shows the calculation for the proportion of the Take at the Interface influenced by gravity flow. Table 3 shows all calculated proportions for Take E by each Put.

$$Take_{Put\%} = \frac{Take_{vol,m} - RF_{vol}}{\sum Take_{vol,m} - RF_{vol}}$$

$Take^{E}{}_{Put\%}{}^{A}$ = (347 AF – 122 AF)/(4,234 AF – 122 AF) = 5.5%

Step 6: Determine volume of mitigation received by each Take

Once the volume proportions for each Take are calculated for each Put, the mitigation volume received can be calculated using the formula below. For this step, the calculation is only shown for Take C. Please note that all the values required for this calculation have been determined in this example, with the exception of the 18 AF ($M_{vol,paid}$) value that would have been determined using Steps 1-3.

$M_{vol,received}$ = Σ $Take_{Put}$% * $M_{vol,paid}$

$M_{vol,received}{}^{C}$ = ($Take^{C}{}_{Put\%}{}^{A}$ * $M_{vol,paid}{}^{A}$) + ($Take^{C}{}_{Put\%}{}^{B}$ * $M_{vol,paid}{}^{B}$)

$M_{vol,received}$ = 8.4% * 68 AF + 8.4% * 18 AF = 7.3 AF

WATER QUALITY LEDGER EXAMPLE SUMMARY

Table 3 provides calculated values for each Put and Take in the Water Quality Ledger example.

This page left blank intentionally.

Table 3. Water Quality Ledger Example Summary

Milepost	District	Put/ Take	Flow Region	Put Volume (Put_{vol}) (AF)	Take Volume ($Take_{vol}$) (AF)	Step 1		Step 2	Step 3	Step 4		Step 5				Step 6
						Put EC (µS/cm)	Mitigation percentage based on measured EC of Put ($M_{put\%}$) (%)	Adjusted Mitigation Percentage ($M_{adj\%}$) (%)	Mitigation Volume Paid ($M_{vol,paid}$) (AF)	Volume of Take Not Eligible for Mitigation ($Take_{vol,nm}$) (AF)	Volume of Take Eligible for Mitigation ($Take_{vol,m}$) (AF)	Portion of Put A Mitigation ($Take_{put\%}^{A}$)	Portion of Put B Mitigation ($Take_{put\%}^{B}$)	Portion of Put C Mitigation ($Take_{put\%}^{C}$)	Portion of Put E Mitigation ($Take_{put\%}^{E}$)	Mitigation Volume Received ($M_{vol,received}$) (AF)
69.15	A	Put	Gravity	902	NA	500	12.5%	7.5%	68.0	--	--	--	--	--	--	--
94.92	A	Take	Gravity	NA	902	--	--	--	--	902	0	-	-	-	-	-
95.5	B	Take	Gravity	NA	694	--	--	--	--	694	0	-	-	-	-	-
102.72	B	Put	Gravity	694	NA	300	7.6%	2.6%	18.0	--	--	--	--	--	--	--
111.56	C	Take	Gravity	NA	2,083	--	--	--	--	1,736	347	8.4%	8.4%	-	-	7.3
117.44	D	Take	Gravity	NA	3,540	--	--	--	--	-	3,540	86.1%	86.1%	-	-	74.0
125	E	Take	Interface	NA	1,388	--	--	--	--	1,041	347	5.5%	5.5%	5.0%	5.0%	15.1
137.17	F	Take	Reverse Flow	NA	902	--	--	--	--	-	902	-	-	37.4%	37.4%	77.9
151.8	G	Take	Reverse Flow	NA	1,388	--	--	--	--	-	1,388	-	-	57.6%	57.6%	120.0
151.8	C	Put	Reverse Flow	1,736	NA	500	12.5%	7.5%	130.2	--	--	--	--	--	--	--
151.8	E	Put	Reverse Flow	1,041	NA	500	12.5%	7.5%	78.1	--	--	--	--	--	--	--

Key:
AF = acre-feet
µS/cm = microsiemens per centimeter (1 uS/cm = 1 umhos/cm = 1/1,000 dS/m)

This page left blank intentionally.

Friant
WATER AUTHORITY

Friant-Kern Canal Water Quality Policy

Draft Attachment C – Water Quality Monitoring Plan

CONTENTS

TABLES

ACRONYMS

µmhos/cm	micromhos per centimeter (1 µmhos/cm = 1 µS/cm = 1/1,000 dS/m)
µS/cm	microsiemens per centimeter (1 µS/cm = 1 µmhos/cm = 1/1,000 dS/m)
Ad hoc Committee	Ad hoc Water Quality Committee
dS/m	deciSiemens per meter (1 dS/m = 1,000 µmhos/cm = 1,000 µS/cm)
CVC	Cross Valley Canal
EC	electrical conductivity
FKC	Friant-Kern Canal
Friant Division	Friant Division of the Central Valley Project
FWA	Friant Water Authority
IOS	Intellisite Operation System
Policy	Friant-Kern Canal Water Quality Policy
Reclamation	U.S. Department of the Interior, Bureau of Reclamation

This page left blank intentionally.

BACKGROUND

The Ad hoc Water Quality Committee (Ad hoc Committee) is working to develop a comprehensive Friant-Kern Canal (FKC) water quality policy to be adopted by Friant Division of the Central Valley Project (Friant Division) Long-Term Contractors in response to concerns regarding the implementation of programs, which would introduce water of a lesser quality when compared to water quality of historic deliveries from Millerton Lake. For the purpose of measuring and classifying water quality of "introduced water" within the FKC, this attachment to the FKC Water Quality Policy (Policy) describes key elements and actions required for implementation of a water quality monitoring plan. The water quality monitoring plan would be inclusive of water quality monitoring and testing for "introduced" water and FKC in-prism water, real-time reporting, and a FKC blending model (i.e. FKC Water Quality Model).

WATER QUALITY MONITORING

Water quality monitoring and testing for "introduced" water and FKC in-prism water will support implementation of the Policy and would be conducted in addition to existing and ongoing FKC water quality monitoring programs.

The Bureau of Reclamation's (Reclamation) *Policy for Accepting Non-Project Water into the Friant-Kern and Madera Canals* (2008) includes requirements for monitoring water quality conditions for specific constituents to demonstrate compliance with California drinking water standards (Title 22), plus other constituents of concern recommended by the California Department of Health Services. According to this Reclamation policy, water quality conditions for pump-in programs (not including reverse-flow, pump-back) are required to be tested once per year. Friant Water Authority (FWA) is not proposing additional testing for pump-in programs at this time. However, in addition to reporting results of water quality conditions to Reclamation for review, these results are required to be reported to the FWA for use as inputs to the FKC Water Quality Mitigation Ledger and FKC Water Quality Model. FWA will use water quality data and these tools to effectively manage water quality thresholds and determine required mitigation as defined in the FWA Policy.

FWA will monitor existing groundwater quality data from existing data sources, which include:

- State Water Resources Control Board's Groundwater Ambient Monitoring and Assessment Groundwater Information System;
- United States Geological Service's National Water Information System;
- California Department of Water Resources Sustainable Groundwater Management Act Data Viewer; and,
- Groundwater Sustainability Agencies.

FWA will also coordinate with Kern County Water Agency on a weekly basis on Cross Valley Canal (CVC) operations and associated CVC water quality.

The following sections describe continuous, real-time monitoring of conductivity in the FKC; reverse-flow, pump-back operations event-based sampling and measurement of specific water quality constituents; and procedures for reporting and integrating water quality data into the FKC Water Quality Mitigation Ledger and FKC Water Quality Model for forecasting water quality conditions.

SURFACE WATER QUALITY MONITORING

FWA staff will implement continuous, real-time monitoring of in-prism water quality conditions in the FKC. Additionally, event-based water quality sampling and analysis will be performed during reverse-flow, pump-back operations. Measured water quality data will be reported weekly to Friant Contractors and used as inputs for the FKC Water Quality Mitigation Ledger and FKC Water Quality Model.

In-Prism Conductivity Measurements

Conductivity meters (or sondes) will measure and record real-time in-prism electrical conductivity (EC), measured as microsiemens per centimeter (µS/cm), every 15 minutes at the FKC check structures and corresponding mileposts shown in Table 1. Collected EC data will be uploaded to FWA's Intellisite Operation System (IOS) in real-time. These continuous, in situ measurements of electrical conductivity will provide real-time data on incremental water quality changes and mixing in the canal and will assist in water quality threshold management.

Table 1. Check Structure Locations for Real-Time Measurements of Electrical Conductivity

Check Structure	Milepost
Little Dry Creek	5.50
Kings River	28.52
Sand Creek	46.04
Dodge Ave	61.03
Kaweah River	71.29
Rocky Hill	79.25
Fifth Ave	88.22
Tule River	95.67
Deer Creek	102.69
White River	112.90
Reservoir (Woollomes)	121.51
Poso Creek	130.03
Shafter	137.20
Kern River	151.81

In addition, FWA staff will perform electrical conductivity measurements using hand-held conductivity meters as-needed, such as during:

- servicing of real-time monitoring equipment;
- unexpected real-time monitoring equipment outages;
- confirmation of real-time monitoring equipment measurements; and,
- targeted in-prism measurements.

Sampling and Laboratory Testing During Reverse-Flow, Pump-Back Operations

During reverse-flow, pump-back operations, weekly water quality sampling will be performed within the CVC near the FKC/CVC Intertie. Grab samples will be collected by FWA staff and provided to a Reclamation approved, third-party laboratory for testing. At a minimum, grab samples collected during reverse-flow pump-back operations will be analyzed for the following agronomic constituents of concern:

- Bicarbonate
- Boron
- Calcium
- Chloride
- Electrical Conductivity
- Iron
- Magnesium
- Manganese
- Nitrate
- pH
- SAR
- Sodium
- Total Dissolved Solids

Samples will be tested for constituents required by Title 22 standards during initiation of pump-back activities and/or if it is anticipated that operations within the CVC will significantly change mixed water quality conditions (i.e. influence from California Aqueduct, Kern River, Kern Fan).

FRIANT-KERN CANAL WATER QUALITY MODEL

Implementation of the water quality monitoring plan and collection of water quality data will be accompanied by the FKC Water Quality Model. a volumetric mass-balance model of the entire FKC. The FKC Water Quality Model will serve as a water quality forecast tool to assist Friant Division Long-Term Contractors in making real-time operation decisions. The calibration and operation of this model will require compilation of surface water quality data collected, as described above, as well as forecasts of water orders. The model output will initially be manually reported, with eventually integrated with IOS.

WATER QUALITY REPORTING AND COMMUNICATIONS

IOS will report real-time, continuous FKC in-prism electrical conductivity measurements. In addition, FWA staff will provide a weekly summary report to Friant Division Long-Term Contractors on:

- FKC current and forecasted operations;
- FKC current in-prism monitoring and forecasted water quality conditions; and,
- pertinent pump-in programs' operations and water quality conditions.

WATER QUALITY MONITORING COSTS

The following section includes the scope and estimate of capital and annual costs for the components of the water quality monitoring plan. Detailed budget information for all components and implementation of the *FKC Water Quality Policy* can be found in Attachment D.

FWA staff-specific monitoring duties will include:

- Bi-weekly maintenance and calibration of real-time water quality monitoring equipment
- Performance of water quality sampling during pump-in operations and coordination of laboratory testing of water quality samples
- Coordination with Friant Division Long-Term Contractors on water quality data monitoring and analysis
- Management of water quality and operations database
- Performance of weekly water quality reporting and forecasting using the FKC Water Quality Model

Water Quality Testing Equipment

FWA staff will perform only in-prism electrical conductivity measurements, whereas all other water quality constituent testing will be conducted by a third-party laboratory.

FWA will install fourteen (14) Seametrics CT2X conductivity meters at each FKC check structure identified in Table 1 for continuous, real-time water quality monitoring. Costs for purchase and installation of the real-time water quality monitoring equipment, including integration with IOS, is approximately $51,500 ($1,612 per unit cost and total of $28,880 for installation). It is assumed the useful the life of a Seametrics CT2X conductivity meter is about 10 years. Additionally, FWA staff will maintain two (2) existing handheld Hanna DIST5 conductivity meters.

Real-time water quality monitoring equipment and handheld conductivity meters will be calibrated and maintained according to manufacturer recommendations. Costs for maintenance of equipment is estimated to be about 10% of the capital cost ($5,150 annually).

Laboratory Testing

BSK Associates Laboratory Fresno was contacted to provide estimate of representative costs per sample for laboratory testing of collected grab samples. Processing and analysis was estimated to be approximately $1250 per sample for testing Title 22 organics and inorganics, excluding dioxin and TCPs. This estimated cost assumes a turnaround time of 5 business days, which is required to quantify total dissolved solids. For the purposes of this cost estimate, it is assumed laboratory testing will occur for six months per year, or an average of 26 samples taken annually at the CVC intertie. To account for the possibility of extended operations or any other additional needs for laboratory testing, a ten percent contingency was added to the anticipated annual costs for laboratory testing. The total estimated annual cost for laboratory testing is $35,750.

Friant
WATER AUTHORITY

Friant-Kern Canal Water Quality Policy

Draft Attachment D – Water Quality Policy Cost Allocation

CONTENTS

ACRONYMS

$/acre-foot	dollar per acre-foot
Ad hoc Committee	Ad hoc Water Quality Committee
FKC	Friant-Kern Canal
Friant Division	Friant Division of the Central Valley Project
FWA	Friant Water Authority
O&M	operations and maintenance
Policy	Friant-Kern Canal Water Quality Policy

This page left blank intentionally.

BACKGROUND

The Ad hoc Water Quality Committee (Ad hoc Committee) is working to develop a comprehensive Friant-Kern Canal (FKC) water quality policy to be adopted by the Friant Division of the Central Valley Project (Friant Division) in response to concerns regarding the implementation of programs, which would introduce water of a lesser quality, when compared to water quality of historic deliveries from Millerton Lake. This attachment to the FKC Water Quality Policy (Policy) describes the estimated capital and annual costs to implement and administer the Policy, including Water Quality Monitoring Plan, Water Quality Mitigation Ledger, Water Quality Model.

CAPITAL AND ANNUAL COSTS

This section includes the scope and estimate of capital, replacement, and annual costs for the components of the Policy.

FRIANT WATER AUTHORITY STAFF

For implementation of the Policy, one full-time equivalent additional Friant Water Authority (FWA) staff person will be required to:

- Maintain and calibrate conductivity meters on a bi-weekly basis
- Perform water quality sampling during pump-in operations
- Coordinate laboratory water quality testing
- Coordinate with Friant Division Long-Term Contractors on water quality data monitoring and analysis
- Manage water quality and operations database
- Perform weekly water quality reporting and forecasting using FKC Water Quality Model
- Perform weekly analysis to determine mitigation and distribution to respective Friant Division Long-Term Contractors using the FKC Water Quality Mitigation Ledger
- Coordinate with U.S. Department of the Interior, Bureau of Reclamation's South-Central California Area Office on water quality reporting, mitigation, and contractual requirements
- Coordinate and facilitate FWA committee on water quality

Compensation, or cost, for this one full-time additional staff is assumed to be about $100,000 per year (including salary and benefits). Additionally, about $25,000 per year is assumed to be required by the FWA Executive Team and Operations and Maintenance (O&M) Management and Administration team to implement and administer to the Policy.

Total additional cost for FWA staff implementation of the Policy is estimated to be $125,000 per year.

WATER QUALITY TESTING EQUIPMENT AND LABORATORY TESTING

As described in Attachment C – FKC Water Quality Monitoring Plan, initial capital and annual maintenance costs for water quality testing equipment are estimated to be about $51,500 and $5,150, respectively. Water quality testing equipment, specifically, Seametrics CT2X conductivity meters, are assumed to require replacement every 10 years. Annual costs for laboratory testing costs are estimated to be $35,750.

COST ALLOCATION

Costs for implementation and administration of the Policy will be paid initially by the subset of Friant Division Long-Term Contractors who pay for FKC O&M to the FWA and subsequently will be reimbursed by contractor's that introduce water (Put) into the FKC (Contributor). The Contributor will pay a dollar per acre-foot ($/acre-foot) surcharge, or 'Policy Surcharge,' that will be credited back to the Friant Division Long-Term Contractors who pay for O&M to the FWA. The Policy Surcharge is based on an estimate of total annual costs divided by average annual deliveries of pump-in programs into the FKC. The Policy Surcharge will be applied to all introduced water even if it is not required to provide mitigation as defined in the Policy.

Total annual costs are estimated to be $172,000 per year, and include:

- Interest and amortization of capital costs for water quality testing equipment ($51,500), assuming 3% interest over 10-year useful life (i.e. replacement every 10 years), $6,040 per year
- Annual maintenance and laboratory testing costs, $40,900 per year
- FWA staff, $125,000 per year

Pump-in programs are estimated to deliver 75,000 acre-feet per year to the FKC. This estimate includes existing programs and a portion of potential future programs.

Based on this, the initial Policy Surcharge is $2.29 per acre-foot and will be escalated 3% per year. Annual costs and deliveries will be reassessed every year and compared to estimates provided in this attachment to determine if any adjustments are required to the Policy Surcharge.

Friant-Kern Canal Water Quality Policy

Major Decisions

Issue: programs and projects that could introduce water of a lesser quality to the Friant-Kern Canal, when compared to water quality of historic deliveries from Millerton Lake.

Discussion and Concerns:

Supply:
- For some districts, pump-in or pump-back programs are their only means for meeting district demands
- Districts want to make sure additional water supplies (SJRRP 16a water, banked groundwater, etc.) can be conveyed to increase supply reliability and meet demands in all year types.

Water Quality:
- Southernmost district experience disproportionate share of water quality impact
- Districts need to have certainty of water quality at their turnout
- Districts have concerns regarding long-term salt loading in groundwater aquifers and nexus with other regional environmental regulations
- Districts have concerns regarding chronic and acute agronomic impacts

All:
- Districts want improved communications of canal water quality conditions to support planning and avoid agronomic impacts
- FWA's authority to implement policy and compliance timing

Supply	Decision	Water Quality
Quantifying Mitigation		
• An approach to accurately quantify mitigation that is representative of all Friant Districts • Depending on establish baseline mitigation curves can be more conservative or generous	• An excel-based approach quantifying leaching requirements to address water quality • Mitigation curves based on leaching requirement for Chloride, Boron, and TDS • Mitigation curves normalized to EC • Applies to all pump-in programs	• An approach that looks at rootzone effects and quantifies mitigation based on agronomic principles • Existing programs should not be exempt
Establishing Baseline Water Quality		
• Existing projects and programs should be included in baseline condition	• Baseline is set at constituent concentrations that correlate with a 5% maintenance leaching fraction which is representative of minimum leaching practice • Under the mitigation rating curve, this corresponds to an EC of 200 µS/cm	• Baseline should be of Millerton water quality • Baseline should consider soil salinity
How is Mitigation Paid? Mitigation Ledger		
• Contributors need to know how much mitigation will be owed prior to moving water • Timing and source of mitigation should be defined	• Mitigation paid is based on concentration of introduced water, or Put, above the baseline • Percent mitigation and total volume of Put determines the volume paid • Mitigation volume is distributed proportionally to eligible Take downstream of Put on a weekly basis • Mitigation will occur in real-time • Additional mitigation is not be required due to the water quality conditions of the mitigation • The value of additional surface water provided by the mitigation rating curves is inclusive of additional costs related to changes in soil amendments	• Deliveries should be mitigated for degraded water quality at turnout • Degraded water quality would require additional or a change in soil amendments
Windows of Operation and Operational Triggers		
• Water quality thresholds should be managed to maximize existing and future program operations • Limitations imposed to existing programs will require exchanges • If in critical year, should consider re-evaluating policy	• Pump-in programs will be managed to stay under defined threshold by shutting off pumps of highest concentration first to avoid in-prism concentration spikes • Three windows of defined thresholds to account for sensitive crops, deficit irrigation, existing programs, and flexibility based on measured water quality • When thresholds are governing, contractors will seek unleveraged exchanges • If Class 1 allocation is equal to or less than 25%, committee will convene to discuss policy • No pump-ins during uncontrolled season unless they alleviate canal prorate	• There should be windows of Millerton-only deliveries to avoid almond hull rot and during reclamation leaching • If Class 1 is greater than 100% and/or uncontrolled season, Millerton-only deliveries
Other Actions and Decisions:		
	• FWA to work with USBR regarding approach, authority and implementation • Policy can be re-evaluated if future regulatory cost or fee is imposed and can be attributed to incremental water quality degradation; and/or if there is scientifically-based justification and 3 out of 5 southern Districts agree to reopen • Costs of Policy will be paid by Contributors and charged by the FWA	• FWA has limited authority to implement policy • Long-term salt loading and potential regulations related to salt loading are not addressed

Friant
WATER AUTHORITY

Notes