Appendix A
Supplemental Materials

Appendix A Supplemental Materials

A.1 List of Preparers

This Environmental Assessment/Initial Study (EA/IS) was prepared by San Luis & Delta-Mendota Water Authority (SLDMWA) and the Bureau of Reclamation (Reclamation). A list of persons who prepared various sections of the EA/IS, prepared significant background materials, or participated to a significant degree in preparing this EA/IS is presented below in Table A-1 through Table A-3.

Table A-1. CEQA Lead

Preparers	Agency	Role In Preparation
Jacob Bejarano	SLDMWA	Project objective identification, alternative formulation, EA/IS development and review
Jaime McNeil	SLDMWA	Project objective identification, alternative formulation, EA/IS development and review
Rebecca Akroyd	SLDMWA	Project objective identification, alternative formulation, EA/IS development and review
Pablo Arroyave	SLDMWA	Project objective identification, alternative formulation, EA/IS development and review
Cindy Meyer	SLDMWA	Project objective identification, alternative formulation, EA/IS development and review
Scott Petersen	SLDMWA	Project objective identification, alternative formulation, EA/IS development and review

Key: CEQA = California Environmental Quality Act; SLDMWA = San Luis & Delta-Mendota Water Authority; EA/IS = Environmental Assessment/ Initial Study

Table A-2. NEPA Lead

Preparers	Agency	Role In Preparation
Aniruddha (Babi) Bhattacharya	Reclamation	Project objective identification, alternative formulation, EA/IS development and review
Numan Mizyed	Reclamation	Project objective identification, alternative formulation, EA/IS development and review
Brandee Bruce	Reclamation	Project objective identification, alternative formulation, EA/IS development and review
Rain Emerson	Reclamation	Project objective identification, alternative formulation, EA/IS development and review
Jeremy Foin	Reclamation	EA/IS development and review
Vince Barbara	Reclamation	Project objective identification, alternative formulation, EA/IS development and review
Derya Sumer	Reclamation	Project objective identification, alternative formulation, EA/IS development and review
Shauna McDonald	Reclamation	EA/IS development and review

Preparers	Agency	Role In Preparation
Amanda Becker	Reclamation	Project objective identification, alternative formulation, EA/IS development and review

Key: NEPA = National Environmental Policy Act; EA/IS = Environmental Assessment/ Initial Study

Table A-3. Consultants

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
CDM Smith			
Christopher Park, AICP, PMP	M.S. City and Regional Planning 15 years' experience	Water Resources Planner	Project Manager, Technical Review
Anusha Kashyap	M.S. Environmental Engineering 10 years' experience	Environmental Engineer	Project Management, Document Review and Revision, Introduction, Project Description
Laura Lawson	B.S. Environmental Studies 5 years' experience	Environmental Planner	Document Review and Revision, Project Description, Noise and Vibration, Air Quality, Greenhouse Gases
Abbie Woodruff, AICP	M.S. Urban and Environmental Planning B.S. Geography B.S. Environmental Studies 6 years' experience	Water Resources Planner	Water Quality, Water Supply, Geology and Soils, Recreation
Jenna Quan	B.S. Ecology, Evolution & Biodiversity <1 years' experience	Environmental Planner	Document Review and Revision, Affected Environment, Geology and Soils, Public Utilities and Power, Hazards and Hazardous Materials
Greta Gledhill	B.S. Environmental Policy Analysis and Planning <1 years' experience	Environmental Planner	Document Review and Revision
Jeremy Gilbride	B.S. Chemical Engineering 7 years' experience	Chemical Engineer	Air Quality and Greenhouse Gas Emissions
John Pehrson, MBA	B.S. Chemical Engineering 40 years' experience	Chemical Engineer	Technical Review- Air Quality and Greenhouse Gas Emissions
Yonnel Gardes	M.S. Transportation Engineering B.S. Civil Engineering 19 years' experience	Transportation Planner	Technical Review

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Szu-han Chen	M.S. Civil and Environmental Engineering B.S. Urban Planning 9 years' experience	Transportation Planner	Traffic and Transportation
Danielle Tran	B.S. Environmental Science 3 years' experience	Environmental Scientist	Regulatory Settings
John Wondolleck	M.S. Zoology B.S. Biology 49 years' experience	Environmental Management	Technical Review
Samuel Bankston	B.S. Aquatic Biology 9 years' experience	Biologist	Biological Resources
Jennifer Jones	M.S. Environmental Science 20 years' experience	Environmental Scientist	Technical Review-Biological Resources
Brian Heywood, PMP	M.S. Civil Engineering B.S. Civil Engineering 25 years' experience	Water Resources Engineer	Technical Review- Water Quality, Water Supply
Brian Shepard	B.S. Geography and Environmental Resources A.A. Science 4 years' experience	Environmental Planner	GIS Specialist
Pacific Legacy			
John Holson, RPA	M.A. Anthropology, CRM 43 years' experience	Archaeology/Cultural Resources Management	Project Manager, Principal Investigator
Christopher Peske	B.A. Anthropology, M.A. in progress 9 years' experience	Archaeology	Field Director
Denise Duffy & Associates			
Josh Harwayne	M.S. Ecology and Systematic Biology 25 years' experience	Natural Resources Division Manager	Project Manager, Technical Review
John Wandke	M.S. Environmental Science 14 years' experience	Associate Scientist	Field Surveys, Document Preparation and Review, GIS Preparation
Rikki Lougee	B.A. Environmental Studies 3 years' experience	Assistant Environmental Scientist	Field Surveys, Document Preparation and Review

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
California Biordi	M.S. Environmental Science 4 years' experience	Assistant Environmental Scientist	GIS Preparation, Spatial Analyses
MBK Engineers			
Walter Bourez	M.S. Civil Engineering, 26 years' experience	Hydrological Modeling	Alternatives Development, CalSim Modeling
Wesley Walker	M.S. Civil Engineering, 4 years' experience	Hydrological Modeling	Alternatives Development, CalSim Modeling
Shankar Parvathinathan	Ph.D. Environmental Engineering 15 years' experience	Environmental Engineer	Alternatives Development, CalSim Modeling
JRP Historical			
Christopher McMorris	M.S. Historic Preservation 24 years' experience	Historic Architectural/Built Environment Resources	Project Manager for Historic Architectural/Built Environment Studies, Technical Review
Heather Norby	M.A. History 14 years' experience	Historic Architectural/Built Environment Resources	Lead Historian/Architectural Historian, Author Technical Studies
Destiny Beltran	B.S. Wildlife Biology 7 years' experience	Biologist II	Document Preparation

Key: AICP= Association of Certified Planners, ASQ= American Society of Quality, B.A.= Bachelor of Arts, B.S.= Bachelor of Science, CA= Certified Arborist, CERP= Certified Ecological Restoration Practitioner, CHMM= Certified hazardous Materials Manager, CQA= Certified Quality Auditor, CWB= Certified Wildlife Biologist, MBA = Master of Business Administration, M.S.= Masters of Science, Ph.D.=Doctor of Philosophy, RCA= Registered Consulting Arborist, RPA = Register of Professional Archaeologists

A.2 Acronyms

AB	Assembly Bill
ACHP	Advisory Council on Historic Preservation
AF	acre-feet
APE	Area of Potential Effects
ARPA	Archaeological Resources Protection Act
B	beneficial
BAAQMD	Bay Area Air Quality Management District
BMP	best management practice
BP	before present
BRMMP	Biological Resources Management and Monitoring Plan

BSR	biological survey report
CAAQS	California Ambient Air Quality Standards
CalSim II	California Simulation Model II
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CCIC	Central California Information Center
CCID	Central California Irrigation District
CDFW	California Department of Fish and Wildlife
CDPR	California Department of Parks and Recreation
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHRIS	California Historical Resources Information System
CH_4	methane
CO_2	carbon dioxide
CRHR	California Register of Historical Resources
CTS	California Tiger Salamander
CVP	Central Valley Project
CVRWQCB	Central Valley Regional Water Quality Control Board
CY	cubic yard
dBA	A- weighted decibels
Delta	Sacramento-San Joaquin River Delta
DMC	Delta-Mendota Canal
DPM	diesel particulate matter
DPR	Department of Parks and Recreation
DWR	California Department of Water Resources
EA	Environmental Assessment
ESA	Endangered Species Act
GHG	Greenhouse Gas
Intertie Pumping Plant	Delta-Mendota Canal – California Aqueduct Intertie Pumping Plant
I	Interstate
IS	Initial Study
ITA	Indian Trust Assets
ITP	Incidental Take Permit
Jones Pumping Plant	C.W. Bill Jones Pumping Plant (formerly the Tracy Pumping Plant)
LOS	level of service
LTS	less than significant

M&I	municipal and industrial
MAF	million acre-feet
MM	mitigation measure
MP	mile post
$MTCO_2e$	metric tons CO_{2e}
MWSEL	maximum water surface elevation when canal is operated at design flow
NAAQS	national ambient air quality standards
NAHC	Native American Heritage Commission
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NI	no impact
NMFS	National Marine Fisheries Service
N_2O	nitrous oxide
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NWIC	Northwest Information Center
OM&R	operation, maintenance, and replacement
O_3	ozone
OHP	Office of Historic Preservation
PA	Programmatic Agreement
PM	particulate matter
PPV	peak particle velocity
PRC	Public Resources Code
Project	Delta-Mendota Canal Subsidence Correction Project
Reclamation	Bureau of Reclamation
ROC on LTO	Reinitiation of Consultation on the Coordinated Long-Term Operations of CVP and SWP
ROD	Record of Decision
ROW	right-of-way
RWQCB	Regional Water Quality Control Board
S	significant
SCAQMD	South Coast Air Quality Management District
SFBAAB	San Francisco Bay Area Air Basin
SGMA	Sustainable Groundwater Management Act
SHPO	California State Historic Preservation Office
SJKF	San Joaquin Kit Fox
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District

SLDMWA	San Luis and Delta-Mendota Water Authority
SMS	Scenery Management System
SR	state road
SRA	state responsibility areas
SSH	state scenic highway
SSJVIC	Southern San Joaquin Valley Information Center
SWP	State Water Project
SWPPP	Stormwater Pollution Prevention Plan
TAC	toxic air contaminant
TAF	thousand acre-feet
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VMT	vehicle miles traveled
WEAT	Worker Environmental Awareness Training
WIIN	Water Infrastructure Improvements for the Nation Act of 2016

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A.3.4.7 Traffic and Transportation

No References

A.3.4.8 Hazards and Hazardous Materials

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Appendix B
Plan Formulation Technical Memorandum

Delta-Mendota Canal Subsidence Correction Project
Plan Formulation Technical Memorandum

Prepared by
United States Department of the Interior
Bureau of Reclamation
California-Great Basin

San Luis & Delta-Mendota Water Authority
Los Banos, CA

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Contents

Tables

Figures

Abbreviations and Acronyms

CEQA	California Environmental Quality Act
cfs	cubic foot per second
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
D&S	Directive and Standards
Delta	Sacramento-San Joaquin Delta
DMC	Delta-Mendota Canal
DWR	California Department of Water Resources
EA/IS	Environmental Assessment/Initial Study
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
JPOD	Joint Point of Diversion
MP	Mile Post
MWSEL	Maximum Water Surface Elevation when canal is operated at design flow
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
OM&R	Operation, Maintenance and Replacement
PR&G	Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies
Project	Delta-Mendota Canal Subsidence Correction Project
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
ROC on LTO	Reinitiation of Consultation on the Coordinated Long-Term Operation of Central Valley Project and State Water Project
ROD	Record of Decision
ROW	Right-of-way
SGMA	Sustainable Groundwater Management Act
SLDMWA	San Luis & Delta-Mendota Water Authority
SWP	State Water Project
TAF	thousand acre-feet
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
VP Study	Value Planning Study, conducted by Reclamation in 2021
WIIN Act	Water Infrastructure Improvements for the Nation Act of 2016. Public Law 114-322

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Chapter 1 Introduction

This report describes the alternatives identification, evaluation and selection process, and selected alternative identified for evaluation in the Delta-Mendota Canal (DMC) Subsidence Correction Project Feasibility Report and Environmental Assessment (EA)/Initial Study (IS).

1.1 Project Background and History

The DMC is a 116-mile-long canal which conveys water from the Sacramento-San Joaquin Delta (Delta) region near Tracy, California to the Mendota Pool near Mendota, California (Figure 1). This canal is one of the major components of the Delta Division of the U.S. Department of the Interior, Bureau of Reclamation's (Reclamation) Central Valley Project (CVP) and is considered critical infrastructure. The San Luis & Delta-Mendota Water Authority (SLDMWA) operates and maintains the DMC on Reclamation's behalf pursuant to Transfer Agreement Contract No. 8-07-20-X0354-X (January 14, 2020).

The DMC delivers water to agricultural, refuge, and municipal and industrial contractors; a significant portion of the water is used to irrigate agricultural lands in the Central Valley and Santa Clara and San Benito Counties. The main crops in the DMC's service area are tree fruit, melons, grapes, vegetables, and deciduous nuts, making the DMC an important contributor to the success of California's agricultural economy (Water Education Foundation 2022).

The DMC was designed by Reclamation in the late 1940's, in compliance with then-current Design Standards and standard industry practices, and construction was completed in 1951. The upper segment of the DMC is lined with four-inch unreinforced concrete. At Mile Post (MP) 98.64 (Station Number 5201+00), the concrete lining is replaced by earthen lining, which continues for the lower 18 miles of the DMC. During design, Reclamation found that the expansive properties of the clay soil surrounding the lower segment of the canal would be detrimental to a concrete lining. Additionally, high groundwater in areas of the lower 18-mile segment would require an elaborate drainage system to be installed underneath any potential concrete lining. Therefore, Reclamation decided to use suitable clay soil from canal excavation to form an earthen lining for the lower 18-mile segment of the DMC (Reclamation 1959).

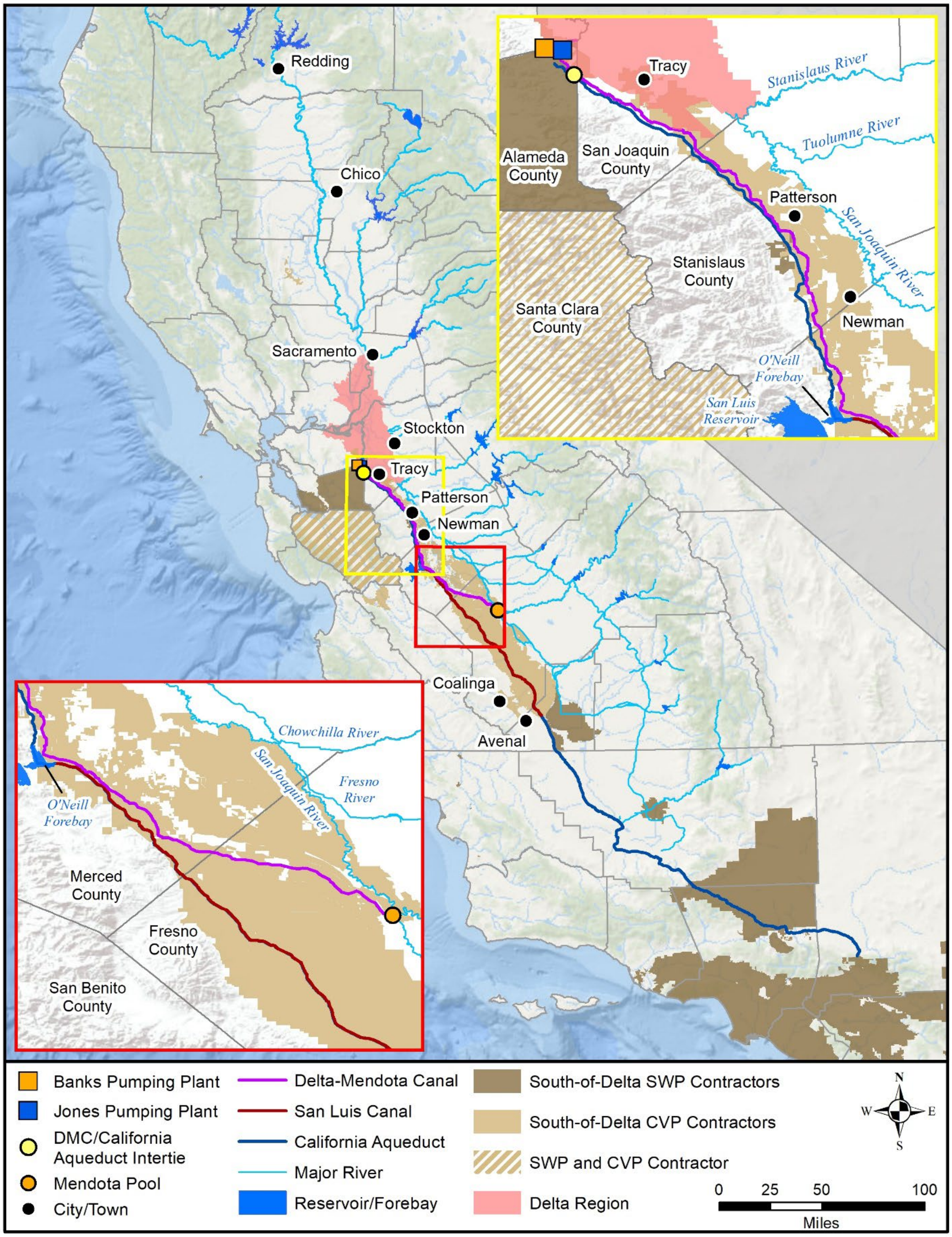

Figure 1. Project Location Map

The DMC was originally designed to convey a variable flow rate, the maximum being 4,600 cubic feet per second (cfs) at its origin (the C.W. "Bill" Jones Pumping Plant near Tracy, CA), reducing to the minimum of 3,210 cfs at its terminal point at Mendota Pool near Mendota, CA. The water is lifted from the Delta into the DMC via large pumps at the C.W. "Bill" Jones Pumping Plant (Jones Pumping Plant; formerly the Tracy Pumping Plant). This pumping plant lifts the water 200 feet to allow for gravity flow through the remaining 113 miles of the DMC, with one major diversion at the San Luis Reservoir/O'Neill Forebay. The DMC has numerous turnouts and delivery locations along its length to service water demands, and a series of check structures and wasteways to monitor, control, and release the flows as needed for operational demands and safety needs. The 700 cfs capacity DMC/California Aqueduct Intertie Pumping Plant (Intertie Pumping Plant) was added to the DMC delivery system in 2012 and is a key component for compensating for diminished capacity in the upper DMC. The Intertie Pumping Plant accomplishes this by pumping water from the DMC into the California Aqueduct for conveyance to O'Neill Forebay where it can be pumped into and stored as CVP supply in San Luis Reservoir, released to the San Luis Canal and the Dos Amigos pumping plant for delivery as CVP supply, or released through the O'Neill Pumping Plant to the lower DMC for delivery as CVP supply. In the short term, the Intertie Pumping Plant allows the subsidence-caused bottleneck in the upper reach of the DMC to be bypassed. Water can also be conveyed from the California Aqueduct to the DMC through the Intertie Pumping Plant; up to 900 cfs can be conveyed from the California Aqueduct to the DMC via gravity flow (Reclamation 2022).

Since its original construction, the DMC has been affected by subsidence generated by groundwater pumping. Reclamation performed construction on the canal to remediate subsidence issues in 1969 and 1977, with work consisting of raising miles of concrete liner and multiple structures. However, subsidence has continued, and the DMC is no longer able to convey the original design flows while operating in accordance with Reclamation Safety Standards and Guidelines. These limits on conveyance capacity have introduced operational constraints that can affect deliveries to south-of-Delta CVP water users. To fully optimize CVP storage and support Reclamation's contract deliveries to south-of-Delta CVP water users, the capacity of the DMC must be restored. Regional groundwater use is anticipated to allow for an additional two feet of inelastic subsidence until full implementation of the Sustainable Groundwater Management Act (SGMA) in 2040, with residual elastic subsidence forecast to continue through the design life of the canal. The DMC Subsidence Correction Project (Project) is proposed to restore conveyance capacity and avoid constraints on the operation of the CVP, as well as address operational safety concerns generated by subsidence.

The Omnibus Public Land Management Act of 2009 (Public Law 111-11) provides Reclamation with the authority to complete or fund work on a project such as the CVP, where the O&M responsibilities have been transferred to a local entity, subject to a repayment contract. This Project meets the definition of extraordinary maintenance, as defined in Public Law 111-11, Section 9603, which includes "major nonrecurring maintenance to Reclamation-owned or operated facilities, or facility components." The Feasibility Report currently underway has been authorized and funded through the Water Infrastructure Improvements for the Nation (WIIN) Act of 2016 (Public Law 114-322) storage projects eligible under Section 4007. Consistent with WIIN and Reclamation's Directive and Standards CMP-09-02, Reclamation has signed a 50-50 cost sharing agreement with SLDMWA, who is the O&M entity of the facility and the nonfederal partner for the Project. Reclamation and SLDMWA are in initial stages of discussion on developing a funding strategy to support final design and construction using federal and other funding.

1.1.1 Groundwater Extraction and Land Subsidence in the San Joaquin Valley

Land subsidence, described as the gradual sinking of a land area, is typically the result of declining groundwater levels due to pumping at a rate higher than that of the aquifer's recharge. Because water in aquifers (especially aquifers composed of fine-grained sediments, which are common in the Central Valley) is somewhat responsible for supporting the structure of the land above it, removing large amounts of water from an aquifer can cause the sediments to compact and the land above to sink (United States Geological Survey [USGS] 2018a). This deformation of aquifers composed of fine-grained sediments is sometimes inelastic, resulting in permanent land subsidence (USGS 2018b). In addition, a portion of the compaction can be residual compaction that occurs over a longer period of time as a result of the delayed drainage of low-permeability fine-grained sediments (USGS 2018b). The San Joaquin Valley has a history of significant regional land subsidence—between 1926 and 1970 land subsidence exceeding 27 feet (8.5 meters) was recorded in the most affected regions of the valley (Poland et al. 1975).

The Sustainable Groundwater Management Act (SGMA) was passed in 2014 with the purpose of regulating groundwater extraction to protect California's groundwater resources over the long term and reduce the occurrence of unsustainable groundwater overdraft. SGMA requires local groundwater sustainability agencies to develop groundwater sustainability plans to mitigate groundwater overdraft within the next 20 years, prioritizing groundwater basins with the greatest problems. These basins are classified as high- and medium-priority basins (California Department of Water Resources [DWR] 2022a).

The DMC is located over the Tracy and Delta-Mendota subbasins, which lie within the San Joaquin Valley groundwater basin. These subbasins are differentially impacted by groundwater overdraft; in the SGMA prioritization categories, the Tracy subbasin is ranked as medium priority whereas the Delta-Mendota subbasin is ranked as high priority/critically overdrafted (DWR 2022b). Because SGMA's regulation of groundwater extraction is focused on medium and high priority basins, groundwater extraction in these areas is expected to be conducted in a more sustainable way following the implementation of SGMA. Once the actions outlined in SGMA are fully implemented, the occurrence and severity of land subsidence is expected to decrease. The contribution of regional groundwater use to subsidence in the Central Valley is anticipated to continue through full SGMA implementation in 2040, with residual subsidence forecast to continue through the year 2070, the design life of the DMC.

1.1.2 Effects of Land Subsidence on the Delta-Mendota Canal: Loss of Available Freeboard and Other Structural Issues

Land subsidence in the most impacted areas along the length of the canal has caused major structural issues that affect the canal's ability to safely carry the capacity of water that it was designed to (its design capacity). The main structural issues caused by land subsidence are the sinking of the canal's lining and embankments, which cause the canal's shape to change in a way that reduces the volume of water that it can carry and therefore reduces the amount available freeboard as the water level rises. Freeboard is the vertical clearance, or additional lining/bank height, above the maximum-designed water surface that acts as an important safety feature to prevent embankment erosion caused by wind waves, protect against flooding in the event of higher-than normal water flows, and more (Reclamation 2018). Reclamation Safety Standards require that available freeboard space should range between 2.21 to 2.36 feet for the concrete-lined segment of the DMC, 1.43 to 1.44 feet for the earth-lined segment, and 4.58 to 4.9 feet for the bank. The rise of the water level in some areas of the canal in response to land subsidence impedes on the available freeboard, meaning that the capacity of the canal must be reduced if it is to operate in accordance with Reclamation Safety Standards and Guidelines. Another safety consequence of land subsidence on the canal is that the clearance space between the water level and some bridges is reduced. Currently, 30 bridges out of the existing 115 along the DMC are considered deficient because they have less than one foot of clearance above the maximum water surface elevation (MWSEL), resulting in deficient bridges being partially submerged when the canal is operated at design capacity. Therefore, if these deficiencies are not rectified, the flow in the canal needs to be restricted further below its current flows so that the canal can be operated in accordance with Reclamation's Safety guidelines as mentioned above.

Because land subsidence varies in severity along the DMC, the loss of available freeboard is not uniform and therefore the reduction in capacity throughout the canal is not uniform. Generally, the northern section of the canal is less impacted by subsidence than the southern section (current capacity reduction in the northern section hovers between eight to 18 percent [368–781 cfs] below design capacity whereas current capacity reduction increases to around 12 to 31 percent [434–1,036 cfs] below design capacity in the southern section), excluding Mile Post (MP) 70 to 85 (station 3023+00 to between stations 3806+72 and 3819+00), where current capacity is reduced by zero to nine percent (0 to 344 cfs). If no action is taken to adjust the capacity of the DMC, the flow in the canal is forecasted to be reduced by up to 44 percent (1,457 cfs) of design capacity by 2070 (design life of the canal) at MP 105 (between stations 4865+00 and 4871+95) when operating in accordance with Reclamation Safety Standards. The least affected region, from MP 70 to 85 (station 3023+00 to between stations 3806+72 and 3819+00), is expected to undergo a capacity reduction of around six to 12 percent (205 to 436 cfs) of design capacity by 2070.

After the DMC capacity reduction issues were initially identified, a separate project was designed in the late 2000s, the Intertie Pumping Plant, which functions by conveying water through the California Aqueduct to O'Neill Forebay for use in the DMC. In the short-term, the Intertie Pumping Plant allows the subsidence-caused bottleneck in the upper reach of the DMC to be bypassed.

1.2 Plan Formulation Process

Consistent with the National Environmental Policy Act (NEPA), the plan formulation process for federal water resources studies is identified in the U.S. Department of the Interior's *Agency Specific Procedures For Implementing the Council on Environmental Quality's Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies* (PR&G) and consists of the following deliberative and iterative steps:

- Identifying water resources problems, needs, and opportunities, and developing planning objectives, constraints, and criteria.
- Inventorying and forecasting conditions likely to occur in the study area.
- Evaluating and comparing alternative plans.
- Selecting a plan for recommendation to decision makers for implementation or no action.

For the Project, this iterative process was separated into multiple phases, as described below:

- **2020 Appraisal Study** – An Appraisal Level study was conducted to identify the sufficient and deficient lengths of canal lining, canal embankment, and associated structures present along the full length of the DMC. This study determined that only 24.82 miles of the 116.51 miles of the canal are sufficient to convey the design flows, whereas 91.69 miles are deficient.
- **2021 Value Planning Report –** The Value Planning Study (hereafter referred to as VP Study) identified a broad range of ideas and options that best meet the goals of the Project. The main goal of the Project identified in the VP Study was to modify or replace existing facilities and construct new facilities to restore the capacity of the DMC and deliver water to satisfy Reclamation's contractual obligations and all other stakeholders. The VP Study also required that the selected solution must include a prioritization of the investment, maintenance of the system's reliability, and protection of the public.
- **2021 Feasibility Study of the Structural Alternatives** – The *Delta-Mendota Canal Subsidence Project — Feasibility Study of the Structural Alternatives* (Feasibility Study of the Structural Alternatives) was conducted by Reclamation in 2021 to further analyze, develop, and combine four alternatives identified in the VP study as solutions to the subsidence problem of the DMC. The study also included a technical evaluation of the alternatives identified and their ability to restore the DMC to its original capacity while satisfying current Reclamation, State, and local design standards. Possible impacts on future canal operations were also presented if the canal is not corrected at this time.

1.3 Planning Objectives, Constraints, and Criteria

1.3.1 National Planning Objective

The Federal Objective, which is defined in the PR&G by the *Water Resources Development Act of 2007* (Public Law 110-114, Section 2031), specifies that federal water resources investments should reflect national priorities, encourage economic development, and protect the environment by doing the following:

- Seek to maximize sustainable economic development.
- Seek to avoid the unwise use of floodplains and flood-prone areas and minimize adverse impacts and vulnerabilities in any case where a floodplain or flood-prone area must be used.
- Protect and restore the functions of natural systems and mitigate any unavoidable damage to natural systems.

Two key concepts in the PR&G are "federal investment" and "public benefit." The PR&G states that total level of a given investment shall be determined on a present value basis over the life of the federal investment. In consideration of the many complex water management challenges and competing demands for limited federal resources, federal agencies investing in water resources should strive to maximize public benefits, particularly compared to costs. Public benefits encompass environmental, economic, and social goals, include monetary and nonmonetary effects and allow for the inclusion of quantified and unquantified measures (U.S. Department of the Interior 2015). Stakeholders and decision makers expect the formulation and evaluation of a diverse range of alternative solutions, which may produce varying degrees of benefits and/or impacts. As a result, the trade-offs among potential solutions need to be assessed and properly communicated during the decision-making process.

1.3.2 Planning Constraints and Other Considerations

1.3.2.1 Partnership and Funding Framework

The Omnibus Public Land Management Act of 2009 (Public Law 111-11) provides Reclamation with the authority to complete or fund work on a project such as the CVP, where the operations and maintenance (O&M) responsibilities have been transferred to a local entity, subject to a repayment contract. This Project meets the definition of extraordinary maintenance, as defined in Public Law 111-11, Section 9603, which includes "major nonrecurring maintenance to Reclamation-owned or operated facilities, or facility components." The Feasibility Report currently underway has been authorized and funded through the Water Infrastructure Improvements for the Nation (WIIN) Act of 2016 (Public law 114-322). Consistent with WIIN and Reclamation's Directive and Standards (D&S) CMP 09-02, Reclamation executed a 50-50 cost sharing agreement with SLDMWA which is the operation, maintenance, and replacement (OM&R) entity for the facility and the Non-Federal partner for the Project. Reclamation and SLDMWA are in the initial stages of discussion on developing a proposed repayment contract to support Final Design and Construction using Federal funding.

1.3.2.2 Laws, Regulations, and Policies

Numerous laws, regulations, executive orders, and policies need to be considered, such as: the PR&G, NEPA, Clean Air Act, Clean Water Act, National Historic Preservation Act, California Public Resources Code, Federal Endangered Species Act (ESA) and California ESA, California Environmental Quality Act (CEQA), and the Central Valley Project Improvement Act (CVPIA). The CVPIA of 1992 (Public Law 102-575) is pertinent because of its influence on water supply deliveries and related environmental conditions in the study area.

1.3.3 Criteria

The federal planning process in the PR&G includes four specific criteria for consideration in formulating and evaluating alternatives: completeness, effectiveness, efficiency, and acceptability (U.S. Department of the Interior 2015).

- Completeness is the extent to which an alternative provides and accounts for all features, investments, and/or other actions necessary to realize the planned effects, including any necessary actions by others. It does not necessarily mean that alternative actions need to be large in scope or scale.
- Effectiveness is the extent to which an alternative alleviates the specified problems and achieves the specified opportunities.
- Efficiency is the extent to which an alternative alleviates the specified problems and realizes the specified opportunities at the least cost; and
- Acceptability is the viability and appropriateness of an alternative from the perspective of the Nation's general public and consistency with existing federal laws, authorities, and public policies. It does not include local or regional preferences for particular solutions or political expediency.

These criteria, and how they apply in helping to compare alternative plans, are described in Chapter 3.

1.4 Problems and Needs

Land subsidence has already caused substantial reductions in the amount of water the DMC can safely convey by causing the canal lining and embankments to sink, resulting in reduced available freeboard and clearances between maximum water surface elevations and structures crossing the DMC. This regional land subsidence is forecasted to continue until at least full implementation of SGMA in 2040 and residually beyond 2040, further impacting the capacity of the DMC through the design life of the canal continuing to limit the amount of water that can be safely delivered to south-of-Delta CVP water users unless action is taken to address this issue (see Figure C-1 in Appendix C).

The Project is critical for the continued operation of the DMC, a vital component of the CVP, as it will restore the conveyance capacity, and ensure the DMC's structural integrity and operational safety are protected and restored. Restoring the conveyance capacity would return the diminished yields and improve water supply reliability to south-of-Delta CVP contractors, meeting the objective to maximize net public benefits.

1.5 Project Objective/Purpose and Need

1.5.1 Project Purpose and Need

As a result of subsidence, the available freeboard for the canal lining and the canal embankment, and clearances between maximum water surface elevations and many structures crossing the DMC, no longer meet Reclamation standards. The combination of reduced freeboard and impacted structures requires that SLDMWA operate the DMC at lower water surface elevations, which reduces its capacity to convey water supply deliveries to south-of-Delta CVP water users dependent on that supply. The continued, safe, and reliable operation of the DMC is critical to the users it serves, and the economies it supports. The purpose and need of Reclamation's Proposed Action is to restore the originally authorized conveyance capacity of the DMC (the design capacity conveys a variable flow rate decreasing from 4,600 cfs at the upstream end to 3,210 cfs at the downstream end).

In compliance with the Council on Environmental Quality's *Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies* (PR&G) and Reclamation's D&S CMP 09-02 Water and Related Resources Feasibility Studies, Reclamation and SLDMWA are evaluating the feasibility of alternatives that would restore the lost conveyance capacity in the DMC caused by regional subsidence. This plan formulation was developed to detail the process of identifying potential alternatives, the evaluation and selection process, and selecting an alternative to be evaluated in the Delta-Mendota Canal (DMC) Subsidence Correction Project Feasibility Report and EA/IS.

1.5.2 CEQA Primary Goals and Objectives

Under CEQA, a lead agency must identify the objectives sought by the proposed project when that project requires an Environmental Impact Report (CEQA Guidelines Section 15124(b)). Although a statement of project objectives is not required under CEQA for an Initial Study (IS), the additional information provided in this section is consistent with CEQA Guidelines. The primary goal for the Project is to restore or replace conveyance capacity in the DMC lost to regional subsidence. The objectives of the Project are as follows:

1. To restore the long-term reliability and quantity of CVP supplies delivered to south-of-Delta contractors dependent on the DMC currently affected by reduced deliveries limited by the canal's reduced conveyance capacity.
2. To support the safe long-term operation of the DMC consistent with its design for freeboard and clearances between maximum water surface elevations and structures crossing the canal.

1.5.2.1 Additional Goals and Objectives

The Project is being designed and implemented to achieve the primary goals and objectives listed above. CEQA Guideline 15124(b) states that the goals and objectives may also outline Project benefits. The additional benefits of the Project are as follows:

- Restore capacity of the DMC for the short-term conveyance of non-CVP water[1] to provide increased water supply reliability and operational flexibility to south-of-Delta CVP contractors and potentially convey surface water supplies for other water users.
- Design and maintain the restored capacity of the DMC for a service life of at least 50 years to avoid potential future reductions in conveyance capacity resulting from continued subsidence forecast following Project implementation.

1.6 Purpose of the Memorandum

This Plan Formulation Technical Memorandum documents the process used to develop the alternatives for the DMC Subsidence Correction Project. The Lead Agencies are using this structured planning process to delineate a reasonable range of alternatives for evaluation in the Feasibility Report and the EA/IS in compliance with CEQA and NEPA.

[1] Environmental compliance for transfer actions including sellers making water available and the conveyance of transferred water to south-of-Delta CVP contractors is analyzed outside this EA/IS in separate environmental compliance documents, including but not limited to the Long-Term Water Transfers environmental document, available here: https://www.usbr.gov/mp/nepa/nepa_project_details.php?Project_ID=18361.

Chapter 2 Pre-Screening of Alternatives

This section summarizes the initial evaluation completed by Reclamation and SLDMWA of existing subsidence generated limits on the operation of the DMC and the identification of potential options to restore that impacted capacity as part of the Appraisal and Feasibility Level Studies and Value Planning Study. In 2020, Reclamation completed an Appraisal Study to identify the sufficient and deficient lengths of canal lining, embankment, and associated structures present along the full length of the DMC. This study determined that only 24.82 miles of the 116.51 miles of the canal are sufficient to convey the design flows, whereas 91.69 miles are deficient.

Following the completion of the Appraisal Study, Reclamation developed a Value Planning Study in 2021 with the purpose of identifying a broad range of ideas or options that best meet the goals of the Project. The main goal of the Project identified in the VP Study was to modify or replace existing facilities and construct new facilities to restore the conveyance capacity of the DMC and deliver water to satisfy Reclamation's contractual obligations and all other stakeholders. The VP Study also required that the selected solution must include a prioritization of the investment, maintenance of the system's reliability, and protection of the public.

2.1 Measures and Alternatives

To begin the process of finding a solution that meets the Project goals, the Reclamation VP Study Team (Team), which included members from Reclamation and SLDMWA, drafted a broad list of 29 measures (referred to in the VP Study as "ideas") that were aimed at solving the problem of the reduced capacity of the DMC. These initial measures are presented in Table 1.

Table 1. Initial Measures

	Measure Description	Disposition
1	Raise canal lining and embankment and associated structures utilizing the existing prism (a) modify impacted bridges (b) siphon at appropriate bridges	Alternative.
2	Raise canal lining and embankment and associated structures utilizing the existing prism siphon at appropriate bridges	Design Consideration/Constraint.
3	Lower/modify the canal invert to reduce impacted structures	Alternative.
4	Widen the canal (a) add culverts at the bridges to reduce impacts (b) change the prism geometry below the top width	Alternative.
5	Replace existing conveyance system to pressurized pipeline (a) one pipe, full flow capacity, within embankment (b) two pipes, half flow capacity each, within embankments	Alternative.
6	Canal lining stays existing and use a pressurized pipeline(s) sized to equal the deficiency within the canal construction (a) within embankment (b) outside of ROW (c) within canal prism including divider wall	Alternative.

	Measure Description	Disposition
7	Canal lining stays existing and use a culvert(s) (gravity flow) sized to equal the deficiency within the canal construction (a) within embankment (b) outside ROW (c) within canal prism including divider wall	Alternative.
8	Rebuild new canal (a) at full flow capacity (b) at deficient flow capacity	Alternative.
9	Do nothing	Alternative, for comparison only.
10	Optimize Water Distribution by reducing canal flows through water exchange and/or point of delivery and/or reverse flow and/or treat and reuse recycled water	Alternative.
11	Add mixtures to limit/eliminate algae growth	Design Consideration/Constraint.
12	Cover canal with "tarp"	Design Consideration/Constraint.
13	Cover canal with solar panel	Design Consideration/Constraint.
14	Erosion protection in unlined sections of the canal, do this first	Included in all Alternatives with relining.
15	Funding and Phasing (start with "easy" end with long-lead items) for the project	Design Consideration/Constraint.
16	Alternative water source for Mendota Pool temporarily, coordination with Friant Water Authority to release water into the San Joaquin River, low flow times only	Design Consideration/Constraint.
17	Temporarily utilize San Luis Drain to convey flows up to 200 cfs	Design Consideration/Constraint.
18	Temporarily supply some users with alternative source water, San Luis Water District can take water out of the San Luis Canal	Design Consideration/Constraint.
19	Permanently supply users with alternative source water, water exchange scenario	Alternative.
20	Exchange contract with California Aqueduct, by enhancing existing agreement	Alternative.
21	Change the point of delivery to districts	Likely more expensive and complex than other Alternatives.
22	Enlarge the point of deliveries to supply more water upstream from canal reducing the required flow within the canal (likely works well on the Lower DMC)	Alternative.
23	Include the ability to reverse the direction of the flow in the canal (reverse flow)	Part of Alternative.
24	Utilize solar panels over the canal to power pumping from Measure 23	Design Consideration.
25	Siphon under highway section or other major road crossing	Part of Alternative.
26	Siphons on the Lower DMC	Included above.
27	Consider various options for structural component modifications	Included above.

	Measure Description	Disposition
28	Use trenchless technology to put pipeline crossings under the canal	Included above.
29	Treat and reuse recycled water to reduce downstream canal demands	Likely too expensive without enough benefit (flow reduction).

Key: White boxes represent measure that were identified as infeasible; Gray boxes represent measures that were identified as feasible. cfs = cubic feet per second; DMC = Delta-Mendota Canal

The Team considered each of the measures and screened out any (represented by white boxes in Table 1) that were identified as being infeasible due to high cost or having major design constraints. For example, use of siphons under Measure 2 would only be possible at one bridge and that bridge currently has freeboard and is not in an area of subsidence. The remaining measures (represented by gray boxes in Table 1) were identified as having potential to be feasible and meet the Project's goals when employed either alone or in tandem with other measures. These measures were further refined and combined by the Team to create 11 alternatives that were evaluated in more depth via a scoring process in the remainder of the VP Study. The 11 alternatives that were born from the refinement and combination of these initial measures are detailed in Table 2.

Table 2. Alternatives Evaluated in Value Planning Study

Alternative	Title	Description
1	Raise Deficient Lining, Embankment, and Impacted Bridges	Raise canal lining & embankment to satisfy freeboard requirements at deficient locations along the canal and modify other impacted structures.
2	Lower the Canal Invert (includes divider wall in portions of the canal)	Lower canal invert at non-subsided locations to restore the hydraulic slope of the canal and reduce the number of impacted structures anticipated to be raised.
3	Widen Canal and Add Culverts at Bridges	Widen canal at top portion on one or both side(s), adding culverts at the outside of bridge abutments.
4	Change Canal Prism Below Top Width (includes divider wall)	Modify canal prism below the top width of the canal to increase capacity and freeboard in accordance with regulations without widening the canal. Currently deficient structures would not need to be replaced.
5	Pressurized Pipeline(s) for Deficient Flow Within Embankment	Create new, buried pipeline(s) within the canal embankment to divert deficient flows of approximately 500-600 cfs.
6	Pressurized Pipeline(s) for Deficient Flow Within Canal Prism (includes divider wall)	Create new pipeline(s) within the canal prism that would be larger than that in Alternative 5.
7	Culvert(s) for Deficient Flow Within Embankment	Construct parallel culvert(s) along the canal embankment at segments that constrict flow to restore canal flow to design capacity.
8	Culvert(s) for Deficient Flow Within Canal Prism (includes divider wall)	Install culvert(s) within the canal prism. Similar to Alternative 7.

Alternative	Title	Description
9	Build New Parallel Canal at Deficient Flow Capacity	Construct a new parallel canal within the existing ROW that would convey flow capacity in excess of the existing canal capacity, meeting safety requirements.
10	Baseline Condition (not considered a solution, included for comparison only)	No action. Current deficient lining lengths (91.7 miles) includes both concrete- and earthen-lined segments of the canal. Given predicted subsidence, approximately 63 vehicular bridge crossings and other utilities would become fully/partially submerged in the future.
11	Optimize Water Distribution	Optimize the use of existing water conveyance systems within the DMC service area, such as the California Aqueduct, district interconnected facilities, and more to reduce DMC flows.

2.2 Pre-Screening Criteria and Process

To further evaluate the potential feasibility and function of Alternatives 1 through 11 and identify the most promising alternatives, the Team developed a set of seven criteria and a scoring system. The seven criteria are consistent with the definition of feasibility as defined under CEQA Guidelines Section 15364. The criteria were weighted differentially in the scoring process based on each criterion's importance in achieving the project goal of restoring the capacity of the DMC while prioritizing long-term investment, reliability, and public safety. These criteria, their weighting, and the scoring system used to evaluate the alternatives are detailed in Table 3.

Alternatives 1 through 11 were evaluated based on the criteria detailed in Table 3 and given a score ranging from one (representing the least favorable outcome) to five (representing the most favorable outcome). These scores were multiplied by the criteria weights, and scores were summed for each alternative.

Table 3. Screening Criteria, Scoring, and Weighting

	Criterion	Evaluation Question	Scoring	Weight (%)
A	OM&R Cost	What is the cost of OM&R? How complicated or difficult is the OM&R compared to the service life and longevity?	5: Low/Favorable 1: High/Unfavorable	9
B	Capital Cost[1]	What is the capital cost?	5: Low 1: High	9
C	Sequencing/Seasonality	How flexible are the sequences of construction?	5: Highly Flexible 1: No Flexibility	9
D	Future Flexibility and Fringe Benefits	Does the solution create future benefits/opportunities?	5: Many 1: None	5
E	Permit Requirements	How complex is the permitting compared to other alternatives?	5: Low Complexity 1: High Complexity	16
F	Delivery Impacts	What is the impact of the solution on the delivery of water (including pipeline crossing deliveries)?	5: Minimal Impact 1: Maximum Impact	41
G	Project Phasing	How easily is the solution phased considering schedule, funding, and user impact?	5: Favorable 1: Unfavorable	11

Notes:
[1] Capital cost is defined as the sum of the construction costs and interest during construction.
Key: OM&R = operation, maintenance, and replacement; % = percent

2.3 Pre-Screening Results

The relative scores and rankings of the 11 alternatives as evaluated against the criteria are detailed in Table 4. Scores highlighted in green correspond to alternatives that scored high enough to be considered further, either individually or in tandem with one another. Scores highlighted in blue correspond to alternatives that will no longer be considered as a solution for the Project. The No Action Alternative (Alternative 10) is highlighted in red.

Table 4. Scoring of No Action Alternative and Five Highest-Scoring Action Alternatives

	Score									
Criteria (Weight %)	**OM&R Costs (9)**	**Capital Costs (9)**	**Sequencing and Seasonality (9)**	**Future Flexibility & Fringe Benefits (5)**	**Permit Requirements (16)**	**Delivery Impacts (41)**	**Project Phasing (11)**	**Raw Score**	**Weighted Score**	**Ranking**
Alternative 1 - Raise Deficient Lining, Embankment, and Impacted Bridges	5	2	5	3	4	5	5	29	447.7	1
Alternative 2 - Lower the Canal Invert (includes divider wall in portions of the canal)	5	3	2	4	5	3	3	25	345.5	4
Alternative 3 - Widen Canal and Add Culverts at Bridges	4	2	3	3	3	3	2	20	288.6	8
Alternative 4 - Change Canal Prism Below Top Width (includes divider wall)	4	2	3	5	3	3	2	22	297.7	7
Alternative 5 - Pressurized Pipeline(s) for Deficient Flow Within Embankment	1	2	4	4	3	3	2	19	275	10
Alternative 6 - Pressurized Pipeline(s) for Deficient Flow Within Canal Prism (includes divider wall)	1	1	3	5	4	3	2	19	277.3	9

	Score									
Criteria (Weight %)	**OM&R Costs (9)**	**Capital Costs (9)**	**Sequencing and Seasonality (9)**	**Future Flexibility & Fringe Benefits (5)**	**Permit Requirements (16)**	**Delivery Impacts (41)**	**Project Phasing (11)**	**Raw Score**	**Weighted Score**	**Ranking**
Alternative 7 - Culvert(s) for Deficient Flow Within Embankment	3	3	4	4	3	4	2	23	343.2	6
Alternative 8 - Culvert(s) for Deficient Flow Within Canal Prism (includes divider wall)	3	2	3	5	4	4	2	23	345.5	4
Alternative 9 - Build New Parallel Canal at Deficient Flow Capacity	4	3	5	4	2	4	3	25	356.8	3
Alternative 10 - Baseline Condition (not considered a solution, included for comparison only)	3	5	5	1	5	1	1	21	254.5	11
Alternative 11 - Optimize Water Distribution	2	4	4	3	3	5	5	26	413.6	2

Alternatives 1 and 11 ranked the highest among the 11 alternatives analyzed in the VP Study overall. These two alternatives both earned scores of fives in the most heavily weighted criterion, Delivery Impacts, in addition to scoring highly in other criteria. Scoring well in the Delivery Impacts criterion indicates that both alternatives would have minimal impacts on water delivery. The lowest-scoring alternative in the Delivery Impacts criterion was the No Action Alternative (Alternative 10) since this alternative would impact water delivery because it does not address the DMC capacity issue, resulting in ongoing and increasing reduced water delivery.

Alternatives 2 and 10 earned scores of fives in the second-most important criterion, Permitting Requirements. Scoring highly in this criterion indicates that both alternatives would require few, if any, permits. Because Alternative 10 is the No Action Alternative, it would not require any permits to complete. The lowest-scoring alternative in this criterion was Alternative 9, which would build a new canal. This effort would require acquiring additional right of way to support construction of the new canal alignment, which is assumed to generate the highest level of permitting complexity in comparison to the other alternatives.

Project Phasing was the third-most important criterion, and Alternatives 1 and 11 scored the highest in this criterion. High scores were identified for both these solutions given that they would not require complex scheduling, funding, or water user impacts. The No Action Alternative (Alternative 10) received the lowest score in this criterion, as taking no action would result in large impacts on canal users that are expected to increase in the future.

Alternatives 1 and 2 scored the highest in the OM&R Cost criterion, indicating that these alternatives would not generate complex or expensive additional OM&R throughout the service life of the DMC. Alternative 6, which involves constructing pressurized pipelines within the canal prism, would require the construction of a new pump station that would create increased energy needs and therefore increased OM&R costs. Alternative 11 also scored poorly in this criterion due to the more complicated and expensive operation efforts that would be required as compared to the life and longevity of this alternative.

The No Action Alternative (Alternative 10) scored the highest in the Capital Cost criterion, reflecting the fact that taking no action is the least expensive alternative. Because Alternative 11 involves optimizing the use of existing water conveyance systems, this alternative also scored highly in this criterion. The lowest-scoring, and therefore most expensive, alternative was Alternative 6. Multiple other alternatives, including Alternative 1 and Alternative 8, also received low scores in this criterion, given their high potential cost to execute.

Alternatives 1, 9, and 10 scored highest in the Sequencing/Seasonality criterion, indicating that the required construction work (or lack thereof) associated with these alternatives is flexible and not hindered by sequence or seasonality concerns. Alternative 2 scored the lowest in this criterion, reflective of the fact that work on the earthen segment of the canal would require the canal to undergo a partial outage and that would be limited to the winter months.

The criterion Future Flexibility and Fringe Benefits reflects whether alternatives create future benefits or opportunities for the canal. Alternatives 4, 6, and 8 were identified as being the most successful in creating future benefits/opportunities by allowing for more flexible future operations. The No Action Alternative (Alternative 10) scored the lowest in this criterion, as taking no action to address the capacity issues of the DMC would result in a reduction of future benefits/opportunities for the canal.

Based on the results of this scoring process, Reclamation identified three action alternatives and one non-structural alternative for further evaluation. Although the No Action Alternative was the least favorable alternative as it does not allow meeting Project goals, it was retained for comparison purposes consistent with D&S and NEPA requirements.

2.4 Alternatives Selected for Further Evaluation

2.4.1 Raise Deficient Structures (Alternative 1)

In this alternative, derived from Alternative 1, deficient lining and embankment segments of the canal and associated impacted structures would be raised to allow for the safe operation of the canal at its design capacity. Specific actions would include raising the concrete lining segments and bank segments, installing riprap for erosion protection to stabilize the banks along the earthen segment, repairing concrete lining, replacing impacted bridges and pipeline crossings, raising the gates of check structures and wasteways, and modifying turnouts and existing drainage structures for safe passage of stormwater.

2.4.2 Adjust Canal Invert and Raise Deficient Structures (Alternative 2)

This alternative was created by combining Alternatives 1, 2, and 11. This alternative aims to lower the canal invert at non-subsided locations to restore the hydraulic slope of the canal and therefore its design capacity. This action, although it would reduce the number of deficient structures along the canal, would not be sufficient to restore the canal's capacity along the whole length of the canal; thus, remaining deficient structures would be raised in the same manner prescribed for Alternative 1. Hydraulic analysis for lowering the invert of non-subsided locations in the concrete lined segment of the DMC showed limited benefits; however, lowering the invert of the earthen segment of the DMC and restoring this segment to its original shape resulted in significant reduction in the number of impacted structures. Thus, this alternative was modified to rebuild the earthen segment, raising deficient lining and embankment, in addition to raising impacted structures.

2.4.3 Optimize Water Distribution (Non-Structural Alternative/Alternative 3)

This alternative, derived from Alternative 11, requires optimizing water distribution to South-of-Delta CVP water users using existing State Water Project (SWP) water conveyance systems including the Banks Pumping Plant, Intertie Pumping Plant, the California Aqueduct, and the San Luis wasteway, owned and operated by Central California Irrigation District, to restore diminished water deliveries. Alternative 11 in the VP study also considered modifying existing water conveyance infrastructure to allow deliveries through alternate delivery points. However, this action would require physical changes to the facilities and would not meet Reclamation D&S CMP 09-04 (Reclamation 2018) requirements for a non-structural alternative. Therefore, this alternative would not include the physical changes under Alternative 11 and only optimize use of existing facilities.

The non-structural alternatives for the upper DMC (Jones Pumping Plant to O'Neill Forebay) and lower DMC (O'Neill Forebay to Mendota Pool) are evaluated separately because the upper DMC is physically connected with the California Aqueduct through the Intertie Pumping Plant, and addressing diminished capacity in the upper DMC requires evaluating use of existing SWP facilities to convey water from the Delta. The lower DMC does not have any existing conveyance features that could be relied on to augment the DMC without structural modification. Under this alternative, Reclamation would need to negotiate and execute a permanent Conveyance and Use Agreement with California Department of Water Resources (DWR) to utilize available pumping capacity at the Banks Pumping Plant for Joint Point of Diversion (JPOD) and maximize pumping at the Intertie Pumping Plant.

2.4.4 Build New Parallel Canal at Point of Deficient Flow Capacity (Alternative 4)

This alternative, derived from Alternative 9, involves constructing a new canal parallel to the DMC that would span 47 miles from MP 16.34 to MP 70.01. This proposed canal would have a bottom width of 18 feet and water depth of 9 feet. New pipe crossings would have to be installed over the new parallel canal and additional work to modify wasteways and drainage structures would be required where the DMC and the new parallel canal would merge. Culverts under existing roads would be utilized for the parallel canal (modification of alternative 8 in the VP study).

In addition to constructing a new canal, sections of the DMC would require raising the canal lining and embankment as proposed in Alternatives 1 and 2, though the lining and embankments would not have to be raised as high under this alternative. This alternative would also require other repairs to the DMC, including rebuilding the earthen-lined segment (since the new canal would terminate at MP 70), replacing impacted bridges and pipeline crossings, modifying check structures and wasteways, and modifying drainage structures Additionally, agricultural lands outside Reclamation RWO would need to be purchased for this alternative.

Chapter 3 Screening Evaluation and Alternative Development

This chapter describes the screening process used to evaluate the alternatives identified in Chapter 2.

Following the VP Study, three action alternatives and one non-structural alternative were selected for further analysis in Reclamation's 2021 Feasibility Study of the Structural Alternatives: Alternative 1 (derived from Alternative 1 in the VP Study), Alternative 2 (a combination of Alternatives 1, 2, and 8 from the VP Study), Alternative 3 (a non-structural alternative derived from Alternative 11 in the VP Study), and Alternative 4 (derived from Alternative 9 in the VP Study). The four alternatives considered in the Screening Evaluation, their names, and their corresponding alternative numbers from the VP Study are detailed in Table 5.

Table 5. Screening Evaluation Alternatives

Screening Evaluation Alternative	Alternative Name	Corresponding Alternative from VP Study
1	Raise Deficient Structures	1
2	Adjust Canal Invert and Raise Deficient Structures	1, 2, and 8
3	Non-Structural; Optimize Water Distribution	11
4	Build New Parallel Canal	9

The screening evaluation considered two levels of screening.

3.1 Level 1 Screening Evaluation

The criteria to evaluate the alternatives include (1) the ability of the alternative to address the Project's objectives (restore original authorized design capacity of the DMC while continuing to meet Reclamation Safety Standards) and (2) the ability of the alternative to address the Project purpose and need (restore the originally authorized conveyance capacity of the DMC). Alternatives were scored for each of the screening criteria using the following metrics:

- High (3) score means the alternative fully meets Project objectives/Project purpose and need
- Medium (2) score means the alternative partially meets the Project objectives/Project purpose and need
- Low (1) score means the alternative does not meet the Project objectives/Project purpose need

3.1.1 Level 1 Screening Results and Discussion

Each of the alternatives were given a score that represents the degree to which it accomplishes the Project objectives/Project purpose and need. Table 6 presents the results of the screening process.

Table 6. Project Objective/Purpose and Need Screening Results

Alternative	Project Purpose and Need	Project Objectives		Overall Score
	Restore DMC Conveyance Capacity or Otherwise Deliver the CVP Supply Through Other Means	Meet Reclamation's Freeboard Requirements on the DMC	Increase Long-term Reliability and Quantity of CVP Supplies to South-of-Delta Contractors	
Alternative 1 (Raise Deficient Structures)	3	3	3	3
Alternative 2 (Adjust Canal Invert and Raise Deficient Structures)	3	3	3	3
Alternative 3 (Non-Structural)	1	3	1	2
Alternative 4 (Build New Parallel Canal)	3	3	3	3

Key: 3 – High, 2 – Medium, 1 – Low

Alternatives 1 and 2 scored high when scored against the Project objective/Project purpose and need, whereas Alternative 3 scored the lowest. Alternatives 1 and 2 both fulfill the Project purpose and need, which is to restore the originally authorized conveyance capacity of the DMC, as well as the Project objectives of increasing freeboard space and making it possible to increase the long-term reliability and quantity of CVP supplies delivered to South-of-Delta contractors dependent on the DMC. Under both alternatives, the DMC would be modified to satisfy current Reclamation safety standards, including freeboard requirements for the canal lining and embankment, to convey the design capacity of water.

Alternative 3 is the non-structural alternative and involves optimizing the use of existing south-of-Delta SWP and CVP water infrastructure (such as the Banks Pumping Plant, Intertie Pumping Plant, California Aqueduct, district interconnected facilities, etc.). Modeling of the non-structural alternative, which is presented in more detail in Section 3.2.1.2, has indicated that this alternative is inadequate to address loss of conveyance capacity. As such, this alternative fails to meet the Project purpose and need of restoring the DMC's originally authorized conveyance capacity or otherwise deliver the CVP supply through other means. Under this alternative, the DMC would be operated consistent with Reclamation's safety standards and would therefore meet the required freeboard requirements. However, even with fully optimized operation of existing south-of-Delta SWP and CVP water infrastructure, the long-term reliability and quantity of CVP supplies delivered to south-of-Delta contractors dependent on the DMC is not expected to substantially increase. Consequently, Alternative 3 would not fully meet the Project Purpose and Need nor Project objective.

Similar to Alternatives 1 and 2, Alternative 4 scored high when scored against the Project objective/Project purpose and need. Under Alternative 4, the new parallel canal capacity would allow the portion of existing canal to operate at reduced capacity without freeboard deficiencies. Additional improvements, similar to those under Alternative 1 and 2, would satisfy current Reclamation safety standards and restore the originally authorized conveyance capacity of the remaining segments of the DMC that are not parallel to the new canal. While Alternative 4 would only partially restore the original capacity of the DMC, the new canal would make it possible to deliver the CVP supply through other means and increase the long-term reliability and quantity of CVP supplies delivered to south-of-Delta contractors dependent on the DMC. Therefore, Alternative 4 would meet the Project purpose and need and the Project objectives.

3.1.2 Alternatives Carried Forward for the Level 2 Screening Evaluation

Alternatives 1, 2, and 4 fully meet the Project objectives/purpose and need and will be carried forward as action alternatives for evaluation in the Level 2 Screening. Alternative 3 did not meet the Project purpose and need but partially met the Project objectives, so it will also be carried forward for evaluation in the Level 2 Screening.

3.2 Level 2 Screening Evaluation

Consistent with the standards for formulating and evaluating alternatives for planning and water resource-related projects outlined in the Council of Environmental Quality's *Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies*, the Level 2 screening evaluation and comparison of alternatives rely on the federal planning criteria of completeness, effectiveness, acceptability, and efficiency. This evaluation, developed by Reclamation and SLDMWA, presents the relative performance of the alternatives as they are defined in this stage of the study process. The federal criteria and their application in the evaluation and comparison process is as follows:

- Completeness: The completeness criterion addresses whether the alternative would account for all investments or other actions necessary to realize the planned effects. This criterion was measured by the operational ability to implement of the alternatives to characterize the degree to which each alternative would provide for the realization of the Project's purpose and need.
- Effectiveness: The effectiveness criterion addresses how well an alternative would alleviate problems and achieve opportunities. This criterion was measured by the improved water supply yield reliability to south-of-Delta CVP contractors provided by the alternatives.
- Acceptability: The acceptability criterion addresses the viability of an alternative from the perspective of the nation's general public and consistently with existing Federal laws, authorities and public policies. The performance measures for the acceptability criterion focus on potential environmental effects and compatibility with existing laws.
- Efficiency: This evaluation criterion is a measure of how efficiently an alternative alleviates identified problems while realizing specified objectives. Possible approaches to evaluating efficiency include (1) dollars per unit of economic benefit, (2) least cost of attaining an objective, (3) and reduced opportunity costs relative to accomplishments of other

alternatives. In this analysis, efficiency of the alternatives was evaluated using an estimated overall Project benefit.

Similar to scoring process used for Level 1 screening, the alternatives were scored for each of the screening criteria using the following metrics:

- High score indicates the alternative fully meets the federal planning criteria of completeness, effectiveness, acceptability, and efficiency.
- Medium score indicates the alternative somewhat meets the federal planning criteria of completeness, effectiveness, acceptability, and efficiency.
- Low score indicates the alternative does not meet the federal planning criteria of completeness, effectiveness, acceptability, and efficiency.

The Plan Formulation Report considers a qualitative approach to the federal planning criteria discussed above. A more detailed and quantitative evaluation of these criteria will be completed in the Feasibility Report and the EA/IS being completed for the selected alternatives.

3.2.1 Completeness

The completeness criterion addresses whether the alternative would account for all investments or other actions necessary to realize the planned effects. This criterion considers how well the alternative plan would achieve the planning objectives. Three performance measures (Authorization and Funding, Full Spectrum of Objectives, and Operational Ability to Implement) were developed for the completeness criterion to characterize the degree to which each alternative would provide for the realization of the project's purpose and need.

3.2.1.1 Authorization and Funding

Public Law 111-11 provides Reclamation with the authority to complete or fund work on a project such as the CVP, where the O&M responsibilities have been transferred to a local entity, subject to a repayment contract. Alternatives 1 and 2 would meet the definition of extraordinary maintenance, as defined in Public Law 111-11. Therefore, Alternatives 1 and 2 scored high under this criterion.

Alternative 3 would not require construction or additional maintenance and would be authorized under Public Law 111-11. Therefore, Alternative 3 scored high under this criterion.

Alternative 4 may not qualify as a project that can be completed or funded under Public Law 111-11 because it may not meet the definition of extraordinary maintenance, which is defined in Public Law 111-11, Section 9603 as "major nonrecurring maintenance to Reclamation-owned or operated facilities or facility components." Therefore, this alternative scored low under this criterion.

3.2.1.2 CEQA Primary Objectives

This performance measure indicates each alternative's capacity to satisfy the two primary planning objectives by the degree to which implementation of each alternative would:

- Restore the long-term reliability and quantity of CVP supplies delivered to south-of-Delta contractors dependent on the DMC currently affected by reduced deliveries limited by the canal's reduced conveyance capacity.
- Support the safe long-term operation of the DMC consistent with its design for freeboard and clearances between maximum water surface elevations and structures crossing the canal.

The ratings identified for each alternative correspond to the number of study objectives that it would meet, and to what extent those objectives would be met. Alternatives 1, 2, and 4 would all meet the project objectives, as discussed in Section 3.1.1, and therefore score high. While Alternative 3 would increase the quantity of CVP supplies delivered to south-of-Delta contractors, it would be to a lower extent than under Alternatives 1, 2 and 4. Therefore, Alternative 3 scores as medium.

3.2.1.2 Operational Ability to Implement

This performance measure indicates the relative complexity associated with operating each alternative with alternatives that would require substantial modification to current operational guidelines/protocols scoring low and alternatives following current guidelines/protocols scoring high.

Alternative 1

Alternative 1 scores high under the operational ability to implement criterion. Under this alternative, the deficient lining, embankment, and impacted structures of the canal would be raised to restore the canal capacity to its originally authorized design flow capacity. The DMC's operations after construction are expected to continue as they were executed following the original construction of the canal under Alternative 1. The canal would be modified to satisfy current Reclamation safety standards, including freeboard requirements for the canal lining and embankment, and would be able to safely operate to deliver the designed capacity of water (variable flow capacity starting at 4,600 cfs at the upstream end and reducing to 3,210 cfs at the downstream end) to contractors.

Alternative 2

Alternative 2 scores low under the operational ability to implement criterion. Although this alternative would be similar to Alternative 1 in that it would raise the deficient lining, embankment, and impacted structures of the canal, it would also require more intensive work in the lower 18-mile earthen-lined segment of the canal. This intensive work to adjust the canal invert would require the shutdown of the lower 18-mile portion of the canal for three months per year of construction, limiting water distribution to contractors within the service area of the affected canal portion. Implementation of this Alternative would require extensive coordination with other water conveyance facilities to ensure that water deliveries would be made pursuant to contract demands in the southern reaches of the DMC and Mendota Pool and would be difficult to implement.

Alternative 3

The non-structural Alternative (Alternative 3) scores low under the operational ability to implement criterion. Alternative 3 would not restore the canal capacity to its originally authorized design flow capacity, as stated in Section 3.1.1. Operations modeling results show that subsidence in the lower DMC contributes more to the water supply shortages to south-of-Delta CVP contractors than other parts of the DMC. Further analysis indicates that the shortages to contractors served by the lower DMC cannot be mitigated through any alternative other than restoring the conveyance capacity in the lower reach of the DMC. The operational ability to implement the non-structural alternative was evaluated separately for the upper DMC (Jones Pumping Plant to O'Neill Forebay) and lower DMC (O'Neill Forebay to Mendota Pool); these evaluations are presented below.

Lower DMC

Diminished capacity in the lower DMC limits the ability to meet full CVP contract demands in southern reaches of the lower DMC and Mendota Pool. Existing capacity in the lower DMC has been reduced compared to design capacity, just upstream from Mendota Pool (MP 95 to MP 105), by approximately 1,000 cfs and is expected to be reduced further in the future for a total reduction of 1,460 cfs. Alternative 3 would not address this capacity restriction in the lower DMC. Figure 2, Figure 3, and Figure 4 contain charts showing the shortage in CVP water delivery to the lower DMC and Mendota Pool for existing, 2035, and 2035 conditions with 2070 DMC capacity. Annual average shortages for existing, 2035, and 2070 conditions are 60 TAF, 86 TAF, and 125 TAF. Diminished capacity in the lower DMC is a significant contributor to the overall inability to satisfy full CVP contract demands south of Delta.

Analyses show that the shortage to contractors served by lower DMC cannot be solved with a non-structural alternative. Restriction in the lower DMC affects deliveries of water to CVP south-of-Delta contractors and limits Reclamation's ability to balance north-of-Delta storage with south-of-Delta storage and CVP water deliveries.

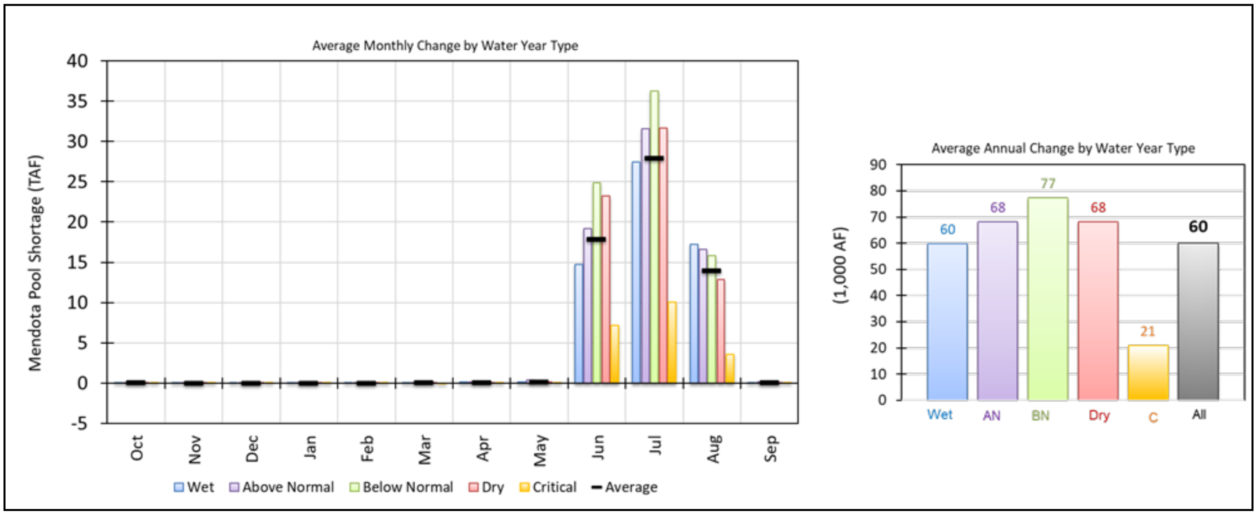

Figure 2. Shortage in CVP Mendota Pool Deliveries - Historically Based Hydrology and Existing DMC Capacity

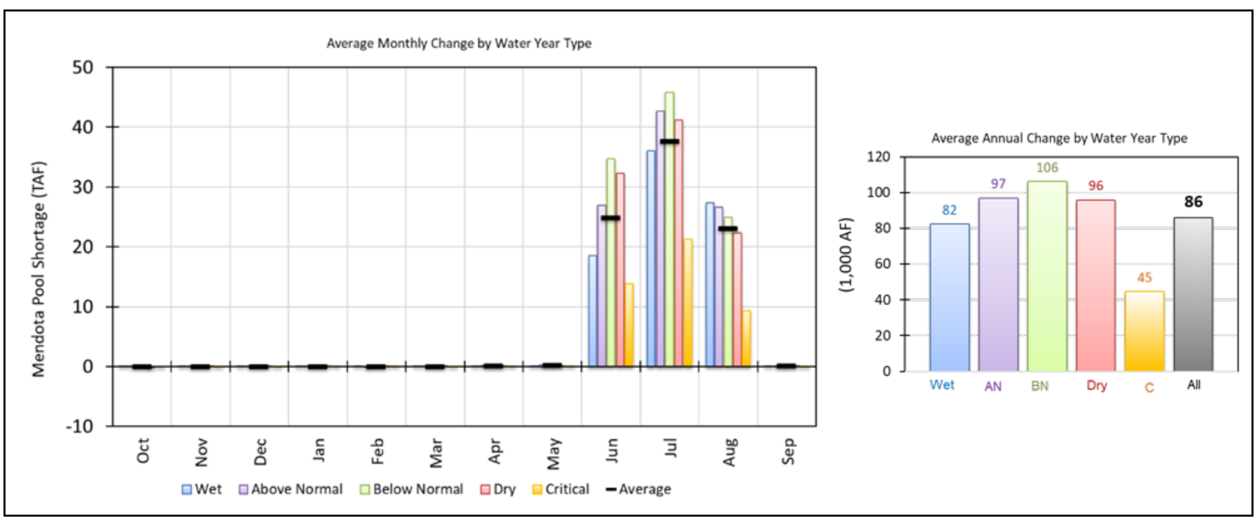

Figure 3. Shortage in CVP Mendota Pool Deliveries - 2035 Hydrology and 2035 DMC Capacity

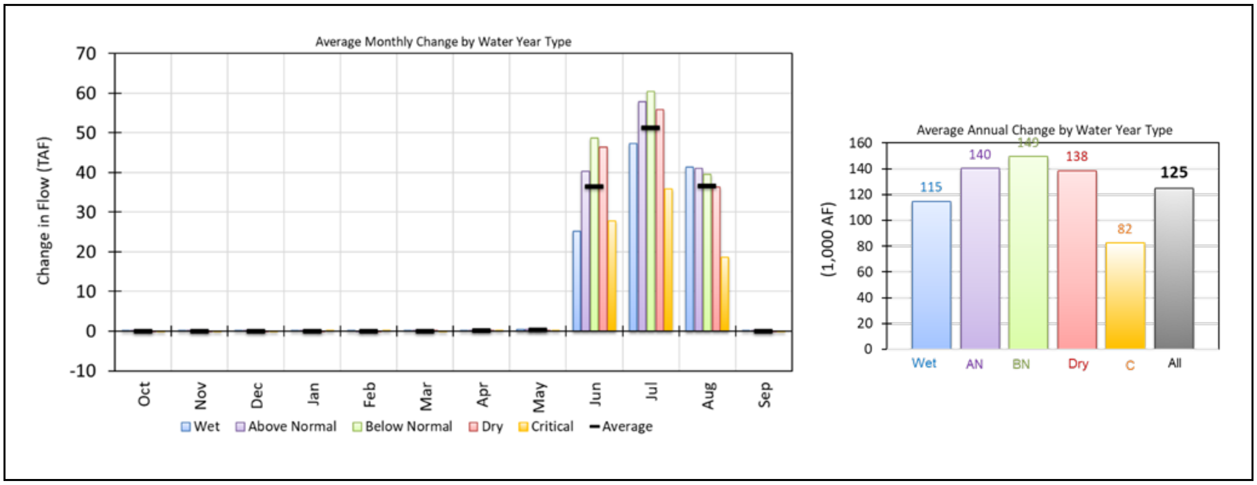

Figure 4. Shortage in CVP Mendota Pool Deliveries – 2035 hydrology and 2070 DMC Capacity

Upper DMC

For the upper DMC, Alternative 3 considers maximizing the use of the Intertie Pumping Plant and use of SWP facilities, specifically the SWP Banks Pumping Plant, for JPOD from the Delta. The Intertie Pumping Plant conveys approximately 100 TAF more annually under the No Action Alternative with existing capacity compared to design capacity. Although the Intertie Pumping Plant compensates for a portion of the diminished DMC capacity, it has insufficient capacity to meet full CVP contract demands, as demonstrated in modeling of With-Project alternatives.

As noted in Section 2.4.3, Reclamation would need to negotiate and execute a permanent Conveyance and Use Agreement with DWR to utilize available pumping capacity at the Banks Pumping Plant for JPOD and maximize pumping at the Intertie Pumping Plant. With execution of a permanent Conveyance and Use Agreement with DWR, Reclamation could use the SWP facilities when there is unused capacity at the SWP Banks Pumping Plant and there is excess water in the Delta available for diversion that the SWP cannot otherwise divert for its own use due to a lack of available storage capacity.

Evaluation of JPOD was performed by analyzing CalSim II output for the Project No Action Alternative and assessing the potential for using SWP facilities for conveying CVP water. The first step in evaluating CalSim II output is to identify times when there is unused capacity at the SWP Banks Pumping Plant while there is excess water in the Delta. Figure 5 contains a chart showing annual available Banks Pumping Plant capacity while the Delta is in excess condition. The ability to use Banks Pumping Plant occurs with low frequency and the volume needed to compensate for diminished DMC capacity occurs less than 5 percent of years. In addition, at times when there is available capacity at Banks Pumping Plant and Delta Excess the CVP has no ability to use or store this water due to the CVP portion of San Luis Reservoir being full and CVP allocations being 100 percent.

Figure 6 contains a chart of the annual high storage in CVP San Luis Reservoir and CVP south-of-Delta agriculture water supply allocation, all occurrences when Banks Pumping Plant may be used (Figure 5) can be compared to full CVP San Luis Reservoir with full allocation (Figure 6).

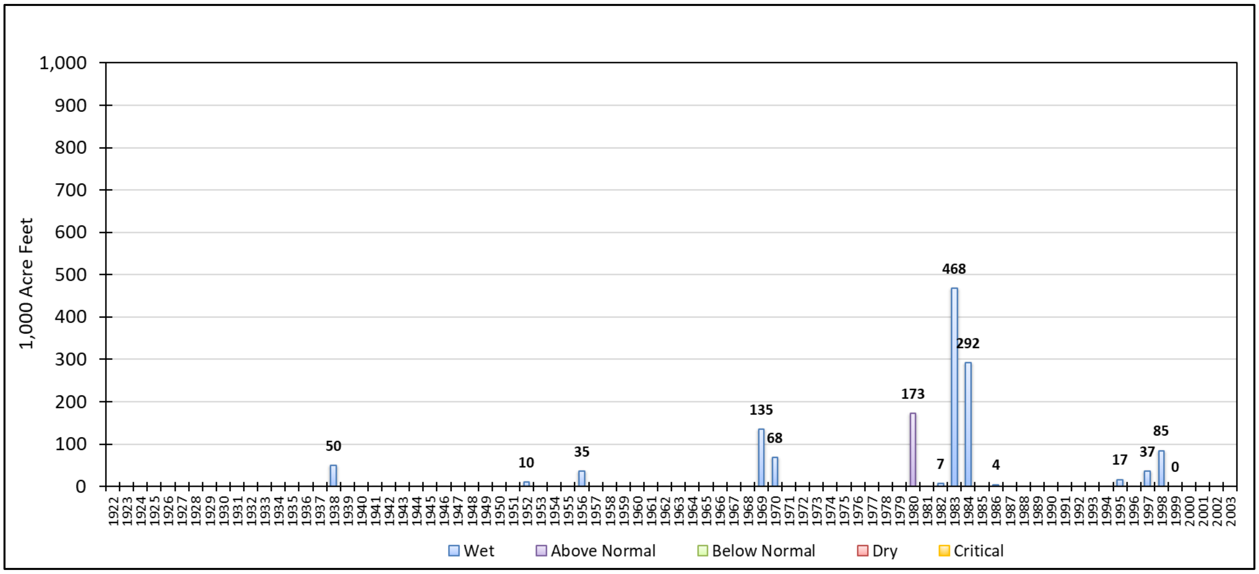

Figure 5. Available Banks Capacity While the Delta is in Excess Condition

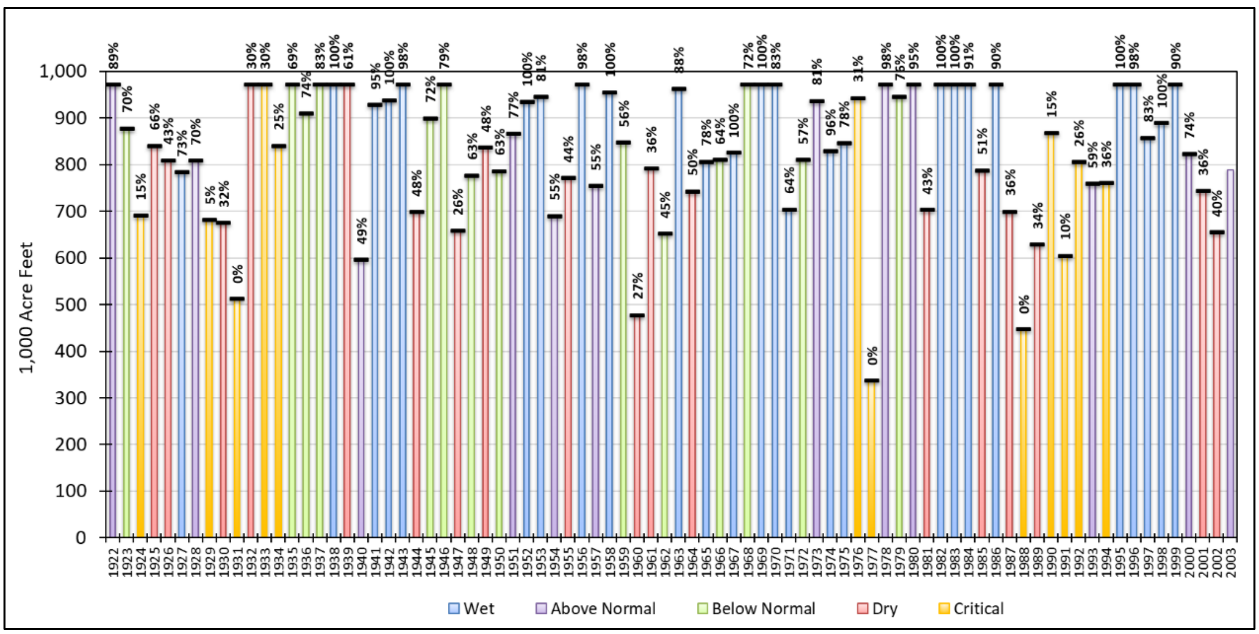

Figure 6. CVP San Luis Reservoir Annual High Storage and CVP SOD Ag Allocation

Use of JPOD during summer months to convey water stored in upstream CVP reservoirs was evaluated by comparing available Banks Pumping Plant capacity to available upstream CVP storage from the No Action Alternative CalSim II simulations. There are frequently times when upstream storage is insufficient to operate Jones Pumping Plant and DMC at capacity, during the times when the CVP is not fully utilizing its own facilities, additional capacity made possible through JPOD is not useful. During most times when upstream reservoirs CVP have additional storage and CVP exports are at capacity, Banks Pumping Plant is also operating at capacity to convey SWP supplies and JPOD is not available. The times when JPOD may be used to fully compensate for diminished DMC capacity occurs with low frequency.

Alternative 4

Alternative 4 scores medium under the operational ability to implement criteria. Raising the canal lining and embankment in deficient areas not parallel to the new canal, similar to Alternatives 1 and 2, would partially restore the canal capacity to its originally authorized design flow capacity. Those portions of the DMC could continue to operate as they were executed following the original construction of the canal. Capacity of the DMC segment parallel to the new canal would remain deficient and would need to be adjusted to operate the new canal. New operations would need to be implemented for this segment of the DMC and new canal.

3.2.1.3 Overall Completeness Ranking

Table 7 summarizes how each of the alternatives were scored for overall completeness. Alternative 1 scored high, given the increases in water supply and continued typical operation of the DMC that would occur under its implementation. Alternative 2 scored medium, as it would qualify for funding and would meet the project objectives but would be difficult to implement. Alternative 3 scored medium in effectiveness because of its limited ability to increase water supply and its reliance on changes to operations. Alternative 4 scored medium due to its increases in water supply and partial reliance on changes to operations.

Table 7. Overall Completeness Ranking for Final Alternatives

Completeness Criteria	Alternative 1 (Raise Deficient Structures)	Alternative 2 (Adjust Canal Invert and Raise Deficient Structures)	Alternative 3 (Non-Structural)	Alternative 4 (Build New Parallel Canal)
Authorization and Funding	High	High	High	Low
Full Spectrum of Objectives	High	High	Medium	High
Operational Ability to Implement	High	Low	Low	Medium
Overall Ranking	High	Medium	Medium	Medium

3.2.2 Effectiveness

The effectiveness criterion addresses how well an alternative would alleviate problems and achieve opportunities. This criterion was measured by the improved water supply reliability to south-of-Delta CVP contractors provided by the alternative.

3.2.2.1 Water Supply Reliability

Alternatives 1, 2, and 4 would fully return the diminished yields to south-of-Delta CVP water users impacted by reduced capacity in the DMC in the long term. The conveyance capacity restored by Alternatives 1 and 2 and constructed by Alternative 4 would support their future operation consistent with the existing operating rules identified in the 2019 U.S. Fish and Wildlife Service (USFWS), and National Marine Fisheries Service (NMFS) Biological Opinions (2019 USFWS and NMFS Biological Opinions) for the Reinitiation of Consultation on the Coordinated Operations of the CVP and SWP (ROC on LTO), 2020 ROC on LTO Record of Decision (ROD), and the 2018 Addendum to the Coordinated Operation Agreement CVP/SWP Finding of No Significant Impact (FONSI)/ROD, and/or any future regulatory requirements and the terms and conditions specified in the relevant Biological Opinions.[2] Alternatives 1, 2, and 4 would restore south-of-Delta CVP agricultural and municipal and industrial (M&I) deliveries.

During construction, Alternatives 1 and 4 would have high water supply reliability; Alternative 1 would not require any partial or full shutdowns of the canal, allowing for a high level of reliability of water supply for DMC contractors. Similarly, during the construction of Alternative 4, the DMC would remain fully functional and would be able to reliably supply water to DMC contractors. For this and the above reasons, Alternatives 1 and 4 score high under the water supply reliability criterion.

As discussed above, Alternative 2 would have high water supply reliability during long-term operation. However, Alternative 2 would require a shutdown of the lower 18-mile segment of the canal for three months every year of construction. This required shutdown would impair water supply reliability for contractors receiving deliveries from the lower DMC and Mendota Pool during construction of this alternative. Therefore, Alternative 2 scores medium under the water supply reliability criterion.

Alternative 3 scores low under the effectiveness criteria. As noted previously, the non-structural alternative would not restore the canal capacity to its original design flow capacity and would not meet the Project purpose and need. As detailed in Section 3.2.1.2, existing capacity in the lower DMC has reduced compared to design capacity, just upstream from Mendota Pool (MP 95 to MP 105), by approximately 1,000 cfs and is expected to be reduced further in the future to 1,460 cfs (see Figure 2 and Figure 3). Diminished capacity in the lower DMC is a significant contributor to the overall inability to satisfy full CVP contract demand south of the Delta, and Alternative 3 would not address this capacity restriction in the lower DMC. Diminished capacity in the lower DMC limits the ability to meet full CVP contract demands in southern reaches of the lower DMC and Mendota Pool.

3.2.2.2 Overall Effectiveness Ranking

Table 8 summarizes how each alternative was ranked for relative effectiveness. Alternatives 1, 2, and 4 scored high in effectiveness because of their ability to restore DMC conveyance capacity to service south-of-Delta CVP contractors and refuge water supply to south-of-Delta CVP refuges. Alternative 3 scored low, given its limited increases in water supplies. Alternative 2 scored medium, given that it would restore water supply reliability during operation but would reduce water supply reliability during construction.

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[2] 2020 Reinitiation of Consultation on the Coordinated Long-Term Operations of CVP and SWP (ROC on LTO) ROD and the 2018 Addendum to the Coordinated Operation Agreement CVP/SWP were both consulted for the original design capacity of the DMC and not the current operation capacity of the DMC.

Table 8. Overall Effectiveness Ranking for Final Alternatives

Effectiveness Criteria	Alternative 1 (Raise Deficient Structures)	Alternative 2 (Adjust Canal Invert and Raise Deficient Structures)	Alternative 3 (Non-Structural)	Alternative 4 (Build New Parallel Canal)
Restore Agricultural Water Supply Reliability	High	Medium	Low	High
Restore Refuge Supply Reliability	High	Medium	Low	High
Overall Ranking	High	Medium	Low	High

3.2.3 Acceptability

The federal acceptability criterion addresses the viability of an alternative with respect to acceptance by state and local entities and compatibility with existing laws. The performance measures for this criterion consider the alternatives' potential environmental impacts to biological, physical, and social resources in the study area.

3.2.3.1 Biological Resource Effects

Biological resources of the study area include aquatic and terrestrial resources. Construction of Alternative 1 could affect sensitive natural communities, including wetland and riparian vegetation communities, disturb terrestrial wildlife, nesting birds, and special status plant species. However, mitigation measures including preconstruction surveys, establishment of buffers, and construction monitoring are expected to be employed to reduce potential impacts, and refuges would continue to receive water supply (Section 3.2.2). Therefore, Alternative 1 scores medium under the biological resource effects criterion.

Construction of Alternative 2 would affect the same biological resources as Alternative 1,but would affect fewer acres of habitat because the extents of lining and embankment raises and the number of bridges and pipeline crossing requiring replacement are reduced under this alternative. However, as discussed in Section 3.2.2, Alternative 2 would require a three-month shutdown of the lower 18-mile segment of the canal during each year of construction. Under current operations of the DMC, refuges primarily receive deliveries from the lower DMC/Mendota Pool. Shutdown of the lower DMC during construction of Alternative 2 could impact these refuge deliveries. Therefore, Alternative 2 scores low under the biological resource effects criterion.

Alternative 3 would include no construction and would have no impact to aquatic or terrestrial resources. Therefore, Alternative 3 scores high under this criterion.

Because Alternative 4 would include building a new canal, it is assumed that the impacts to biological resources would be similar to Alternatives 1 and 2 but on a greater scale and have potential impacts that may not be mitigated to a less than significant level. Therefore, Alternative 4 scores low under this criterion.

3.2.3.2 Physical Resource Effects

Construction of Alternative 1 could impact physical resources such as air quality, geology and soils, water quality, noise, and visual resources. Air quality impacts would likely be the result of operating construction equipment and operating vehicles to transport waste from the construction site to landfills. Construction activities involving ground disturbance could affect geology and soils as well as water quality. Noise and visual resources impacts would be the result of operating construction equipment. However, mitigation measures are expected to be implemented to reduce any potential impacts. Therefore, Alternative 1 scores as medium under the physical resource effects criterion.

Construction of Alternative 2 would impact the same resources as Alternative 1; however, additional excavation of the earthen-lined segment under Alternative 2 would require more truck trips to dispose of excavated waste, which would have a greater impact on air quality than Alternative 1 would. Additionally, the work required by Alternative 2 would require more construction equipment that would create higher levels of noise and would require additional mitigation measures. Therefore, Alternative 2 scores low under the physical resource effects criterion.

Alternative 3 would include no construction and would have no impact to physical resources. Therefore, Alternative 3 scores high under this criterion.

Because of the new construction associated with Alternative 4, impacts related to air quality, geology and soils, water quality, noise, and visual resources would occur on a larger scale compared to Alternatives 1 and 2. Some impacts related to air quality and noise may be significant yet unavoidable during construction activities. In addition, acquisition of additional land would be required to build the parallel canal. Therefore, Alternative 4 scores low under this criterion.

3.2.3.3 *Social Resource Effects*

Construction of Alternative 1 could affect social resources such as traffic, hazardous materials, water supply, and cultural resources. However, these effects are expected to be minor. As such, Alternative 1 scores high under the social resource effects criterion.

As discussed in Section 3.2.2, construction of Alternative 2 would require a shutdown of the lower 18-mile segment of the canal for three months during every year of construction. This shutdown would restrict water supply reliability for contractors that rely on water from the lower 18-mile segment of the DMC, which could result in social effects. Additionally, construction of Alternative 2 could affect other social resources such as traffic, hazardous materials, and cultural resources. Therefore, Alternative 2 scores as medium under the social resource effects criterion.

Alternative 3 would include no construction and would have no impact on social resources. Therefore, Alternative 3 scores high under this criterion.

Because of the new construction associated with Alternative 4, impacts related to social resources would occur on a larger scale compared to Alternatives 1 and 2. Some impacts may be significant yet unavoidable during construction activities. Therefore, Alternative 4 scores low under this criterion.

3.2.3.4 Compatibility with Existing Laws

Alternatives 1 and 4 score high under the compatibility with existing laws criteria. As noted previously, the restored conveyance capacity after construction of the alternatives would conform to the existing operating rules identified in the 2020 ROC on LTO ROD, 2019 USFWS and NMFS Biological Opinions, the 2018 Addendum to the Coordinated Operation Agreement CVP/SWP FONSI/ROD, and/or any future regulatory requirements and the terms and conditions specified in the relevant Biological Opinions. Both alternatives require compliance with NEPA and CEQA, as well as consultations under Section 7 of the Endangered Species Act, Section 106 of the National Historic Preservation Act (NHPA), and Section 401 and 404 of the Clean Water Act.

Although Alternative 2 would comply with most of the existing laws, the three-month shutdown of the lower 18-mile segment of the DMC would result in changes in water supply reliability for Exchange Contractors and refuges that rely on the affected canal segment to convey water deliveries. Because Reclamation is required by law to deliver water to Exchange Contractors and refuges, this canal shutdown would likely result in Reclamation being unable to meet the established contract amounts for Settlement/Exchange Contractors and refuges that rely on the southern reaches of the DMC. Therefore, Alternative 2 scores low under this criterion.

Alternative 3 scored low under the compatibility with existing laws criteria. As noted previously, the non-structural alternative would not address this capacity restriction in the lower DMC. Consequently, under Alternative 3, the DMC cannot be operated to successfully fulfill Reclamation's contracts to deliver water to those who rely on the DMC.

3.2.3.5 Overall Acceptability Ranking

Table 9 summarizes how each alternative was ranked for relative acceptability.

Table 9. Overall Acceptability Ranking for Final Alternatives

Acceptability Criteria	Alternative 1 (Raise Deficient Structures)	Alternative 2 (Adjust Canal Invert and Raise Deficient Structures)	Alternative 3 (Non-Structural)	Alternative 4 (Build New Parallel Canal)
Biological Resource Impacts	Medium	Medium	High	Low
Physical Resource Impacts	Medium	Low	High	Low
Social Resource Impacts	High	Medium	High	Low
Compatibility with Existing Laws	High	Low	Low	High
Overall Ranking	High	Medium	Medium	Low

3.2.4 Efficiency

This evaluation criterion is a measure of how efficiently an alternative alleviates identified problems while realizing specified objectives. Possible approaches to evaluating efficiency include (1) dollars per unit of economic benefit, (2) least cost of attaining an objective, (3) and reduced opportunity costs relative to accomplishments of other alternatives. In this analysis, efficiency of the alternatives was evaluated using an estimated overall Project benefit.

3.2.4.1 Project Benefits

Alternatives 1, 2, and 4 scored high under the efficiency criterion. All three alternatives would restore lost water supply yield to south-of-Delta CVP contractors in comparison to water supply deliveries under existing conditions. Alternative 3 would not restore the lost water supply yield in comparison to existing conditions. Table 10 summarizes how each alternative was ranked for relative efficiency.

Table 10. Overall Efficiency Ranking for Final Alternatives

Efficiency Criteria	Alternative 1 (Raise Deficient Structures)	Alternative 2 (Adjust Canal Invert and Raise Deficient Structures)	Alternative 3 (Non-Structural)	Alternative 4 (Build New Parallel Canal)
Overall Ranking	High	High	Low	High

3.2.5 Level 2 Screening Results

Each of the alternatives were given a score that represents the degree to which it meets the federal planning criteria of completeness, effectiveness, acceptability, and efficiency. Table 11 presents the results of the screening process.

Table 11. Federal Planning Criteria Screening Results

Alternative	Completeness	Effectiveness	Acceptability	Efficiency
Alternative 1 (Raise Deficient Structures)	High	High	High	High
Alternative 2 (Adjust Canal Invert and Raise Deficient Structures)	Medium	Medium	Medium	Medium
Alternative 3 (Non-Structural)	Medium	Low	Medium	Low
Alternative 4 (Build New Parallel Canal)	Medium	High	Low	High

3.2.6 Alternative Carried Forward

Alternative 1 fully meets the Project purpose and need/objectives and fully meets the federal planning criteria. Therefore, Alternative 1 is being carried forward for further consideration in the Feasibility Report and EA/IS.

Although Alternative 2 fulfilled the Project purpose and need and the Project objectives, it scored medium under all four federal planning criteria; specifically, Alternative 2 would have impacts on water supply reliability during construction and would be overall difficult to implement. Alternative 3 would not meet the purpose and need and scored low to medium under all four federal planning criteria. While Alternative 4 scored high in two of the four federal planning criteria, this alternative would not be eligible for funding under Public Law 111-11, as described in Section 3.2.2.1.

Chapter 4 Analyzed Alternatives

This chapter presents alternatives developed and based on the evaluation described in Chapter 3. Alternatives identified for evaluation in the Feasibility Report and the EA/IS include a No Action/No Project Alternative and the Proposed Action/Proposed Project. The Proposed Action/Proposed Project would be operated within the limits of the operating rules identified in the 2020 ROC on LTO ROD, 2019 USFWS and NMFS Biological Opinions (USFWS 2019; NMFS 2019) and/or any future regulatory requirements and the terms and conditions specified in the relevant Biological Opinions.

The numbering of the alternatives identified for evaluation in the Feasibility Report and the EA/IS has been narrowed from the options that had been used to identify alternatives in the Feasibility Study of the Structural Alternatives. The two alternatives identified for evaluation in the Feasibility Report and the EA/IS, their names, and their corresponding alternative numbers from the Feasibility Study of the Structural Alternatives are detailed in Table 12.

Table 12. Alternatives Identified for Feasibility Report and EA/IS Evaluation

FSA Alternative #	Alternative Name in Feasibility Report and EA/IS
--	No Action/No Project
1	Raise Deficient Structures (Proposed Action/Proposed Project)

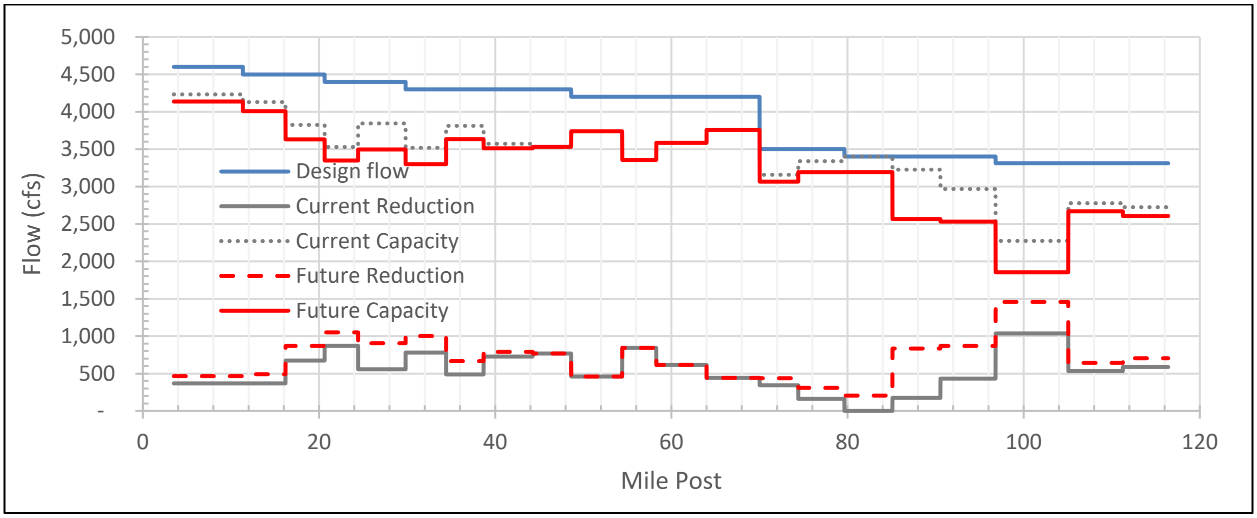
Key: FSSA = Reclamation's 2021 Feasibility Study of the Structural Alternatives

4.1 No Action/No Project Alternative

The No Action Alternative (under NEPA) describes future circumstances without the Proposed Action and includes predictable actions by persons or entities, other than the federal agency involved in a project action, acting in accordance with current management direction or level of management intensity. The No Project Alternative (under CEQA) describes the future without the project and may include some reasonably foreseeable changes in existing conditions and changes that would reasonably be expected to occur in the foreseeable future if the project were not approved.

Under the No Action/No Project Alternative (subsequently identified to as the No Action Alternative), the existing conditions of the DMC would remain unchanged, and the flow rates would be reduced from design capacity during operation to meet Reclamation Design Standards No. 3 (Reclamation 2014). Currently, 30 out of the existing 115 bridges along the DMC are considered deficient because they do not have one-foot of clearance above the Maximum Water Surface Elevation (MWSEL) when the canal is operated at design flow. However, the number of deficient bridges is expected to reach 45 when taking into consideration future subsidence conditions. Deficient bridges would be partially submerged when the canal is operated at the design flow, resulting in safety risks. To operate the canal safely and in accordance with Reclamation safety standards under the No Action Alternative, the maximum flow reduction in the DMC is estimated to be 1,457 cfs (44 percent reduction) from design capacity. Figure 7 details the current and anticipated future reduction of the canal capacity as compared to the designed capacity. The purpose of the No Action Alternative is to provide decision-makers a comparison of the potential impacts of approving a project against the potential impacts of not approving the project.

The No Action Alternative includes current conditions in the Project area and will be analyzed consistently with the water deliveries under ROC on LTO of CVP and SWP and the 2018 Addendum to the Coordinated Operation Agreement Central Valley Project/State Water Project FONSI/ROD that are assumed to also reasonably portray future anticipated operational conditions. Both ROC on LTO of CVP and SWP and the 2018 Addendum to the Coordinated Operation Agreement CVP and SWP FONSI/ROD assumed DMC flow rate would be the original design capacity. As noted previously, the No Action Alternative assumes a reduced capacity of the DMC consistent with existing conditions.



Source: Feasibility Study of the Structural Alternatives

Figure 7. Design Flows, Reduction in Flow, and Actual Flow Capacities in the DMC for Current and Future (With Future Subsidence) Conditions

4.2 Raise Deficient Structures Alternative (Proposed Action)

The Raise Deficient Structures Alternative has been identified as the Proposed Action (under NEPA) and the Proposed Project (under CEQA). Under the Proposed Action/Proposed Project (subsequently identified as the Proposed Action), the deficient lining, embankment, and impacted structures of the canal would be raised to restore the canal capacity to its originally authorized design flow capacity. Under the Proposed Action, the canal would be modified to satisfy current Reclamation safety standards, including freeboard requirements for the canal lining and embankment, and would be able to safely operate to deliver the designed capacity of water (variable flow capacity starting at 4,600 cfs at the upstream end and reducing to 3,210 cfs at the downstream end) to contractors. Therefore, no changes to future operations and maintenance are anticipated.

Specific construction actions under the Proposed Action include:

- **Raising deficient canal concrete lining:** To achieve this, new concrete lining would be placed above the existing concrete lining, with seals installed between the old and new concrete linings to eliminate seepage at select locations along the canal. At locations with ladders installed in the concrete lining (every 750 feet), additional risers would be added in the new lining.
- **Raising the earth embankment at deficient bank segments of the canal:** This would be achieved by adding fill material from an existing borrow sites along the canal ROW at select locations along the canal. The added fill material would be rolled and smooth to match adjacent road elevations, and an asphalt chip seal will be installed on the left service road along the length of the canal.
- **Stabilizing the canal banks along the earthen-lined segment of the canal:** This would require lowering the water depth in the canal by up to six feet during construction, which would allow construction to extend about 6 feet below the maximum water surface elevation when the canal is operated at design flow for the canal (MWSEL). Two-foot-deep sections of earthen materials would be excavated from the sides of the canal, and a one-foot-thick strip of filter material would be installed above the excavated surface followed by a one-foot riprap that would be placed above the filter material.
- **Repairing distressed concrete lining above and below the water's surface:** Lining distresses were found to be either in the upper parts of the canal prism or more extensive, extending to the bottom of the canal prism. The distresses in the upper parts of the canal prism are local and do not extend to the bottom of the canal, so to fix these the water depth would be lowered about six feet below the design level during construction. Damaged lining would be removed, and the embankment would be excavated for at least two feet below the lining where all materials would be removed and replaced with selected and acceptable earth fill material. At locations where the lining distresses extend under the water surface to the bottom of the canal prism, the repairs required are more extensive. Damaged concrete lining and material distorting the canal would be removed with underwater operations, and grouted mattress would be installed and grouted with cement underwater at applicable locations.
- **Replacing impacted vehicle bridges:** Forty-five bridges have been identified as impacted. Identified bridges would be replaced by single span bridges with deep foundations at two abutments of the bridges in the concrete-lined segment. Along the earthen segment, intermediate piers would be constructed to support the replaced bridges within the canal prism. The low chord elevation of replaced bridges would be at least three feet above the MWSEL, including predicted subsidence. Asphalt pavement would be installed for the modified road segments. All affected utilities would be replaced and attached to newly constructed bridges. Earthwork would extend on both sides of the bridge to smoothly merge the profile of the bridge deck with the approach roads. Pipes carrying natural gas would be relocated under the canal utilizing horizontal directional drilling, whereas pipes carrying any other liquids would be replaced by pipes of equal diameter. New pipes would be epoxy coated and attached to bridges with hangers.

- **Replacing impacted pipeline crossings:** Thirty-six pipeline crossings have been identified as impacted.[3] The new pipelines would be carried by truss bridges, and pipes adjacent to each other would be carried by single bridges.
- **Modifying check structures and wasteways:** Although gates on check structures and wasteways were designed to have heights that exceeded the MWSEL at their locations, subsidence has caused an increase in water surface elevations which has resulted in some of these gates having heights lower than the MWSEL. To avoid overtopping, gates at seventeen check structures would require raising. Raising the heights of the gates could require changes to the drums, hoists, and cables to confirm that the gates will open to levels above the new MWSEL. The 20 by 17 foot gates are not likely to require hoist system replacements while the 18 by 15 foot gates, located at check structures 14, 15, 16, 17, 19, and 20, are likely to require hoist system replacements.
- **Modifying turnouts:** Walls for the stilling pits of 82 turnouts on the left side of the canal would require raising. The walls requiring raise would be raised with concrete, the existing galvanized steel would be removed, and metal guards would be installed around each stilling pit for all gravitational turnouts.
- **Modifying drainage structures:** Work on drainage structures would include installing trash racks for drain inlets; installing flared inlets for pipe culverts without inlets; replacing drain inlets that require relocation during replacement of deficient bridges; installing additional drain inlets at five structures; replacing existing headwalls and wing walls with new ones that are higher at seven structures; and replacing the clogged side culvert at one structure with a new box culvert, raising the headwalls for drain inlets, culverts, and overchutes at some locations; and installing or replacing riprap at inlets, outlets, culverts, and overchutes to protect embankment from erosion.

[3] Pipeline crossings with clearances less than one foot above the MWSEL (with predicted subsidence added).

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Appendix C
Project Description

Appendix C Project Description

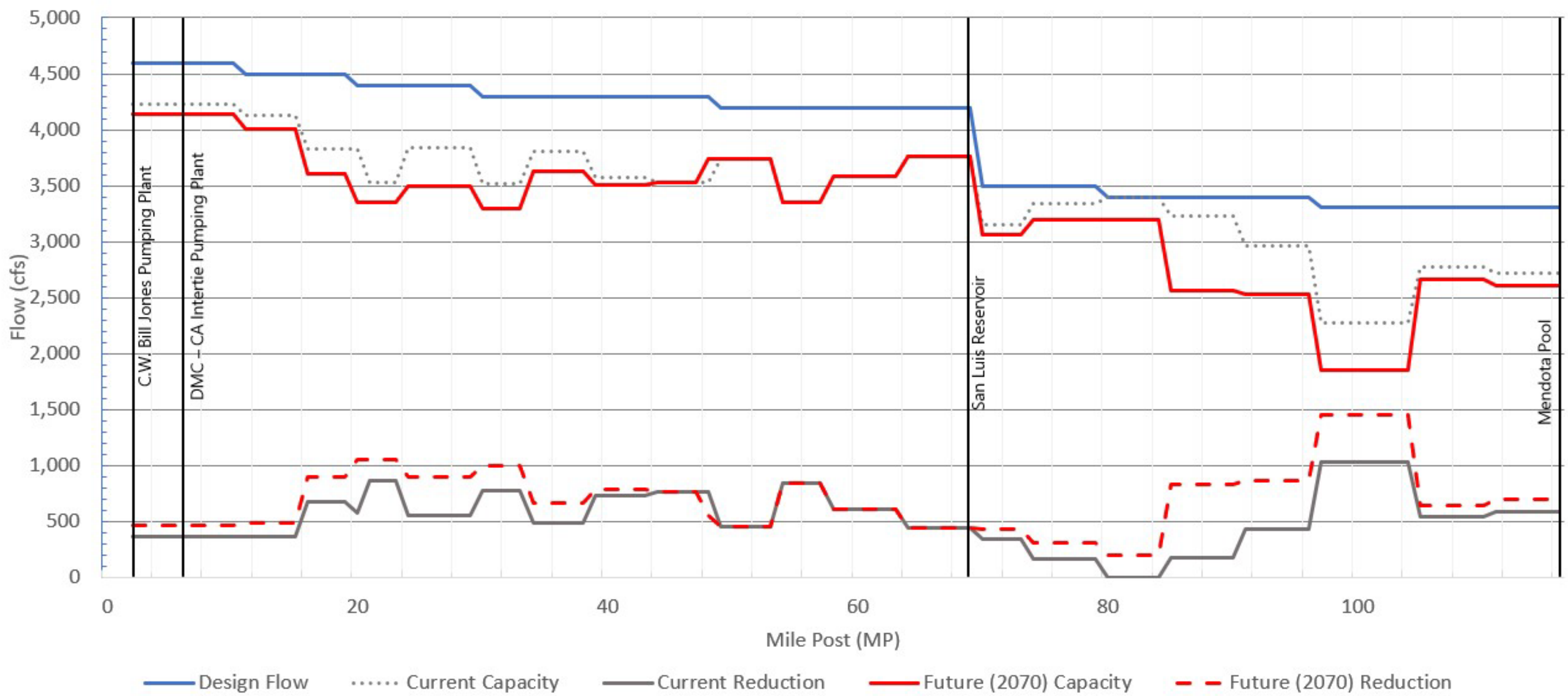
This appendix presents detailed description of the No Action/No Project Alternative and the Proposed Action/Proposed Project.

C.1 No Action/ No Project Alternative

The No Action Alternative (under the National Environmental Policy Act [NEPA]) describes future circumstances without the Proposed Action and includes predictable actions by persons or entities, other than the federal agency involved in a project action, acting in accordance with current management direction or level of management intensity. Under California Environmental Quality Act (CEQA), an evaluation of the No Project Alternative is not required in an Initial Study (IS)/ Mitigated Negative Declaration (MND). If the requirements of an EIR are triggered, the No Project Alternative describes the future without the project and may include some reasonably foreseeable changes in existing conditions and changes that would reasonably be expected to occur in the foreseeable future if the project were not approved.

The purpose of the No Action/No Project Alternative (subsequently identified as the No Action Alternative) is to provide decision-makers a comparison of the potential impacts of approving a project against the potential impacts of not approving the project. Under the No Action Alternative, the existing conditions of the Delta-Mendota Canal (DMC) would remain unchanged, and the flow rates would be further reduced from current flows during operation to obtain operational safety and meet Bureau of Reclamation [Reclamation] Design Standards No. 3 (Reclamation 2014). Currently, 30 out of the existing 115 bridges along the DMC are considered deficient because they do not have one foot of clearance above the Maximum Water Surface Elevation (MWSEL) when the canal is operated at design flow. However, the number of deficient bridges is expected to reach 45 when considering future subsidence conditions. Deficient bridges would be partially submerged when the canal is operated at the design flow, resulting in safety risks. To operate the canal safely and in accordance with Reclamation safety standards under the No Action Alternative, the maximum flow reduction in the DMC is estimated to be 1,457 cfs (44 percent reduction) from design capacity. Figure C-1 details the current and anticipated reduction of the canal capacity compared to the designed capacity.

The No Action Alternative evaluates the reduced capacity of the DMC under (1) current conditions as of 2020; (2) under forecasted 2035 conditions; and (3) under forecasted 2070 conditions. The operations of the No Action Alternative would be consistent with the 2019 United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) Biological Opinions for the Reinitiation of Consultation on the Long-term Operations of the Central Valley Project (CVP) and State Water Project (SWP) (ROC on LTO) (USFWS 2019; NMFS 2019), Reclamation's 2020 ROC on LTO Record of Decision (ROD), and the 2018 Addendum to the Coordinated Operation Agreement CVP/SWP Finding of No Significant Impact (FONSI)/ROD. Both the Biological Opinions for ROC on LTO and the 2018 Addendum to the Coordinated Operation Agreement CVP and SWP FONSI/ROD assume a DMC flow rate reflecting the original design capacity. As noted previously, the No Action/No Project Alternative assumes a reduced capacity of the DMC consistent with existing conditions.



Source: Feasibility Study of the Structural Alternatives

Figure C-1. Design Flows, Reduction in Flow, and Actual Flow Capacities in the DMC For Current and Future (With Future Subsidence) Conditions

C.2 Proposed Action/Proposed Project

The Raise Deficient Structures Alternative was selected as the Proposed Action (under NEPA) and the Proposed Project (under CEQA). Under the Proposed Action/Proposed Project (subsequently identified as the Proposed Action), the deficient lining, embankment, and impacted structures of the canal would be raised to restore the canal capacity to its originally authorized design flow capacity. Proposed modifications of the canal and related structures would be in accordance with current federal, state, and local design guidelines and standards.[1] The canal would be modified to satisfy current Reclamation safety standards, including freeboard requirements for the canal lining and embankment, and would be able to safely operate to deliver the designed capacity of water (variable flow capacity starting at 4,600 cfs at the upstream end and reducing to 3,210 cfs at the downstream end) to contractors. Therefore, no changes to future maintenance and operations are anticipated. Specific construction actions under the Proposed Action would include:

- Raising deficient concrete lining segments and bank segments to meet the minimum freeboard requirements;
- Installing riprap for erosion protection to stabilize the banks along the earthen-lined segment;
- Replacing bridges and pipeline crossings that do not have enough clearance above water surface elevation to meet minimum required clearings;
- Raising the gates of check structures and wasteways to design level and modify impacted structures; and
- Evaluating existing drainage structures to modify them for safe passage of stormwater.

C.2.1 Construction

C.2.1.1 Methods

Construction activities described above are presented below in more detail.

- **Raising deficient canal concrete lining**: To achieve this, new concrete lining would be placed above the existing concrete lining, with seals installed between the old and new concrete linings to eliminate seepage at approximately 80 miles along the canal. At locations with ladders installed in the concrete lining (every 750 feet), additional risers would be added in the new lining. Table C-1 and Figure C-2 detail the locations along the canal where this work would be necessary.

[1] Relevant guidelines/standards include Reclamation's Design Standards (Reclamation 2012; 2014; 2018), Reclamation's Engineering and O&M Guidelines for Crossings (Reclamation 2008), and Reclamation Earth Manual (Reclamation 1998).

Table C-1. Deficient Concrete Lining Raises

Mile Post Range		Length (miles)	Station Number Range	
4.67	10.54	5.87	241+90 – 250+20	609+00 – 610+00
11.68	61.68	50.00	661+47 – 673+00	2555+00 – 2574+00
61.87	64.52	2.65	2574+00 – 2577+57	2717+50 – 2730+00
65.08	65.46	0.38	2739+34 - 2765+70.70	2775+00 - 2780+50
65.65	66.03	0.38	2783+50 - 2802+98	2802+98 - 2811+50
66.22	66.41	0.19	2819+00	2819+00 - 2844+50
66.79	67.36	0.57	2847+00 - 2869+37	2869+83 - 2891+50
70.20	72.38	2.18	3029+60 - 3053+65	3145+75 - 3150+66.98
74.55	75.31	0.76	3257+37 - 3267+50	3297+50 - 3307+80
75.50	76.54	1.04	3310+50 - 3326+50	3346+50 - 3374+60
76.83	78.72	1.89	3381+50 - 3399+00	3477+40 - 3492+00
78.91	80.05	1.14	3492+00 - 3505+50	3554+05 - 3563+00
80.24	80.43	0.19	3563+00 - 3570+00	3570+19 - 3585+00
80.62	80.71	0.09	3585+00	3588+00 - 3601+36
81.56	81.65	0.09	3633+88 - 3641+23	3633+88 - 3641+23
83.27	87.82	4.55	3720+50 - 3730+00	3957+00 - 3969+30
88.10	88.19	0.09	3973+25 - 3981+42	3981+67 - 3987+35
90.27	90.46	0.19	4094+75	4101+10 - 4108+00
90.65	98.42	7.77	4110+64 - 4128+25	4498+99.80 - 4527+40

- **Raising the earth embankment at deficient bank segments of the canal**: This would be achieved by adding fill material from an existing borrow sites at approximately 50 miles along the canal right-of-way (ROW). The added fill material would be rolled and smoothed to match adjacent road elevations, and an asphalt chip seal installed on the left service road along the length of the canal. Table C-2 and Figure C-2 detail the locations along the canal where this work would be necessary.

Table C-2. Locations for Modifications of Embankments

Left Bank Raises			Right Bank Raises		
MP start	Station Number	Length	MP start	Station Number	Length
11.96	680+00 - 690+18	1.99	9.59	497+00 - 571+20	0.57
16.22	901+65 – 904+05	0.85	12.24	690+18 - 702+95	0.76
17.45	954+14 - 973+00	0.28	16.22	901+65 – 904+05	1.52
19.06	1038+00 - 1049+20	2.08	19.06	1038+00 - 1049+20	2.08
21.71	1183+00 - 1195+00	1.52	21.71	1183+00 - 1195+00	0.09
26.83	670+00 - 680+73	0.57	22.09	1199+00 - 1211+75	1.14
28.91	787+00 - 790+50	0.19	26.64	644+57 - 670+00	0.19
29.86	836+80 - 838+65	0.19	30.24	841+88 - 862+00	0.57
30.24	841+88 - 862+00	0.19	31.56	914+00 - 928+38	0.95
30.62	867+28 - 877+92	0.19	33.46	1018+27 - 1031+00	0.19
31.18	903+91 - 913+50	0.38	35.35	1118+00 - 1128+40	0.19
31.75	931+51 - 940+00	0.57	35.73	1146+90	0.19
32.70	982+72 - 994+00	0.57	36.11	1166+00 - 1182+00	0.95
33.46	1018+27 - 1031+00	5.49	37.62	1245+00 - 1251+00	0.57
39.14	1319+00 - 1330+42	0.38	38.38	1287+13.70	0.19
39.90	1365+00 - 1365+00	0.19	38.95	1309+00 - 1319+00	0.19
40.27	1365+00 - 1391+74	0.19	39.33	1331+00 - 1343+89	0.19
41.41	1433+50 - 1451+03	0.19	39.71	1343+89 - 1361+00	0.19
42.55	1506+19.5 - 1514+00	2.08	42.17	1483+20 - 1505+00	0.19
45.96	1683+00 - 1688+50	0.76	42.74	1514+00 - 1525+75	0.95
50.12	1902+33.44 - 1911+75	0.19	43.87	1569+25 - 1580+30	0.38
50.69	1935+75 - 1938+10	0.38	44.44	1600+65 - 1610+00	0.19
51.45	1975+80 - 1988+50	0.38	45.20	1645+00	0.19
52.96	2073+35 - 2083+00	0.19	45.77	1675+17	0.38
55.99	2248+50 - 2253+00	0.19	46.33	1697+79 - 1705+80	0.19
57.89	2354+18 - 2366+10	0.19	50.50	1927+40 - 1929+00	0.19
60.16	2481+00 - 2497+50	0.19	50.88	1948+00 - 196253.86	0.19
60.92	2508+46 - 2529+65	0.19	51.26	1966+08 - 1967+85	0.57
61.30	2542+00 - 2546+35.45	0.38	55.24	2162+00 - 2197+72	0.19
65.84	2783+50 - 2802+98	0.19	55.99	2248+50 - 2253+00	0.19
72.47	3150+66.98 - 3161+50	0.38	58.46	2392+79	0.19
86.11	3873+00 - 3878+06	0.19	61.30	2542+00 - 2546+35.45	0.19
88.57	3987+35 - 4006+50	0.09	65.84	2783+50 - 2802+98	0.19
95.39	4321+94 - 4368+05	0.38	94.44	4305+93 - 4317+54	2.27
96.90	4441+37 - 4457+66.75	4.17	96.90	4441+37 - 4457+66.75	4.55
110.92	5180+00 - 5186+97	0.19	110.16	5142+79 - 5151+32	0.19
115.46	5418+40 - 5430+15	0.19	110.92	5180+00 - 5186+97	0.38
			115.65	5433+25 - 5445+00	0.19
Sum (miles)		26.89			22.63

Key: MP – Mile Post

- **Stabilizing the canal banks along the earthen-lined segment of the canal:** The lower 18-mile segment of the canal from Mile Post (MP) 98.64 to 116.59 is earthen-lined. This construction activity would require lowering the water depth in the earthen-lined segment of the canal by up to six feet during construction, which would allow construction to extend about four feet below the MWSEL. Two-foot-deep sections of earthen materials would be excavated from the sides of the canal, and a one-foot-thick strip of filter material would be installed above the excavated surface, followed by one-foot of riprap that would be placed above the filter material.
- **Repairing distressed concrete lining above and below the water's surface:** Lining distresses were found to be either in the upper parts of the canal prism or more extensive, extending to the bottom of the canal prism. Distressed lining were observed at several locations along the DMC including MPs 8.2 (between station 422+01 and 433+00), 17.8 (between stations 982+00 and 996+51), 18.07 (between stations 997+50 and 1019+48), 23.2 (between stations 1260+50 and 1268+37.31), 30.64 (between stations 841+88 and 862+00), 33.7 (between stations 1054+75 and 1060+00), 42.39 (between stations 1483+20 and 1505+00), and 42.66 (between stations 1506+19.5 and 1514+00). The distresses at these locations are extensive and extend to nearly the bottom of the canal. Other more extensive damages were also observed at locations downstream of MP 50 (between station 1890+25 and 1905+00.00) including damages at MPs 64.28, 74.6 to 75.3, 87.3 to 87.8 and 92.6 to 97.6. Damaged concrete lining and material distorting the canal would be removed with underwater operations, and a grouted mattress would be installed and grouted with cement underwater at applicable locations.
- **Replacing impacted vehicle bridges**: 45 bridges have been identified as impacted.[2] Identified bridges would be replaced by single span bridges with deep foundations at two abutments of the bridges in the concrete-lined segment. Along the earthen-lined segment, intermediate piers would be constructed to support the replaced bridges within the canal prism. The low chord elevation of replaced bridges would be at least three feet above the MWSEL, including predicted subsidence. Asphalt pavement would be installed for the modified road segments. All affected utilities would be replaced and attached to newly constructed bridges. Earthwork would extend on both sides of the bridge to smoothly merge the profile of the bridge deck with the approach roads. Pipes carrying natural gas would be relocated under the canal using horizontal directional drilling, whereas pipes carrying any other liquids would be replaced by pipes of equal diameter. New pipes would be epoxy coated and attached to bridges with hangers. Table C-3 details the locations of the impacted bridges.

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[2] Impacted bridges were defined as those bridges with a vertical clearance between the low chord elevation and the maximum water surface (with the project subsidence added to it) of one foot or less.

Table C-3. Deficient Bridges

MP	Station Number	Bridge Name	MP	Station Number	Bridge Name
13.25	752+60	S. Lammers Road	45.77	1675+17	Davis Road
14.80	833+87	Corral Hollow Road	46.84	1731+79	Fink Road
17.23	954+14	Durham Ferry Road	48.38	1812+75	Diehl Road
18.04	996+51	McArthur Road	51.40	1975+64	Stuhr Road
19.18	1052+83	Chrisman Road	52.01	2007+68	Orestimba Road
20.96	1146+85	Unnamed	56.60	2283+62	Pete Miller Road
21.49	1174+52	S. Bird Road	57.95	2366+10	Sullivan Road
23.36	494+35	Unnamed	58.46	2392+79	Gravel Pit Road
24.48	553+35	Koster Road	60.06	2477+17	Taglio Road
26.21	644+57	Gaffery Road	61.06	2530+22	Snyder Road
26.93	682+58	Unnamed	90.91	4128+25	Unnamed
28.27	754+19	Welty Road	95.45	4368+05	Unnamed
29.93	841+23	McCracken Road	96.61	4429+57	Althea Avenue
31.12	903+91	Unnamed	97.68	4482+25	Russell Avenue
31.59	928+38	Unnamed	98.74	4540+12	Unnamed
32.10	955+51	Unnamed	102.03	4713+89	Unnamed
32.61	982+32	Howard Road	105.03	4873+29	Jerrold Avenue
33.29	1018+27	Unnamed	105.55	4901+06	Unnamed
34.39	1076+33	Needham Road	106.59	4955+60	Unnamed
34.89	1102+78	Unnamed	107.42	5000+14	Nees Avenue
39.21	1330+56	Rodgers Road	110.12	5142+79	Washoe Avenue
42.53	1505+86	Ward Avenue	111.51	5216+16	Sierra Avenue
43.24	1541+41	Marshall Road			

- **Replacing impacted pipeline crossings:** 36 pipeline crossings have been identified as impacted.[3] The new pipelines would be carried by truss bridges, and pipes adjacent to each other would be carried by single bridges. Table C-4 details the locations of the impacted pipeline crossings.

Table C-4. Pipeline Crossing Replacements

Pipe	Mile Post	Station Number	Size	Notes
9	16.78	932+32	26"	Gasoline Line Crossing (Stan. Pac. Pipeline)
10	16.78	932+22	24"	Oil Line Crossing (Std. Oil Co.)
11	18.47	1019+48	24"	Gas Line Crossing (Stan. Pac. Pipeline) On Steel Piers
12	18.47	1019+48	26"	Oil Line Crossing (Std. Oil Co.)
13	21.13	1155+50	16"	Irrigation Pipe Crossing on Concrete Piers (J.F. Traina)

[3] Pipeline crossings with clearances less than one foot above the MWSEL (with predicted subsidence added).

Pipe	Mile Post	Station Number	Size	Notes
14	22.75	1242+00	16"	Irrigation Pipe Crossing on Steel Piers (Logan)
15	23.76	515+22	16"	Irrigation Crossing on Steel Piers
16	46.17	1696+98	16"	Pipeline Crossing on U/S Side (Cerutti Bros.)
18	59.50	2448+00	16"	Irrigation Pipe Crossing on Concrete Piers (Simon Newman Co.)
32	83.36	3730+00	18"	Irrigation Pipe Crossing on Piers (H.G. Fawcett)
33	83.57	3740+86	30"	Irrigation Pipe Crossing on Piers (H.G. Fawcett)
35	83.88	3757+30	24"	Drainpipe Crossing on D/S Side of Bridge (Fawcett)
39	85.04	3819+00	18"	Irrigation Pipe Crossing on Piers (F. Cotta & R. Lindemann)
40	85.47	3841+00	18"	Irrigation Pipe Crossing on D/S Side (Jacob Dillinger)
42	86.70	3905+95	18"	Irrigation Pipe Crossing on Concrete Piers (Joe Fialho)
44	89.23	4039+92	18"	Irrigation Pipe Crossing (Joseph Y. Woo & Sam Hamburg Farms)
45	90.57	4110+64	24"	Pipe Crossing on Concrete Piers (Hamburg Lifelines)
46	90.57	4110+64	36"	Pipe Crossing on Concrete Piers (Hamburg Lifelines)
47	90.57	4110+64	30"	Pipe Crossing on Concrete Piers (Hamburg Lifelines)
48	90.91	4128+25	18"	Irrigation Pipe Crossing on U/S Side (Sam Hamburg Farms)
49	91.71	4170+50	18"	Irrigation Pipe Crossing on Concrete Piers (Sam Hamburg Farms)
50	92.23	4170+50	24"	Pipeline Crossing
51	92.73	4224+36	18"	Gas line On Underside of Bridge (PG&E) (Hugh Bennet)
52	93.23	4251+20	18"	Drainpipe Crossing on Piers (Pacific Western Oil)
53	94.26	4305+50	18"	Irrigation Pipe Crossing Piers (Pipe Removed)
54	95.45	4368+05	24"	Pipe on U/S Side of Bridge
55	95.45	4368+05	30"	Unknown
57	98.74	4540+12	18"	Unknown
58	99.82	4597+05	18"	Irrigation Pipe Crossing D/S Side of Bridge
59	100.23	4619+00	36"	Irrigation Pipe Crossing on Timber Pile Bents (B.B. Britton)
60	101.27	4674+00	24"	Irrigation Pipe Crossing on Timber Pile Bents (V.C. Britton)
61	102.54	4750+70	24"	Irrigation Pipe Crossing on Timber Pile Bents (V.C. Britton)
62	102.93	4761+81	36"	Unknown
63	102.93	4761+81	24"	Irrigation Pipe Crossing D/S Side of Bridge
64	105.04	4873+89	24"	Irrigation Pipe Crossing on Timber Pile Bents (V.C. Britton)
65	106.48	4950+00	24"	Irrigation Pipe Crossing on Timber Pile Bents (V.C. Britton)

- **Modifying check structures and wasteways:** Although gates on check structures and wasteways were designed to have heights that exceeded the MWSEL at their locations, subsidence has caused an increase in water surface elevations which has resulted in some of these gates having heights lower than the MWSEL. To avoid overtopping, gates at 17 check structures would require raising. Raising the heights of the gates could require changes to the drums, hoists, and cables to confirm that the gates will open to levels above the new MWSEL. The 20 by 17 foot gates are not likely to require hoist system replacements while the 18 by 15 foot gates, located at check structures 14, 15, 16, 17, 19, and 20, are likely to require hoist system replacements. Raising the gates at these check structures will increase the forces on the concrete structures supporting these gates and thus structural reinforcement will be required to reinforce the concrete elements. Table C-5 details the location of the check structures and wasteways to be modified and the required gate raise for each.

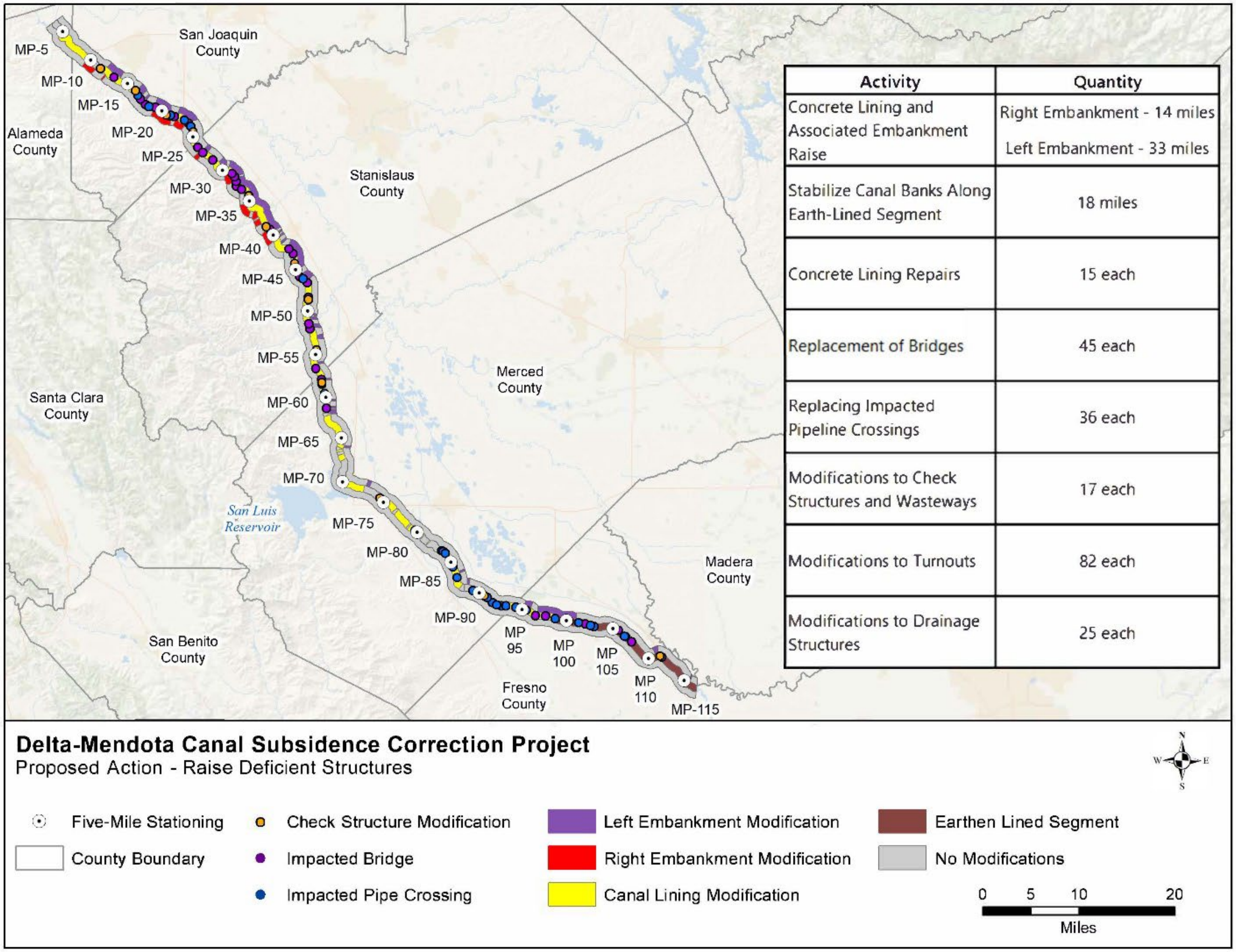
Table C-5. Check Structures and Wasteways to be Modified

Check Number	Mile Post	Station Number	Required Gate Raise (ft)
1	11.35	652+65	1.11
2	16.18	900+65	1.07
3	20.63	1129+35	1.65
4	24.42	550+00	2.06
5	29.81	835+00	1.9
6	34.42	1078+15	1.9
7	38.69	1303+80	1.23
8	44.26	1597+65	0.82
9	48.62	1825+65	0.42
10	54.41	2148+65	0.3
11	58.28	2383+65	0.09
14	74.4	3256+50	0.16
15	79.65	3534+20	0.87
16	85.09	3821+50	0.46
17	90.54	4109+20	2.68
19	105.06	4875+40	2.02
20	111.26	5202+30	2.26
Wasteway Number	**Mile Post**	**Station Number**	**Required Gate Raise (ft)**
1	34.32	1072+55	0.44
6	111.22	5200+90	1.9

Modifying turnouts. Walls for the stilling pits of 82 turnouts on the left side of the canal would require raising. The walls requiring raise would be raised with concrete, the existing galvanized steel would be removed, and metal guards would be installed around each stilling pit for all gravitational turnouts.

Modifying drainage structures. Work on drainage structures would include:

- Installing trash racks for drain inlets; installing flared inlets for pipe culverts without inlets;
- Replacing drain inlets that require relocation during replacement of deficient bridges; installing additional drain inlets at MP 18.06 (station 997+25), 20.71 (station 1133+75), 41.08 (between stations 1427+00 and 1433+50), 49.83 (between stations 1889+00 and 1890+25) and 60.44 (station 2497+50);
- Replacing existing headwalls and wing walls with new ones that are higher at MP 5.77 (station 303+15), 21.91 (station 1197+00), 25.62 (station 613+36), 30.63 (station 877+92), 41.93 (station 1474+40), 45.75 (station 1673+80), and 64.28 (station 2709+35);
- Replacing the clogged side culvert at MP 5.77 (station 303+15) with a new box culvert, raising the headwalls for drain inlets, culverts, and overchutes at some locations; and
- Installing or replacing riprap at inlets, outlets, culverts, and overchutes to protect embankment from erosion.



Activity	Quantity
Concrete Lining and Associated Embankment Raise	Right Embankment - 14 miles Left Embankment - 33 miles
Stabilize Canal Banks Along Earth-Lined Segment	18 miles
Concrete Lining Repairs	15 each
Replacement of Bridges	45 each
Replacing Impacted Pipeline Crossings	36 each
Modifications to Check Structures and Wasteways	17 each
Modifications to Turnouts	82 each
Modifications to Drainage Structures	25 each

Figure C-2. Construction Details under the Proposed Project

C.2.1.2 Equipment and Staging

Construction staging and stockpiling would occur within the canal ROW, which extends approximately 100 to 200 feet on both sides of the canal depending on specific location. Construction staging and stockpiling would typically occur in the immediate vicinity of the construction activity and would be limited to duration of the construction activity (see details in Table C-6 and Table C-7 below). In addition to the construction staging area, 54 borrow areas (approximately 227.7 acres total) have been identified within the canal ROW for excavation of embankment material and backfill material. These areas would be returned to preconstruction condition after the Project is completed.

Equipment in the staging areas would include trailers, equipment to be used, and stockpiled materials. Construction equipment would access the construction sites and stockpiling areas through existing left and right bank service roads. Table C-6 below summarizes the construction equipment list by construction activity.

Table C-6. Assumptions for the Construction Equipment Under the Proposed Action

Activity	Equipment List
Concrete Lining and Associated Embankment Raise	1 Small Dozer, 2 Loaders, 1 Small Excavator, 1 Compacter, 1 Skid Steer, 7 Water Trucks and 2 Dump Trucks
Stabilize Canal Banks Along Earth-Lined Segment	2 Small Dozers, 5 Loaders, 1 Small Excavator, 2 Roller Compacters, 1 Plate Compactor, 1 Grader, 7 Water Trucks and 2 Dump Trucks
Concrete Lining Repairs	1 Excavator, 2 Dump Trucks, 1 Skid Steer
Replacement of Bridges	1 Crane, 1 Sawcut,1 Dozer,1 Compactor,1 Excavator,1 Drill Rig,1 Skid Steer, 1 Paver, 1 Tractor, 4 Water Trucks and 6 Dump Trucks
Replacing Impacted Pipeline Crossings	1 Small Excavator, 1 Skid Steer,1 Crane,1 Loader, 2 Dump Trucks
Modifications to Check Structures and Wasteways	2 Cranes and 3 Lifts
Modifications to Turnouts	2 Cranes, 1 Skid Steer, and 2 Dump Trucks
Modifications to Drainage Structures	2 Excavators, 2 Skid Steers, 1 Dump Truck

*Activities listed above could occur concurrently

C.2.1.3 Schedule

Construction duration for the Proposed Action is assumed to be seven and a half years. Work would be performed seven days per week, 12 months per year. Work during the weekdays (Monday through Friday) would be performed in one 10-hour work shift that would occur between 7 a.m. and 7 p.m. Work during the weekends (Saturday and Sunday) would be performed in one eight-hour shift that would occur between 9 a.m. and 5 p.m. It is assumed, for the purpose of this EA/IS, that construction would start in March 2025. The major assumptions for the schedule development of the Proposed Action as well as the anticipated construction duration of construction activities are detailed in Table C-7.

Table C-7. Assumptions for the Proposed Action Schedule Development

Activity	Seasonal Designation	Production Rates Used for the Schedule	Duration (Years)
Concrete Lining and Associated Embankment Raise	Low-flow work	400 feet per day - One Form/Reinforce/Place operation.	4 (October – May)
Stabilize Canal Banks Along Earth-Lined Segment	Low-flow work	400 feet per day - One construction operation.	1 (October – May)
Concrete Lining Repairs	Low-flow work	Two weeks for each repair area - one construction operation.	0.75 (November – February)
Replacement of Bridges	All season work	Six months per bridge - Three bridges are being constructed concurrently for the duration of the Project	7.25
Replacing Impacted Pipeline Crossings	All season work	Three weeks for each pipeline crossing - one construction operation	2
Modifications to Check Structures and Wasteways	Low-flow work	Four months per structure - Two structures are being constructed concurrently for the duration of the Project.	4.5 (November – February)
Modifications to Turnouts	All season work	One week each – one construction operation	2
Modifications to Drainage Structures	All season work	Two weeks each - one construction operation	1

*Activities listed above could occur concurrently

C.2.2 Operations

C.2.2.1 Operations During Construction

Some drawdowns of the canal water surface are needed to support in-water construction activities; however, no canal outages are required, thus providing flexibility in completing construction activities.

C.2.2.2 Operations After Construction

The Proposed Action would restore conveyance capacity in the DMC back to its originally authorized design capacity. Operation of the DMC after construction would conform to the existing operating rules identified in the 2019 USFWS and NMFS Biological Opinions for the ROC on LTO of CVP and SWP (USFWS 2019; NMFS 2019) or any future regulatory requirements and the terms and conditions specified in the relevant Biological Opinions. Reclamation would continue to maintain the facilities in compliance with the existing USFWS biological opinion titled *Formal Endangered Species Consultation on the Operations and Maintenance Program Occurring on Bureau of Reclamation Lands within the South-Central California Area Office* that was issued on February 17, 2005 (referred furthermore as the 2005 USFWS Biological Opinion) (USFWS 2005) or any future regulatory requirements and the terms and conditions specified in the relevant Biological Opinions. As the canal would be modified to meet originally authorized design capacity and flows, no changes to the current operations and maintenance are anticipated.

C.3 References

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Appendix D
CalSim Modeling Technical Report

Contents

Tables

Figures

Chapter 1 Background and Project Description

The Delta-Mendota Canal (DMC) is a 116-mile-long gravity canal that conveys water from the Delta region near Tracy, CA to the Mendota Pool near Mendota, CA. The DMC was constructed in 1951 in compliance with the then-current Design Standards and standard industry practices. The Bureau of Reclamation (Reclamation) documented that the canal was incapable of conveying the original designed capacity due to the occurrence of regional land subsidence within the California Central Valley, which caused structural deficiencies in the canal. The technical appendix describes analysis performed in support of the DMC Subsidence Correction Project (Project).

This technical appendix provides a description of the of the project alternatives (Chapter 1), analysis of historical operations data (Chapter 2), description of the CalSim model (Chapter 3), and analytical modeling results for the Proposed Action (Chapter 4).

1.1 Project Purpose and Need/Project Objectives

1.1.1 Project Purpose and Need

As a result of subsidence, the available freeboard for the canal lining and the canal embankment, and clearances between maximum water surface elevations and many structures crossing the DMC, no longer meet Reclamation standards. The combination of reduced freeboard and impacted structures requires that SLDMWA operate the DMC at a lower water surface elevation, which reduces its capacity to convey water supply deliveries to water users dependent on that supply. The continued, safe, and reliable operation of the DMC is critical to the users it serves, and the economies it supports. The purpose and need of Reclamation's Proposed Action is to restore the originally authorized conveyance capacity of the DMC (the design capacity conveys a variable flow rate decreasing from 4,600 cubic feet per second (cfs) at the upstream end to 3,211 cfs at the downstream end).

In compliance with the Council on Environmental Quality's *Economic and Environmental Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies* and Reclamation's Directive and Standards CMP 09-02 *Water and Related Resources Feasibility Studies*, Reclamation and SLDMWA are evaluating the feasibility of alternatives that would restore the lost conveyance capacity in the DMC to regional subsidence. Reclamation is completing a Feasibility Study evaluation to identify, evaluate and select an alternative that can support the delivery of Central Valley Project (CVP) supplies needed by CVP water users dependent on the DMC that would otherwise be blocked by limits on its conveyance capacity generated by regional subsidence.

1.1.2 CEQA Goals and Objectives

The primary goal for the Project is to restore or replace conveyance capacity in the DMC lost to regional subsidence. The objectives of the Project are as follows:

1. To increase the long-term reliability and quantity of CVP supplies delivered to south-of-Delta contractors dependent on the DMC currently affected by reduced deliveries limited by the canal's reduced conveyance capacity.

2. To support the safe long-term operation of the DMC consistent with its design for freeboard and clearances between maximum water surface elevations and structures crossing the canal.

1.1.3 No Action/No Project Alternative

Under the No Action/No Project Alternative (subsequently identified as the No Action Alternative), the existing conditions of the DMC would remain unchanged, and the flow rates would be further reduced from original design capacity during operation to meet Reclamation Design Standards No. 3 (Reclamation 2014). Currently, 30 of the existing 115 bridges along the DMC are considered deficient because they do not have one foot of clearance above the Maximum Water Surface Elevation (MWSEL) when the canal is operated at design flow. However, the number of deficient bridges is expected to reach 45 when taking future subsidence conditions into consideration. Under the No Action Alternative, deficient bridges would be partially submerged when the canal is operated at the design flow, resulting in safety risks. To operate the canal safely and in accordance with Reclamation safety standards under the No Action Alternative, flow in the canal would need to be restricted further below its current operating flows, with a forecasted maximum, permanent flow reduction in the DMC estimated at 1,457 cfs (44-percent reduction) from original design capacity by 2070. Figure 1 contains details the current and anticipated reduction of the canal capacity compared to the designed capacity.

The No Action Alternative evaluates the reduced capacity of the DMC under (1) current conditions as of 2020; (2) forecasted 2035 conditions; and (3) forecasted 2070 conditions. The operations of the No Action Alternative would be consistent with the 2019 United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) Biological Opinions (2019 USFWS and NMFS Biological Opinions) for the Reinitiation of Consultation on the Long-term Operations of CVP and State Water Project (SWP) (ROC on LTO), 2020 ROC on LTO Record of Decision (ROD), and the 2018 Addendum to the Coordinated Operation Agreement Central Valley Project/State Water Project Finding of No Significant Impact (FONSI)/ROD. Both the Biological Opinion for ROC on LTO and the 2018 Addendum to the Coordinated Operation Agreement CVP and SWP FONSI/ROD assume a DMC flow rate reflecting the original design capacity. As noted previously, the No Action/No Project Alternative assumes a reduced capacity of the DMC consistent with existing conditions.

1.1.4 Raise Deficient Structures Alternative (Proposed Action)

The Raise Deficient Structures Alternative has been identified as the Proposed Action (under NEPA) and the Proposed Project (under CEQA). Under the Proposed Action/Proposed Project (subsequently identified as the Proposed Action), the DMC would be modified to satisfy current Reclamation safety standards, including freeboard requirements for the canal lining and embankment. The deficient lining, embankment, and impacted structures of the canal would be raised to restore the canal to its original conveyance capacity. The proposed modifications of the canal and related structures would be in accordance with current federal, state, and local design guidelines and standards.

Delta Mendota Canal Capacity (cfs)

Mile Post	Design Flow	Current Conditions		2035 Projected Conditions		2070 Projected Conditions	
	Capacity	Capacity	Reduction	Capacity	Reduction	Capacity	Reduction
11.35	4600	4232	-368	4189	-411	4136	-464
16.19	4498	4129	-369	4076	-422	4008	-490
20.63	4498	3825	-673	3738	-760	3630	-868
24.43	4399	3529	-870	3450	-949	3348	-1051
29.82	4399	3843	-556	3692	-707	3494	-905
34.42	4299	3518	-781	3395	-904	3299	-1000
38.68	4299	3810	-489	3743	-556	3633	-666
44.26	4299	3571	-728	3559	-740	3510	-789
48.62	4299	3530	-769	3530	-769	3530	-769
54.41	4199	3739	-460	3739	-460	3739	-460
58.28	4199	3356	-843	3356	-843	3356	-843
63.99	4199	3585	-614	3585	-614	3585	-614
70.01	4199	3759	-440	3759	-440	3759	-440
74.4	3501	3157	-344	3125	-376	3065	-436
79.64	3501	3339	-162	3269	-232	3191	-310
85.09	3400	3400	0	3376	-24	3195	-205
90.54	3400	3227	-173	2861	-539	2565	-835
96.81	3400	2966	-434	2750	-650	2532	-868
105.06	3310	2274	-1036	2090	-1220	1853	-1457
111.26	3310	2777	-533	2716	-594	2668	-642
116.41	3310	2724	-586	2683	-627	2607	-703

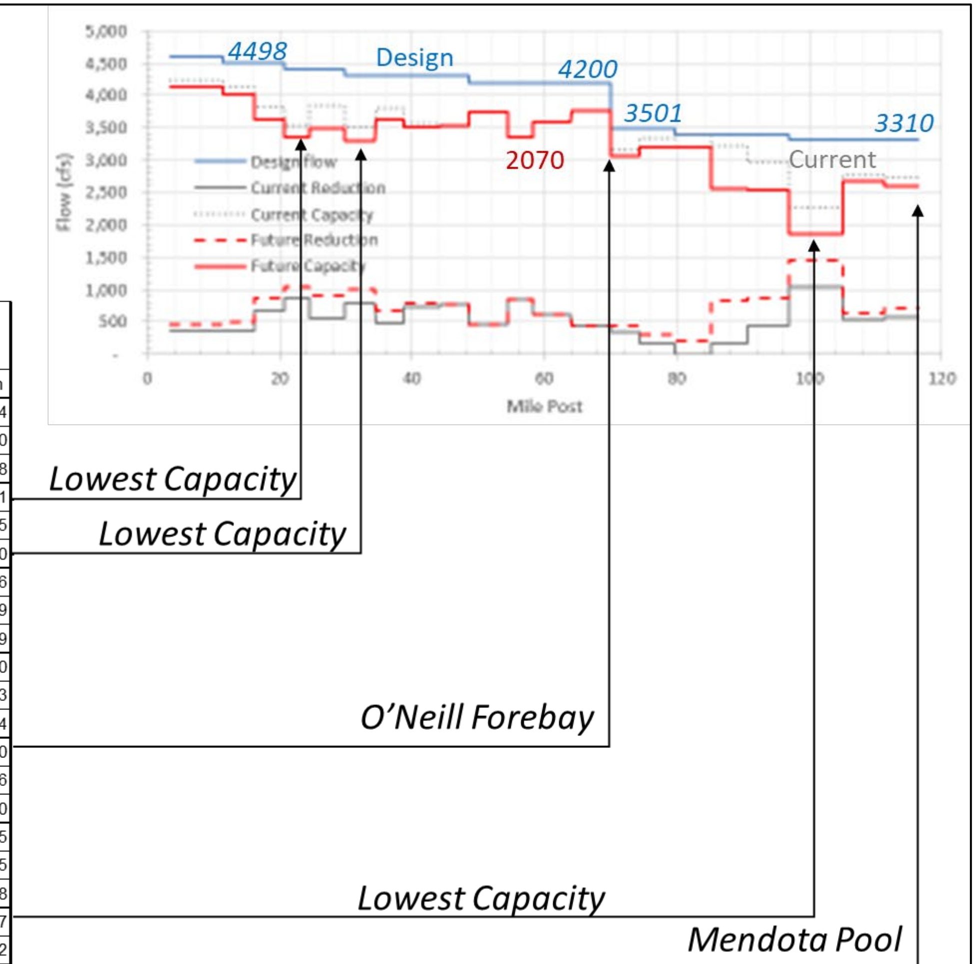

Figure 1. Design Flows, Reduction in Flow, and Actual Flow Capacities in the DMC for Current and Future (with-Future Subsidence) Conditions

Chapter 2 Historical Operations and Data

Evaluating historical operations data provides insights regarding the reduced capacity of the DMC and how reduced capacity has affected CVP south-of-Delta operations. Review of historical data also guides modeling and forms a basis for relating the modeling to actual CVP/SWP operations.

A key indicator for how DMC capacity reductions have affected CVP operations is historical pumping at C.W. "Bill" Jones Pumping Plant (Jones Pumping Plant). Figure 2 contains a plot of historical pumping at Jones Pumping Plant from 1955 through 2020. Until San Luis Reservoir began operation in about 1967, the Jones Pumping Plant rarely reached full pumping capacity. From 1967 through the late 1980s, Jones Pumping Plant often reached full capacity. Pumping at Jones Pumping Plant was below capacity during a drought in California that lasted from the late 1980s though 1994. After the wet hydrologic period from 1995 through 1998, Jones Pumping Plant pumping steadily declined due to reduced DMC capacity. The lowest pumping at Jones Pumping Plant occurred prior to the construction of the Intertie in 2012, but has continued a steady decline since then.

Figure 3 contains a chart with a DMC water balance for year 2011. Pumping at Jones Pumping Plant (positive bar in the chart) is water entering the DMC. Flow leaving the DMC are diversions along the DMC, flow to Mendota Pool, and pumping from the DMC at O'Neill (shown as negative bars in the chart). The maximum pumping at Jones Pumping Plant in 2011 is about 4,190 cfs, about 400 cfs below design capacity due to reduced DMC capacity during times when regulations do not constrain pumping to levels below design capacity. Figure 4 contains a DMC water balance for year 2012, and indicates when the Intertie began operation. Flow in the Intertie is shown as water leaving the DMC (red in Figure 4), and water released from CVP San Luis reservoir to meet water demands on the DMC is shown as water entering the DMC (orange). Maximum pumping at Jones Pumping Plant increased during June of 2012 due to operation of the Intertie. Figure 5 contains a DMC water balance for California's most recent wet year, 2017. Reduced DMC capacity limits Jones pumping during wet winter months by approximately 600 cfs, also indicated by pumping at O'Neill of 3,500 cfs being 700 cfs below capacity.

Review of historical data demonstrates that reduced DMC capacity has affected the CVP ability to satisfy full CVP contract demand in the export region. Overall CVP allocations have reduced, and CVP contractors have altered, their demands and operations as a result of reduced capacity. Modeling of the Proposed Action demonstrates consistent effects to CVP south-of-Delta operations as has been observed in historical operations records.

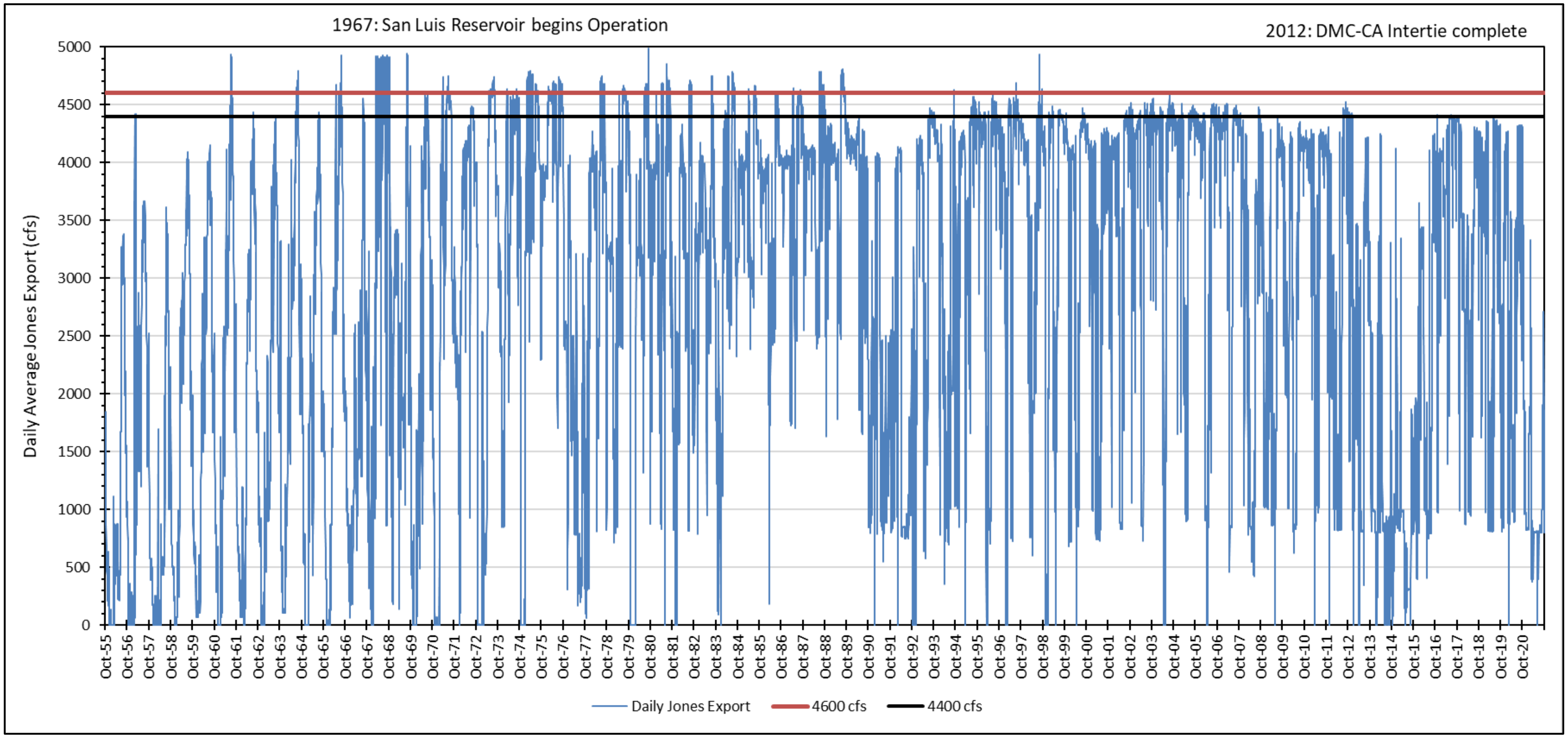

Figure 2. Average Daily Jones Pumping Plant Export (1955 - 2020)

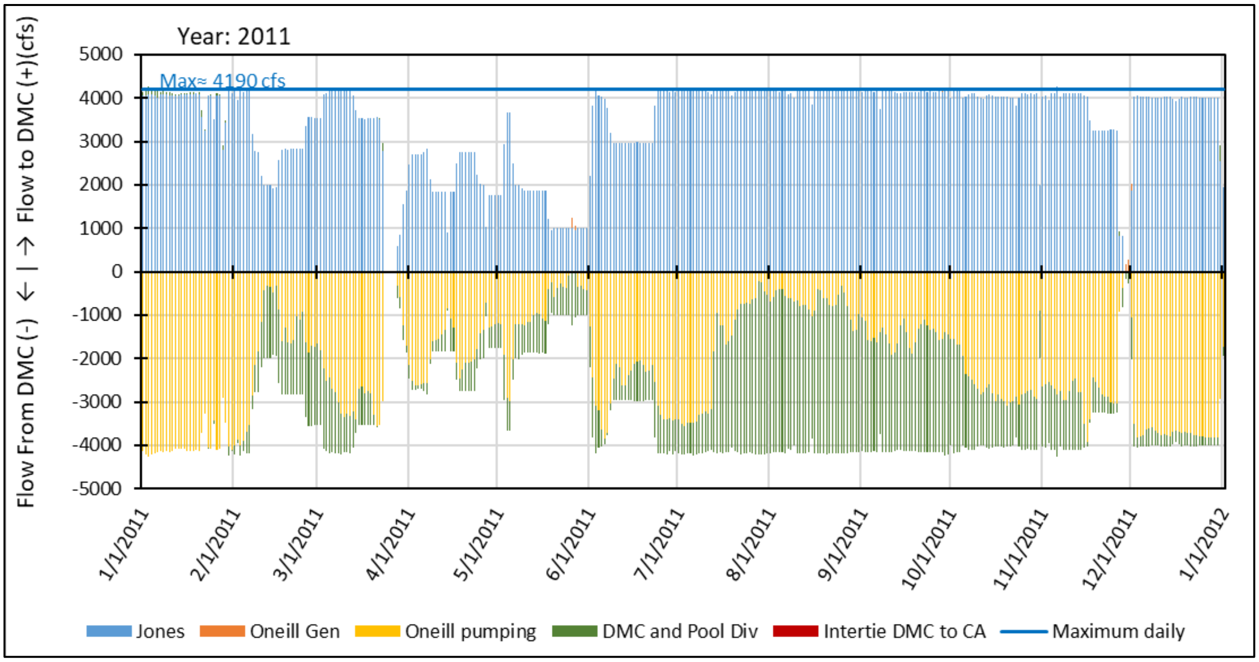

Figure 3. Historical Daily DMC Inflow (Jones Pumping Plant) and Outflow (2011)

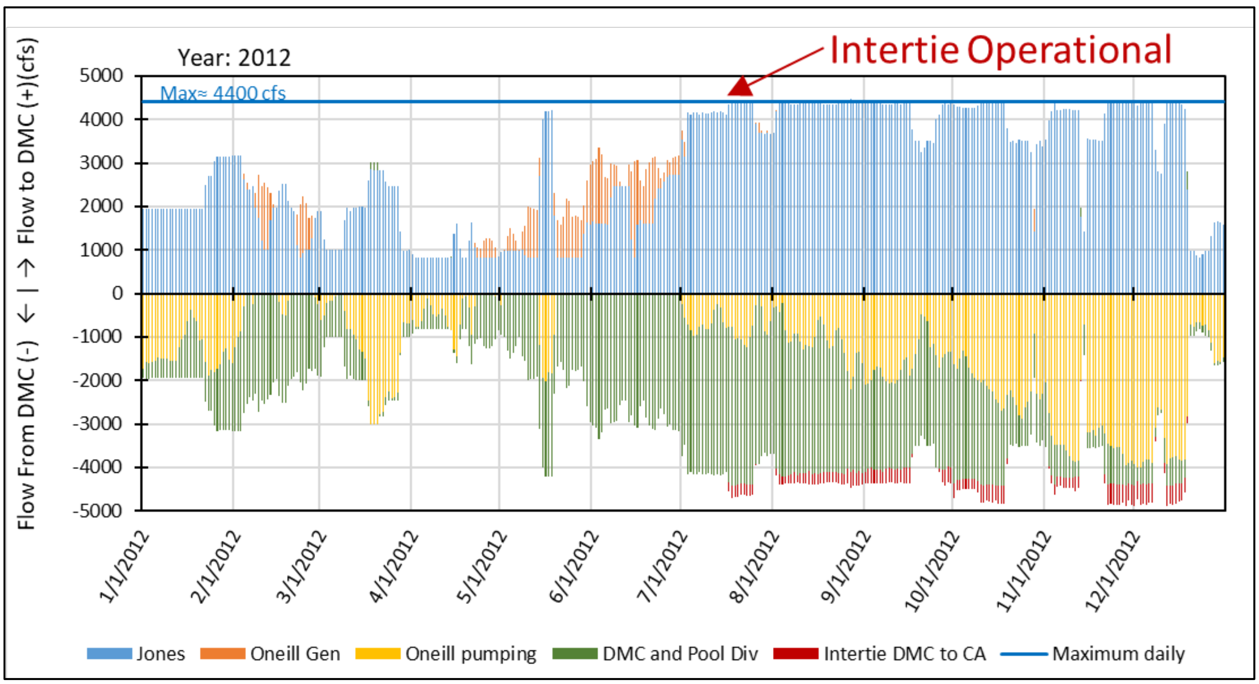

Figure 4. Historical Daily DMC Inflow (Jones Pumping Plant) and Outflow (2012)

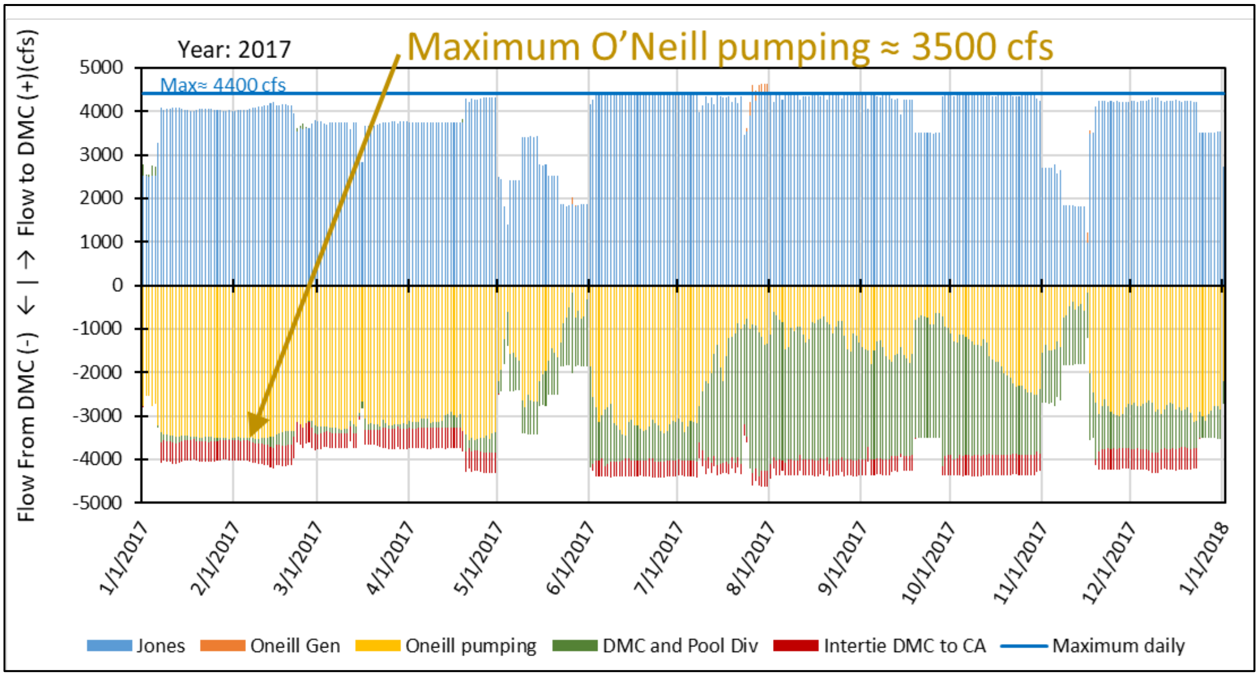

Figure 5. Historical Daily DMC Inflow (Jones Pumping Plant) and Outflow (2017)

Chapter 3 Water Operations Modeling

Water operations modeling is a key step in the analysis of Project alternatives. Water operations model results frequently serve as the basis of subsequent economic and environmental analyses. This section provides brief descriptions of the models used to analyze the alternatives. Descriptions include model assumptions and modifications made to baseline model files provided by Reclamation.

3.1 Operations Models

CalSim II was used to simulate CVP/SWP operations, including the DMC, for each Project alternative.

3.1.1 CalSim II

CalSim II is a planning model designed to simulate operations of CVP and SWP reservoirs and water delivery systems. CalSim II simulates flood control operating criteria, water delivery policies, and in-stream flow and Delta outflow requirements. CalSim II is the best available tool for modeling CVP and SWP operations and is the primary system-wide hydrologic model used by the Department of Water Resources (DWR) and Reclamation to conduct planning and impact analyses of potential projects.

CalSim II is a simulation by optimization model. The model simulates operations by solving a mixed-integer linear program to maximize an objective function for each month of the simulation. CalSim II was developed by Reclamation and DWR to simulate operation of the CVP and SWP for defined physical conditions and a set of regulatory requirements. The model simulates these conditions using 82 years of hydrology from water year 1922 through 2003.

CalSim II modeling conducted for the for the Project was developed from baseline models[1] provided by Reclamation. The model's input hydrology incudes historical hydrology and 2035 level climate change hydrology. The sensitivity analysis is performed by incorporating 2070 climate hydrology from the California Water Storage Investment Program (WSIP) into Reclamation's CalSim II Baseline. Land use projections for this model are based on Year 2020 estimates for the Sacramento Valley, and draft Year 2030 estimates for the San Joaquin Valley. Regulatory requirements imposed in CalSim II model for all Project alternatives included all existing regulatory requirements, as well as actions detailed in the 2019 USFWS and NMFS Biological Opinions for delta smelt and listed salmonid species, respectively (USFWS 2019, NMFS 2019) and the March 31, 2020, Incidental Take Permit (ITP) issued by the California Department of Fish and Wildlife (CDFW) for the SWP. The baseline model also includes the changes to operating criteria and requirements put in place under the 2018 Coordination Operations Agreement (COA) Addendum.

Table 1 contains a list of CalSim II model scenarios developed for analyzing the water operational effects of each Project alternative. Effects of the Project are determined by comparing CalSim II

[1] Reclamation Benchmark models released on March 01, 2022.

model scenarios that assume full design capacity to a corresponding no action/no project model scenario. The following model scenarios described in Table 1 are compared to assess Project effects:

- Existing Conditions With-Project (2) compared to Existing Conditions (1)
  - Evaluates current DMC capacity to design capacity using historically based hydrology
- 2035 Future With-Project (5) compared to 2035 Future No Action (3)
  - Evaluates forecasted DMC capacity in year 2035 to design capacity using 2035 (Central Tendency) climate change hydrology
- 2035 Future With-Project (5) compared to 2035 Future No Action (4)
  - Evaluates forecasted DMC capacity in year 2070 to design capacity using 2035 (Central Tendency) climate change hydrology

Model scenarios with 2070 climate (WSIP) hydrology are used to estimate how effects of the Project may be further influenced by changes in hydrology due to more extreme changes in climate. Model simulation 2070 Future With-Project (7) is compared to the simulation 2070 Future No Action (6) for the sensitivity analysis.

Table 1. CalSim II Modeling Scenarios

	Baseline/Action Alternatives	Modeled DMC Conveyance Capacity	Hydrology	CalSim II Reclamation Benchmark Simulation Name
1	Existing Conditions	Current Conditions	Historical	Benchmark_Hist_030122
2	Existing With Project	Design Capacity	Historical	Benchmark_Hist_030122
3	2035 Future No Action	2035 Level	2035 Climate (CT)	Benchmark_2035CT_03012035
4	2035 Future No Action	2070 Level	2035 Climate (CT)	Benchmark_2035CT_03012035
5	2035 Future With Project	Design Capacity	2035 Climate (CT)	Benchmark_2035CT_03012035
6	*2070 Future No Action	2070 Level	2070 Climate (WSIP)	Benchmark_030122 (2070 WSIP)
7	*2070 Future With Project	Design Capacity	2070 Climate (WSIP)	Benchmark_030122 (2070 WSIP)

Note: * Used for sensitivity modeling only

3.1.2 Modifications to Reclamation CalSim II Baselines

The baseline model provided by Reclamation required minor modifications for use in evaluating operations under the Project alternatives. These changes are made in close coordination with Reclamation modeling experts to better assess operational effects of the Project.

3.1.2.1 Delta-Mendota Canal/California Aqueduct Intertie (Intertie)

The Intertie is a shared federal-state water system located in a rural agricultural area of the San Joaquin Valley in Alameda County, west of the city of Tracy, California. The 500-foot-long Intertie connects the federal DMC and the California Aqueduct via two 108-inch-diameter pipes. The Intertie Pumping Plant has a capacity of 700 cfs[2] uphill from DMC to the California Aqueduct and 900-cfs gravity flow down from California Aqueduct to the DMC (Reclamation 2022). The Intertie is downstream from Jones and Harvey O. Banks (Banks) pumping plants at DMC Mile 7.2 and California Aqueduct Mile 9.

Intertie capacity is assumed to be 400 cfs in the baseline CalSim II model that was modified in this study to 700 cfs, as per the data in the factsheet[3] published by Reclamation. According to the factsheet, the final two pumps were installed in October 2022, expanding the capacity of the Intertie from 467 cfs to 700 cfs.

3.1.2.2 Joint Point of Diversion (JPOD)

On February 28, 1995, DWR and Reclamation filed a petition requesting, among other things, that their water right permits authorizing diversion or rediversion of water in the southern Delta be amended to add the SWP's Banks Pumping Plant as a point of diversion and rediversion in Reclamation's water rights, and to add the CVP's Jones Pumping Plant as a point of diversion and re-diversion in the DWR's water rights (California State Water Resources Control Board and California Environmental Protection Agency 1999). This use of one project's diversion facility by the other project is referred to as the Joint Points of Diversion (JPOD). Figure 6 shows the historical use of JPOD.

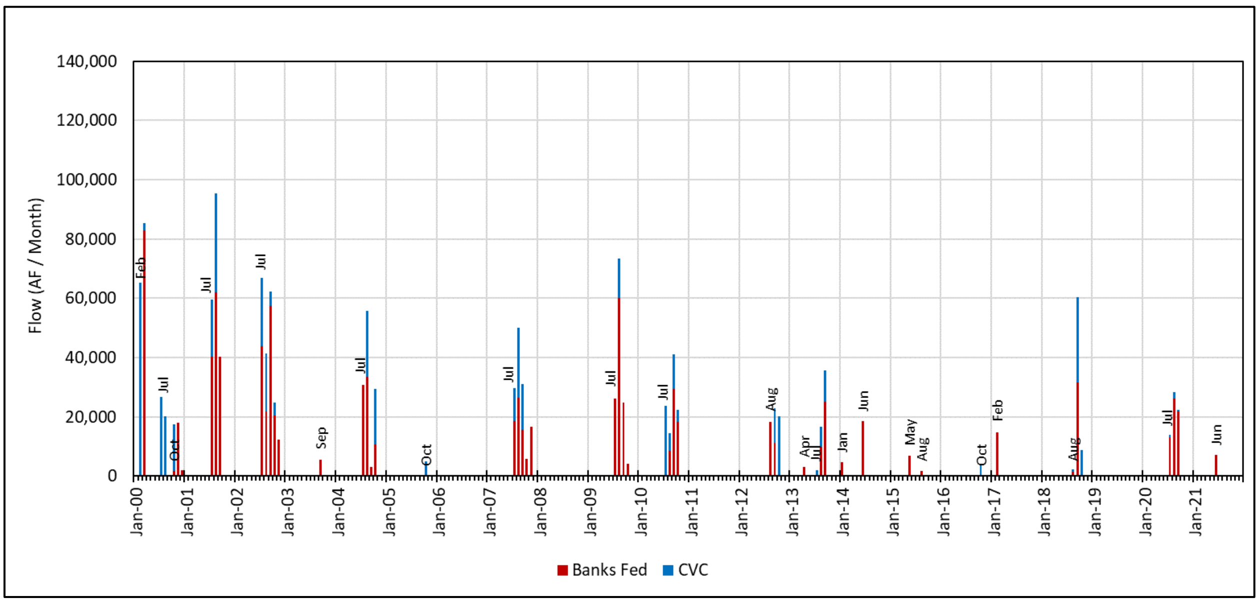

Figure 6. Historical Use of Joint Points of Diversion

[2] The modeled Intertie Pumping Plant conveyance capacity of 700 cfs is based on the assumption of the Intertie Pumping Plant becoming fully operational and pending applicable Endangered Species Act compliance. The operation of Delta exports by the CVP and SWP and those exports' ultimate conveyance through the DMC and SWP as facilitated by the Intertie Pumping Plant was modeled consistent with the controls on operations required under the 2019 USFWS and NMFS Biological Opinions for Reinitiation of Consultation on the Long-Term Operation of CVP and SWP.

[3] https://www.usbr.gov/mp/mpr-news/docs/factsheets/intertie.pdf

Results showed a significant difference in the use of JPOD between the existing capacity model and design capacity model. The difference in JPOD use between the two models is a result of the difference in the maximum export capacity at Jones Pumping Plant that resulted in an increase of the benefits of the Project by approximately 20 thousand acre-feet (TAF) on an annual average basis.

Several test runs were performed by adjusting the JPOD logic to have a consistent operation of JPOD between the two scenarios. Results were found to be inconsistent with the objectives of the analysis and eventually, JPOD operations were turned off in the models for this study to develop the most accurate assessment of effects of this project.

Chapter 4 Comparison of Alternative

This chapter compares With-Project CalSim II scenarios to the No Action Alternative with existing or projected reduced DMC conveyance capacity. Section 4.1 compares a With-Project Alternative to Existing Conditions capacity using historically based hydrology. Section 4.1.1 compares a With-Project Alternative to 2035 forecasted capacity using 2035 climate change hydrology. Section 4.1.2 compares a With-Project Alternative to 2070 forecasted capacity using 2035 climate change hydrology. Section 4.1.3 describes a sensitivity analysis that compares a With-Project Alternative to 2070 forecasted capacity using 2070 climate change hydrology.

Section 4.1 through Section 4.1.3 describe comparisons of CalSim II scenario output for components of CVP and SWP operations with greater detail on DMC flows, CVP deliveries and other key components of the entire CVP and SWP system.

4.1 Existing Conditions With-Project Compared to Existing Conditions

This section compares Existing Conditions With-Project to Existing Conditions (No Action Alternative) using historically based hydrology. One of the most informative metrics for the effects of the Project is change in Jones Pumping Plant export from the Delta. Table 2 contains average monthly and annual Jones Pumping Plant export by water year type for Existing Conditions, Existing Conditions With-Project, and the difference. Comparison of model scenarios show existing Jones Pumping Plant export has been reduced, due to subsidence, by an average annual of 58 TAF and restoring capacity would increase export by this amount. Reduced capacity has limited Jones Pumping Plant export of stored water during the June through October period, and export of Delta excess flows in the November through March period, as can be seen in Table 2.

The Intertie allows water exported at Jones Pumping Plant to be pumped into the California Aqueduct and then flow to O'Neill for use by the CVP. Use of the Intertie has decreased impacts of reduced DMC capacity and restoration of DMC capacity would reduce use of the Intertie. Table 3 contains average monthly and annual flow from the DMC to the California Aqueduct through the Intertie by water year type. Comparison of model scenarios show an annual average reduction of 140 TAF in use of the Intertie with restored DMC capacity. This decrease occurs mostly in winter of all year types and in summer of wetter year types, with smaller summer decreases in dryer year types.

Capacity reductions in the lower DMC limit the ability to meet full CVP contract demands for Exchange, Settlement, Water Service, and Repayment contractors. This limitation generally occurs during peak of the irrigation season in June, July, and August. The average annual reduction in deliveries from Mendota Pool, with the use of the Intertie Pumping Plant, is approximately 60 TAF, as shown in Table 4.

Table 2. Jones Pumping Plant Export for Existing Conditions and Existing Conditions With-Project

Existing Conditions Units: TAF

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	246	252	251	229	211	213	211	238	243	267	277	251	2890
AN	186	247	261	240	225	204	182	214	220	234	235	197	2645
BN	210	204	227	237	220	176	158	202	187	239	209	255	2523
D	151	159	195	236	216	166	116	154	165	186	192	222	2158
C	129	107	146	187	187	127	71	113	68	79	160	140	1512
All	193	201	221	228	212	182	157	192	187	212	224	221	2429

Existing Conditions With Project

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	254	271	262	233	221	205	206	240	244	275	280	255	2947
AN	184	256	278	245	232	199	184	214	226	239	264	211	2731
BN	213	196	238	243	229	170	157	203	192	259	229	259	2589
D	154	154	196	237	210	166	115	153	174	222	200	229	2210
C	134	116	147	183	187	124	71	113	74	88	168	140	1544
All	197	208	229	230	217	178	155	192	192	228	235	227	2487

Existing Conditions With Project -Minus- Existing Conditions

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	8	19	11	4	11	-8	-6	2	1	8	3	4	57
AN	-1	9	16	5	7	-5	2	0	5	5	29	14	86
BN	3	-8	11	6	9	-6	-1	1	6	19	20	4	66
D	2	-5	2	1	-5	0	-1	-2	9	36	7	6	52
C	6	9	1	-3	1	-3	0	0	6	9	8	0	33
All	4	6	8	3	5	-5	-2	1	5	16	11	5	58

Table 3. DMC to CA Intertie Flow for Existing Conditions and Existing Conditions With-Project

Existing Conditions Units: TAF

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	31	40	36	26	28	19	10	13	19	25	33	29	308
AN	5	35	43	27	26	15	3	4	9	13	13	4	197
BN	12	22	31	27	29	5	3	0	0	16	7	33	185
D	0	5	18	24	19	2	1	0	0	1	3	16	90
C	0	2	4	13	11	0	0	0	0	0	15	0	45
All	13	23	27	24	23	9	4	5	7	13	17	19	184

Existing Conditions With Project

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	8	20	14	10	11	5	1	0	0	0	2	4	76
AN	1	14	17	5	11	4	1	0	0	0	2	0	57
BN	2	8	10	7	12	1	0	0	0	1	1	5	47
D	0	2	4	0	1	0	0	0	0	0	0	5	13
C	0	0	2	0	0	0	0	0	0	0	4	0	6
All	3	10	10	5	7	2	0	0	0	0	2	3	44

Existing Conditions With Project -Minus- Existing Conditions

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-23	-20	-22	-16	-16	-14	-9	-13	-19	-25	-31	-25	-232
AN	-3	-21	-26	-22	-15	-11	-3	-4	-9	-12	-11	-4	-140
BN	-10	-15	-20	-20	-17	-4	-3	0	0	-15	-7	-28	-138
D	0	-3	-14	-24	-18	-2	-1	0	0	-1	-3	-12	-77
C	0	-2	-2	-13	-11	0	0	0	0	0	-11	0	-38
All	-9	-13	-17	-19	-16	-7	-4	-5	-7	-12	-15	-16	-140

Table 4. DMC Flow to Mendota Pool for Existing Conditions and Existing Conditions With-Project

Existing Conditions Units: TAF

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	57	17	9	5	19	31	40	62	85	112	138	85	660
AN	61	19	10	8	29	41	54	95	126	136	140	86	807
BN	61	19	9	8	29	49	62	103	132	140	140	86	837
D	60	19	10	10	37	53	68	111	135	140	139	84	866
C	51	16	10	10	36	46	58	95	128	137	127	72	787
All	58	18	10	8	29	43	55	90	116	130	137	83	775

Existing Conditions With Project

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	57	17	9	5	19	31	40	62	100	139	155	85	719
AN	61	19	10	8	29	41	54	95	145	168	156	86	875
BN	61	19	9	8	29	49	62	103	157	176	156	86	914
D	60	19	10	10	37	53	68	111	158	171	152	84	934
C	51	16	10	10	36	46	58	95	136	147	130	72	807
All	58	18	10	8	29	43	55	90	134	158	151	83	835

Existing Conditions With Project -Minus- Existing Conditions

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	0	0	15	27	17	0	59
AN	0	0	0	0	0	0	0	0	19	32	17	0	68
BN	0	0	0	0	0	0	0	0	25	36	16	0	77
D	0	0	0	0	0	0	0	0	23	32	13	0	68
C	0	0	0	0	0	0	0	0	7	10	4	0	21
All	0	0	0	0	0	0	0	0	18	28	14	0	60

Restoring DMC conveyance capacity to design levels increases Reclamation's ability to meet CVP contractor demands. Table 5 contains a summary of CVP deliveries to CVP contractors south and north of the Delta. Average annual south-of-Delta deliveries would increase by approximately 58 TAF/year with restored capacity and use of the Intertie Pumping Plant. Restored conveyance capacity would allow Reclamation to distribute contract deliveries more evenly to all CVP water service contractors according to the CVP municipal and industrial (M&I) water shortage policy, this results in an average annual decrease to north-of-Delta CVP contractors by 3 TAF.

Table 5. CVP Delivery Summary for Existing Conditions and Existing Conditions With Project Change

	North of Delta			South of Delta					North + South
	Ag Service	M&I Service	Total	Ag Service	M&I Service	Exchange	Refuge	Total	Total
Wet	342	247	2294	1629	145	837	278	2888	5183
Abv. Norm	350	247	2282	1321	136	828	277	2562	4844
Blw. Norm	321	238	2309	1182	133	819	278	2412	4721
Dry	245	216	2183	784	114	809	274	1980	4163
Critical	49	161	1794	297	94	725	235	1351	3145
All Years	276	226	2197	1127	127	810	271	2335	4532

All Values are in 1,000 acre feet

	North of Delta			South of Delta					North + South
	Ag Service	M&I Service	**Total**	Ag Service	M&I Service	Exchange	Refuge	**Total**	**Total**
Wet	0	0	0	6	0	38	0	44	44
Abv. Norm	1	0	0	25	2	45	0	73	73
Blw. Norm	-3	-1	-4	31	1	55	0	87	83
Dry	-5	-1	-5	20	1	54	0	75	70
Critical	-3	-2	-5	0	0	19	0	19	13
All Years	-2	-1	-3	15	1	43	0	58	56

All Values are in 1,000 acre feet

Restored DMC capacity would allow the CVP to convey more of its share of Delta excess, as defined under the COA. Although analysis performed for COA negotiations assume the DMC is operating at design capacity, the CVP has been limited in export of its negotiated share due to diminished DMC capacity. Restoring DMC capacity would allow the CVP to export more of its share of excess, and therefore reduces the SWP export of unused CVP share. Restored DMC capacity would also allow the CVP to convey more stored water in years with high upstream storage, this results in less spill in upstream reservoirs that SWP may also divert. Thus, the restored DMC capacity would allow for a greater CVP export of its share under COA resulting in reduced SWP delivery of approximately 20 TAF, as shown in Table 6.

Table 6. SWP Delivery Summary for Existing Conditions and Existing Conditions With-Project Change

	Table A	Article 21	Article 56	Total
Wet	2848	235	340	3423
Abv. Norm	2610	91	236	2938
Blw. Norm	2556	78	215	2849
Dry	1533	31	199	1762
Critical	985	33	107	1125
All Years	2202	113	238	2553

All Values are in 1,000 acre feet

	Table A	Article 21	Article 56	Total
Wet	-16	-5	-2	-22
Abv. Norm	-18	-16	-2	-37
Blw. Norm	-23	-1	3	-22
Dry	-14	3	3	-9
Critical	-11	6	-11	-16
All Years	-16	-3	-1	-20

All Values are in 1,000 acre feet

Because Jones Pumping Plant is operated as an integral component of the CVP, changes in pumping at Jones Pumping Plant due to restoration of DMC capacity would affect operations of a majority of CVP and SWP facilities. Table 7 contains average monthly values for flow and storage at key locations in the CVP and SWP system for Existing Conditions, Existing Conditions With-Project, and the difference between these model scenarios. Although the maximum average monthly change in Delta outflow is approximately one percent, the average annual change is approximately 0.2 percent.

Table 7. Summary of Average Monthly System Effects

(Existing Conditions with Project compared to Existing Conditions with Existing capacity)

Existing Conditions NAA	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Delta Outflow (cfs)	6,260	8,726	22,406	42,036	54,072	43,297	30,322	21,053	12,896	8,160	5,124	7,346
Jones Pumping Plant (cfs)	3,143	3,383	3,588	3,701	3,783	2,964	2,631	3,117	3,149	3,450	3,637	3,719
Banks Pumping Plant (cfs)	3,535	4,814	4,785	3,447	4,086	3,238	1,653	1,413	2,378	5,437	4,003	4,800
Sac. R. into Delta (cfs)	11,166	14,380	26,752	41,182	52,154	40,836	27,569	20,901	17,070	17,981	13,582	15,160
Sac. R. at Keswick (cfs)	6,132	5,830	7,376	8,731	10,710	9,015	5,954	8,626	10,006	12,774	9,968	7,281
Sac R. at NCP (cfs)	6,281	7,288	11,635	13,662	15,412	14,235	10,706	7,106	5,847	6,629	5,174	6,915
Feather R. blw Thermalito(cfs)	2,531	1,907	2,908	4,198	4,977	5,490	2,853	3,821	4,123	6,597	4,465	3,967
Lower Feather R. (cfs)	3,082	2,764	5,220	10,747	12,733	12,853	8,847	7,968	6,881	7,164	5,103	5,682
American R. at Nimbus (cfs)	1,379	2,548	3,395	4,497	5,388	3,373	3,238	4,333	3,182	3,240	2,193	1,891
American R. at H. St. (cfs)	1,205	2,387	3,243	4,333	5,187	3,179	2,972	3,947	2,786	2,705	1,815	1,633
SJ R. at Vernalis (cfs)	2,523	2,333	3,089	4,732	6,350	6,636	7,143	5,620	4,497	3,237	2,088	2,323
Shasta Storage (TAF)	2,833	2,853	2,975	3,214	3,456	3,783	4,136	4,123	3,851	3,377	3,058	2,915
Folsom Storage (TAF)	511	486	508	526	535	674	805	860	821	685	602	546
Oroville Storage (TAF)	1,736	1,712	1,816	2,023	2,261	2,494	2,780	2,906	2,767	2,351	2,079	1,860
CVP San Luis Storage (TAF)	204	327	488	652	763	834	826	745	545	306	156	162
SWP San Luis Storage (TAF)	380	466	590	670	759	801	734	616	470	448	372	388
Existing Conditions With Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Delta Outflow (cfs)	6,230	8,664	22,176	42,003	53,940	43,304	30,301	21,042	12,891	8,158	5,117	7,350
Jones Pumping Plant (cfs)	3,210	3,491	3,726	3,743	3,872	2,889	2,598	3,126	3,229	3,707	3,823	3,808
Banks Pumping Plant (cfs)	3,500	4,748	4,741	3,404	4,009	3,270	1,660	1,399	2,316	5,402	4,038	4,778
Sac. R. into Delta (cfs)	11,169	14,360	26,619	41,147	52,034	40,802	27,534	20,883	17,079	18,193	13,794	15,230
Sac. R. at Keswick (cfs)	6,128	5,828	7,268	8,710	10,600	8,991	5,925	8,598	10,044	12,937	10,095	7,337
Sac R. at NCP (cfs)	6,279	7,306	11,597	13,661	15,396	14,219	10,700	7,085	5,892	6,797	5,290	6,962
Feather R. blw Thermalito(cfs)	2,546	1,923	2,924	4,206	4,980	5,477	2,849	3,827	4,072	6,565	4,511	3,969
Lower Feather R. (cfs)	3,096	2,780	5,236	10,755	12,735	12,840	8,843	7,974	6,830	7,131	5,149	5,684
American R. at Nimbus (cfs)	1,370	2,509	3,352	4,471	5,376	3,373	3,235	4,331	3,196	3,313	2,237	1,907
American R. at H. St. (cfs)	1,193	2,351	3,202	4,307	5,176	3,180	2,969	3,946	2,804	2,769	1,842	1,643
SJ R. at Vernalis (cfs)	2,523	2,333	3,089	4,732	6,350	6,636	7,143	5,620	4,501	3,246	2,088	2,323
Shasta Storage (TAF)	2,802	2,822	2,951	3,192	3,441	3,769	4,123	4,112	3,838	3,354	3,028	2,883
Folsom Storage (TAF)	501	479	504	523	533	672	803	859	819	678	593	535
Oroville Storage (TAF)	1,728	1,703	1,806	2,012	2,250	2,484	2,771	2,896	2,760	2,347	2,072	1,852
CVP San Luis Storage (TAF)	197	326	495	661	777	843	832	751	535	283	140	151
SWP San Luis Storage (TAF)	377	458	580	659	747	793	727	609	462	441	368	385
Change from No Action	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Delta Outflow (cfs)	-30	-63	-230	-33	-133	7	-21	-11	-5	-2	-7	4
Jones Pumping Plant (cfs)	68	109	137	41	89	-75	-33	9	79	258	186	89
Banks Pumping Plant (cfs)	-35	-67	-44	-43	-77	32	7	-14	-62	-35	35	-22
Sac. R. into Delta (cfs)	3	-20	-133	-36	-121	-35	-35	-17	8	212	212	69
Sac. R. at Keswick (cfs)	-4	-2	-108	-21	-110	-24	-30	-28	38	163	128	56
Sac R. at NCP (cfs)	-3	18	-38	-1	-17	-16	-6	-21	46	168	116	46
Feather R. blw Thermalito(cfs)	15	16	16	8	2	-13	-4	6	-51	-33	46	2
Lower Feather R. (cfs)	15	16	16	8	2	-13	-4	6	-51	-33	46	2
American R. at Nimbus (cfs)	-10	-39	-44	-26	-12	0	-3	-1	14	73	43	16
American R. at H. St. (cfs)	-11	-36	-41	-26	-11	1	-3	-1	18	64	27	10
SJ R. at Vernalis (cfs)	0	0	0	0	0	0	0	0	4	9	0	0
Shasta Storage (TAF)	-30	-30	-23	-21	-15	-14	-12	-11	-13	-23	-30	-32
Folsom Storage (TAF)	-9	-7	-4	-3	-2	-2	-2	-2	-2	-7	-9	-10
Oroville Storage (TAF)	-8	-8	-10	-11	-10	-10	-9	-10	-7	-5	-8	-8
CVP San Luis Storage (TAF)	-7	-1	7	9	14	9	6	6	-9	-23	-16	-11
SWP San Luis Storage (TAF)	-3	-8	-10	-11	-12	-8	-7	-7	-8	-7	-5	-4

4.1.1 2035 Future With-Project Compared to Forecasted 2035 Future No Action Capacity

This section compares 2035 Future With-Project to 2035 No Action with 2035 DMC capacity. One of the most informative metrics for the effects of the Project is change in exports. Table 8 contains average monthly and annual Jones Pumping Plant export by water year type for 2035 No Action with 2035 DMC capacity, 2035 Future With-Project, and the difference. Comparison of model scenarios show existing Jones Pumping Plant exports have been reduced, due to subsidence, by an average annual of 90 TAF and restoring capacity would increase export by this amount. Reduced capacity has limited Jones Pumping Plant export of stored water during the June through October period and export of Delta excess flows in the November through March period, as can be seen in Table 8.

Table 8. Jones Pumping Plant Export for 2035 No Action with 2035 Capacity and 2035 With Project

2035 No Action - 2035 Capacity Units: TAF

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	201	241	242	233	203	208	197	231	221	198	247	198	2619
AN	143	229	229	234	224	215	194	219	176	88	210	148	2308
BN	212	164	208	228	208	189	156	192	135	175	172	240	2279
D	143	145	181	225	214	167	111	158	106	119	152	209	1931
C	110	75	141	187	202	148	70	124	59	62	90	142	1410
All	170	180	206	224	208	188	151	191	151	143	185	194	2191

2035 With Project

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	205	266	256	248	217	202	190	230	226	210	262	220	2731
AN	141	240	239	243	236	225	188	215	180	98	241	170	2417
BN	206	193	213	235	230	194	147	193	157	193	183	237	2381
D	146	132	175	230	215	169	110	158	139	157	154	216	2000
C	105	75	147	197	206	146	69	124	70	78	90	148	1455
All	170	192	212	234	219	188	147	190	166	163	196	206	2281

2035 With Project -Minus- 2035 No Action - 2035 Capacity

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	4	24	13	15	14	-6	-6	-1	6	12	15	21	111
AN	-2	12	11	9	12	9	-6	-4	5	10	31	22	108
BN	-6	29	6	7	23	4	-10	2	23	18	11	-3	103
D	3	-13	-7	5	1	1	0	0	33	38	2	7	69
C	-4	0	5	10	4	-2	0	0	12	16	0	6	45
All	0	12	6	10	11	0	-5	-1	15	19	11	12	90

Use of the Intertie has decreased impacts of reduced DMC capacity and restoration of DMC capacity would reduce use of the Intertie. Table 9 contains average monthly and annual flow from the DMC to the California Aqueduct through the Intertie by water year type. Comparison of model scenarios show an annual average reduction of 124 TAF in use of the Intertie with restored DMC capacity. This decrease occurs mostly in winter of all year types and in summer of wet year types.

Table 9. DMC to CA Intertie Flow for 2035 No Action with 2035 Capacity and 2035 With Project

2035 No Action - 2035 Capacity Units: TAF

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	16	37	37	31	29	20	10	13	14	8	23	13	252
AN	0	27	34	27	31	24	10	14	9	0	11	0	188
BN	16	14	26	23	27	8	5	2	0	0	2	31	153
D	0	5	20	24	23	1	0	0	0	0	2	18	93
C	0	3	11	14	21	4	0	0	0	0	0	0	52
All	8	20	27	25	27	12	6	6	6	3	10	14	162

2035 With Project

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	4	19	12	13	12	4	1	0	0	0	1	1	67
AN	0	11	15	5	12	6	1	1	0	0	3	0	55
BN	2	6	6	5	11	3	0	0	0	0	0	2	36
D	0	1	2	0	2	0	0	0	0	0	0	3	8
C	0	0	3	0	2	2	0	0	0	0	0	0	7
All	2	9	8	6	8	3	0	0	0	0	1	1	38

2035 With Project -Minus- 2035 No Action - 2035 Capacity

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-12	-19	-24	-18	-18	-16	-10	-13	-14	-8	-22	-12	-186
AN	0	-17	-19	-21	-19	-18	-9	-13	-9	0	-8	0	-133
BN	-14	-8	-20	-18	-16	-5	-5	-2	0	0	-2	-29	-117
D	0	-3	-18	-24	-22	-1	0	0	0	0	-2	-15	-85
C	0	-3	-8	-14	-19	-2	0	0	0	0	0	0	-46
All	-7	-11	-19	-19	-19	-9	-5	-6	-6	-3	-9	-12	-124

Capacity reductions in the lower DMC limit the ability to meet full CVP contract demands for Exchange and Settlement Contractors, water service and repayment contractors, and refuge contractors. This limitation generally occurs during peak of the irrigation season in June, July, and August. The average annual reduction in deliveries from Mendota Pool is approximately 86 TAF, as shown in Table 10.

Restoring DMC capacity to design levels would increase Reclamation's ability to meet CVP contractor demands. Table 11 contains a summary of CVP deliveries to CVP contractors south and north of the Delta. Average annual south-of-Delta deliveries would increase by approximately 92 TAF/year with restored capacity. Restored conveyance capacity would allow Reclamation to distribute water service contract deliveries more evenly to all CVP water service contractors according to the CVP M&I water shortage policy, which would result in an average annual decrease to north-of-Delta CVP contractors by 2 TAF.

Table 10. DMC Flow to Mendota Pool for 2035 No Action with 2035 Capacity and 2035 With Project

2035 No Action - 2035 Capacity Units: TAF

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	59	17	9	4	7	25	40	54	84	112	127	84	622
AN	61	19	10	7	17	35	50	67	116	129	129	85	725
BN	61	19	8	7	23	47	62	92	124	129	129	85	786
D	60	19	10	10	36	53	67	110	124	129	128	83	829
C	52	17	10	10	37	47	59	97	124	129	123	73	777
All	59	18	9	7	22	40	54	81	110	123	127	83	733

2035 With Project

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	59	17	9	4	7	25	40	54	103	148	155	84	704
AN	61	19	10	7	17	35	50	67	143	171	155	85	822
BN	61	19	8	7	23	47	62	92	159	174	154	85	892
D	60	19	10	10	36	53	67	110	157	170	150	83	925
C	52	17	10	10	37	47	59	97	138	150	133	73	822
All	59	18	9	7	22	40	54	81	135	161	150	83	818

2035 With Project -Minus- 2035 No Action - 2035 Capacity

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	0	0	19	36	27	0	82
AN	0	0	0	0	0	0	0	0	27	43	27	0	97
BN	0	0	0	0	0	0	0	0	35	46	26	0	106
D	0	0	0	0	0	0	0	0	32	41	22	0	96
C	0	0	0	0	0	0	0	0	14	21	9	0	45
All	0	0	0	0	0	0	0	0	25	38	23	0	86

Table 11. CVP Delivery Summary for 2035 No Action with 2035 Capacity and 2035 With Project

	North of Delta			South of Delta					North + South
	Ag Service	M&I Service	Total	Ag Service	M&I Service	Exchange	Refuge	Total	Total
Wet	326	243	2273	1468	141	812	278	2699	4972
Abv. Norm	347	247	2276	1041	125	794	277	2237	4512
Blw. Norm	300	237	2282	908	119	785	278	2090	4372
Dry	215	209	2147	546	108	777	272	1703	3849
Critical	43	156	1798	257	92	720	239	1308	3106
All Years	258	222	2178	934	120	784	271	2109	4287

All Values are in 1,000 acre feet

	North of Delta			South of Delta					North + South
	Ag Service	M&I Service	**Total**	Ag Service	M&I Service	Exchange	Refuge	**Total**	**Total**
Wet	0	0	0	18	-1	62	0	80	79
Abv. Norm	0	0	0	50	1	79	0	131	131
Blw. Norm	-2	-1	-3	48	1	89	0	138	134
Dry	-3	0	-3	8	-2	86	0	92	89
Critical	-3	-1	-4	-11	-1	41	0	30	26
All Years	-1	0	-2	21	0	71	0	92	90

All Values are in 1,000 acre feet

Restored DMC capacity would allow the CVP to convey more of its share of Delta excess, as defined under COA. Although analysis performed for COA negotiations assumes the DMC is operating at design capacity, the CVP has been limited in export its negotiated share due to diminished DMC capacity. Restoring DMC capacity would allow the CVP to export more of its share of excess, and therefore reduce the SWP export of unused CVP share. Restored DMC capacity would also allow the CVP to convey more stored water in years with high upstream storage, resulting in less spill in upstream reservoirs that SWP may also divert. Thus, the restored DMC capacity would allow for a greater CVP export of its share under COA, which would result in reduced SWP export of approximately 33 TAF, as shown in Table 12.

Table 12. SWP Delivery Summary for 2035 No Action with 2035 Capacity and 2035 With Project

	Table A	Article 21	Article 56	Total
Wet	2771	279	293	3344
Abv. Norm	2474	76	156	2706
Blw. Norm	2378	48	227	2653
Dry	1354	21	135	1510
Critical	913	13	106	1031
All Years	2080	116	202	2398

All Values are in 1,000 acre feet

	Table A	Article 21	Article 56	Total
Wet	-20	-6	-14	-40
Abv. Norm	-16	-6	-22	-43
Blw. Norm	-17	-5	1	-20
Dry	-26	0	4	-22
Critical	-42	5	-5	-42
All Years	-23	-3	-7	-33

All Values are in 1,000 acre feet

Because Jones Pumping Plant is operated as an integral component of the CVP, changes in pumping at Jones Pumping Plant due to restoration of DMC capacity would affect operations of a majority of CVP and SWP facilities. Table 13 contains average monthly values for flow and storage at key locations in the CVP and SWP system for 2035 No Action with 2035 DMC capacity, 2035 Future With-Project, and the difference between these model scenarios. Although the maximum average monthly change in Delta outflow is approximately 2.3 percent, the average annual change is approximately 0.3 percent.

Table 13. Summary of Average Monthly System Effects

(2035 with Project compared to 2035 with 2035 capacity)

2035 NAA - 2035 Capacity	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Delta Outflow (cfs)	6,127	9,371	26,231	50,646	62,396	49,888	31,643	16,926	9,095	8,125	4,814	6,859
Jones Pumping Plant (cfs)	2,764	3,030	3,352	3,638	3,721	3,052	2,545	3,099	2,531	2,331	3,008	3,260
Banks Pumping Plant (cfs)	3,039	4,318	4,291	3,644	4,254	3,376	1,702	1,322	2,390	4,616	3,759	4,285
Sac. R. into Delta (cfs)	10,266	14,168	29,300	48,239	58,493	46,068	28,278	16,436	13,649	17,295	12,772	13,793
Sac. R. at Keswick (cfs)	5,668	5,538	7,759	9,959	11,635	9,787	6,344	8,710	10,204	13,130	9,280	6,344
Sac R. at NCP (cfs)	5,683	7,112	12,023	14,310	15,797	14,606	10,456	6,360	5,606	6,984	4,520	6,028
Feather R. blw Thermalito(cfs)	2,360	1,922	2,811	5,246	6,587	7,329	2,915	2,812	3,888	6,432	4,786	3,623
Lower Feather R. (cfs)	2,863	2,750	5,790	13,230	15,610	15,760	9,046	5,908	5,180	6,571	5,401	5,336
American R. at Nimbus (cfs)	1,313	2,539	4,137	6,256	6,869	4,405	3,826	3,007	1,793	2,768	1,752	1,754
American R. at H. St. (cfs)	1,142	2,384	3,984	6,078	6,646	4,191	3,536	2,712	1,519	2,293	1,451	1,505
SJ R. at Vernalis (cfs)	2,484	2,311	3,448	5,927	7,870	7,719	7,535	6,075	3,905	2,171	1,776	2,267
Shasta Storage (TAF)	2,719	2,767	2,934	3,201	3,457	3,796	4,121	4,029	3,699	3,177	2,900	2,801
Folsom Storage (TAF)	465	448	490	517	535	693	804	822	750	603	542	494
Oroville Storage (TAF)	1,615	1,609	1,800	2,081	2,358	2,575	2,825	2,861	2,646	2,220	1,925	1,730
CVP San Luis Storage (TAF)	175	283	434	602	725	813	816	767	572	314	162	150
SWP San Luis Storage (TAF)	345	417	520	633	749	803	743	630	499	440	363	366
2035 With Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Delta Outflow (cfs)	6,197	9,151	25,937	50,352	62,245	49,900	31,651	16,924	9,087	8,178	4,832	6,863
Jones Pumping Plant (cfs)	2,761	3,228	3,451	3,798	3,917	3,053	2,464	3,090	2,790	2,643	3,186	3,455
Banks Pumping Plant (cfs)	2,923	4,268	4,179	3,583	4,134	3,353	1,753	1,329	2,236	4,654	3,776	4,258
Sac. R. into Delta (cfs)	10,218	14,094	28,993	48,046	58,420	46,058	28,264	16,433	13,736	17,680	12,981	13,963
Sac. R. at Keswick (cfs)	5,652	5,488	7,515	9,812	11,574	9,718	6,310	8,710	10,365	13,406	9,406	6,493
Sac R. at NCP (cfs)	5,666	7,103	11,926	14,217	15,792	14,566	10,441	6,363	5,769	7,255	4,625	6,172
Feather R. blw Thermalito(cfs)	2,333	1,934	2,799	5,226	6,595	7,385	2,917	2,810	3,758	6,477	4,844	3,644
Lower Feather R. (cfs)	2,835	2,762	5,778	13,210	15,618	15,816	9,048	5,906	5,049	6,616	5,462	5,359
American R. at Nimbus (cfs)	1,310	2,495	4,080	6,223	6,850	4,408	3,841	3,002	1,850	2,834	1,783	1,751
American R. at H. St. (cfs)	1,139	2,343	3,928	6,046	6,628	4,194	3,552	2,707	1,572	2,359	1,473	1,504
SJ R. at Vernalis (cfs)	2,484	2,311	3,448	5,927	7,870	7,719	7,535	6,076	3,916	2,188	1,781	2,267
Shasta Storage (TAF)	2,675	2,726	2,908	3,184	3,443	3,787	4,113	4,022	3,682	3,145	2,861	2,754
Folsom Storage (TAF)	455	441	487	516	535	692	803	821	746	595	532	484
Oroville Storage (TAF)	1,617	1,610	1,802	2,084	2,360	2,574	2,824	2,861	2,653	2,224	1,925	1,730
CVP San Luis Storage (TAF)	152	271	428	606	739	827	824	772	565	288	128	127
SWP San Luis Storage (TAF)	338	408	508	618	731	785	731	620	483	430	358	363
Change from No Action	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Delta Outflow (cfs)	70	-220	-293	-293	-151	13	8	-2	-9	53	18	4
Jones Pumping Plant (cfs)	-2	198	99	160	196	0	-81	-9	260	312	178	195
Banks Pumping Plant (cfs)	-116	-50	-111	-61	-120	-23	50	7	-154	38	17	-27
Sac. R. into Delta (cfs)	-48	-74	-307	-192	-73	-10	-13	-4	87	386	208	170
Sac. R. at Keswick (cfs)	-16	-50	-244	-147	-61	-69	-34	1	161	276	127	149
Sac R. at NCP (cfs)	-17	-9	-98	-93	-6	-40	-15	3	163	271	105	144
Feather R. blw Thermalito(cfs)	-27	12	-12	-20	7	56	2	-1	-130	45	58	21
Lower Feather R. (cfs)	-28	12	-12	-20	7	56	2	-2	-131	45	61	24
American R. at Nimbus (cfs)	-3	-44	-57	-33	-19	4	15	-5	58	66	30	-3
American R. at H. St. (cfs)	-3	-41	-57	-33	-18	4	15	-5	53	66	22	0
SJ R. at Vernalis (cfs)	0	0	0	0	0	0	0	0	11	17	5	0
Shasta Storage (TAF)	-44	-41	-26	-17	-13	-9	-8	-7	-17	-32	-39	-48
Folsom Storage (TAF)	-10	-7	-3	-1	0	-1	-1	-1	-4	-8	-10	-10
Oroville Storage (TAF)	2	1	2	3	3	-1	-1	-1	7	4	0	0
CVP San Luis Storage (TAF)	-23	-12	-6	4	14	13	8	5	-7	-26	-34	-23
SWP San Luis Storage (TAF)	-8	-9	-12	-14	-18	-18	-12	-10	-16	-10	-4	-3

4.1.2 2035 Future With-Project Compared to Forecasted 2070 Future No Action Capacity

This section compares 2035 Future With-Project to 2035 No Action with 2070 DMC capacity. One of the most informative metrics for the effects of the Correction Project is a change in Jones Pumping Plant exports from the Delta. Table 14 contains average monthly and annual Jones Pumping Plant export by water year type for 2035 No Action with 2070 DMC capacity, 2035 Future With-Project, and the difference. Comparison of model scenarios show existing Jones Pumping Plant export has been reduced, due to subsidence, by an average annual of 122 TAF and restoring capacity would increase export by this amount. Reduced capacity has limited Jones Pumping Plant export of stored water during the June through October period and export of Delta excess flows in the November through March period, as can be seen in Table 14.

Table 14. Jones Pumping Plant Export for 2035 No Action with 2070 Capacity and 2035 With Project

2035 No Action - 2070 Capacity Units: TAF

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	201	239	239	225	205	204	200	231	218	193	240	192	2586
AN	154	224	228	233	210	207	176	210	166	98	201	151	2257
BN	207	169	202	223	206	189	162	193	125	179	170	237	2262
D	142	148	181	223	212	171	110	158	93	113	152	204	1909
C	109	89	126	193	198	135	70	124	57	60	87	146	1392
All	169	183	202	221	206	184	151	189	144	140	181	189	2159

2035 With Project

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	207	268	255	249	223	204	193	231	227	213	261	220	2752
AN	135	240	241	243	219	216	170	209	183	112	239	180	2387
BN	217	187	211	234	231	193	153	195	155	192	183	237	2388
D	146	132	175	230	215	169	110	158	139	157	154	216	2000
C	105	75	147	197	206	146	69	124	70	78	90	148	1455
All	170	192	212	234	219	188	147	190	166	163	196	206	2281

2035 With Project -Minus- 2035 No Action - 2070 Capacity

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	5	30	17	24	18	0	-7	1	10	19	21	28	166
AN	-19	15	14	10	9	9	-6	-1	16	14	39	29	130
BN	10	18	9	10	26	4	-9	3	30	12	13	0	126
D	4	-16	-7	6	3	-2	0	0	45	44	1	12	91
C	-4	-14	21	5	8	11	0	0	14	18	3	2	63
All	1	9	11	13	13	3	-5	1	22	23	15	16	122

Table 15 contains average monthly and annual flow from the DMC to the California Aqueduct through the Intertie by water year type. Comparison of model scenarios show an annual average reduction of 133 TAF in use of the Intertie with restored DMC capacity. This decrease occurs mostly in winter of all year types and in summer of wet year types.

Table 15. DMC to CA Intertie Flow for 2035 No Action with 2070 Capacity and 2035 With Project

2035 No Action - 2070 Capacity Units: TAF

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	17	40	37	31	30	22	12	17	16	9	25	14	270
AN	4	28	36	31	30	21	10	10	9	0	7	3	188
BN	15	15	27	22	30	9	6	2	0	0	2	32	161
D	0	5	20	27	26	3	0	0	0	0	2	19	103
C	0	3	7	17	25	5	0	0	0	0	0	1	58
All	8	21	27	26	28	13	6	7	7	3	10	15	171

2035 With Project

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	4	19	13	13	12	4	1	0	0	0	1	1	69
AN	0	11	12	5	10	5	1	1	0	0	3	0	48
BN	3	5	7	6	12	3	0	0	0	0	0	2	37
D	0	1	2	0	2	0	0	0	0	0	0	3	8
C	0	0	3	0	2	2	0	0	0	0	0	0	7
All	2	9	8	6	8	3	0	0	0	0	1	1	38

2035 With Project -Minus- 2035 No Action - 2070 Capacity

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-13	-21	-24	-17	-18	-17	-11	-17	-16	-9	-23	-12	-200
AN	-4	-17	-23	-26	-19	-16	-9	-9	-9	0	-4	-3	-140
BN	-13	-10	-20	-17	-18	-6	-6	-2	0	0	-1	-30	-124
D	0	-3	-19	-26	-25	-3	0	0	0	0	-2	-16	-95
C	0	-3	-4	-17	-23	-3	0	0	0	0	0	-1	-51
All	-7	-12	-19	-21	-20	-10	-6	-7	-6	-3	-9	-13	-133

The average annual reduction in existing deliveries from Mendota Pool is approximately 125 TAF, as shown in Table 16. Restoring capacity would increase deliveries by this amount.

Table 17 contains a summary of CVP deliveries to CVP contractors south and north of the Delta. Average annual south-of-Delta deliveries would increase by approximately 124 TAF/year with restored capacity. Restored conveyance capacity would allow Reclamation to distribute contract deliveries more evenly to all CVP water service contractors according to the CVP M&I water shortage policy, which would result in an average annual decrease to north-of-Delta CVP contractors by 3 TAF.

Table 16. DMC Flow to Mendota Pool for 2035 No Action with 2070 Capacity and 2035 With Project

2035 No Action - 2070 Capacity Units: TAF

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	59	17	9	4	8	24	38	51	75	99	113	84	581
AN	61	19	10	6	17	38	53	75	106	114	114	85	699
BN	61	19	8	7	22	47	62	90	110	114	114	85	739
D	60	19	10	10	36	53	67	110	110	114	114	83	787
C	52	17	10	10	37	47	59	97	110	114	114	73	740
All	59	18	9	7	22	40	54	81	99	109	114	83	694

2035 With Project

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	59	17	9	4	8	24	38	51	100	147	155	84	696
AN	61	19	10	6	17	38	53	75	146	172	155	85	839
BN	61	19	8	7	22	47	62	90	159	174	153	85	888
D	59	19	10	10	36	53	67	110	157	170	150	83	925
C	52	17	10	10	37	47	59	97	138	150	133	73	822
All	59	18	9	7	22	40	54	81	135	161	150	83	818

2035 With Project -Minus- 2035 No Action - 2070 Capacity

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	0	0	25	47	41	0	114
AN	0	0	0	0	0	0	0	0	40	58	41	0	140
BN	0	0	0	0	0	0	0	0	49	60	40	0	149
D	0	0	0	0	0	0	0	0	46	56	36	0	138
C	0	0	0	0	0	0	0	0	28	36	19	0	82
All	0	0	0	0	0	0	0	0	36	51	37	0	125

Table 17. CVP Delivery Summary for 2035 No Action with 2070 Capacity and 2035 With Project

	North of Delta			South of Delta					North + South
	Ag Service	M&I Service	Total	Ag Service	M&I Service	Exchange	Refuge	Total	Total
Wet	326	243	2273	1457	140	779	278	2654	4927
Abv. Norm	348	247	2276	1044	125	753	277	2199	4475
Blw. Norm	302	237	2284	921	119	742	278	2059	4344
Dry	217	210	2148	573	109	734	272	1688	3836
Critical	44	156	1799	265	93	683	239	1280	3079
All Years	259	222	2178	940	121	745	271	2077	4255

All Values are in 1,000 acre feet

	North of Delta			South of Delta					North + South
	Ag Service	M&I Service	**Total**	Ag Service	M&I Service	Exchange	Refuge	**Total**	**Total**
Wet	0	0	0	30	0	95	0	125	125
Abv. Norm	-1	0	0	47	1	120	0	168	168
Blw. Norm	-4	-1	-5	35	1	132	0	168	163
Dry	-4	0	-4	-19	-2	129	0	107	103
Critical	-4	-1	-5	-19	-2	78	0	57	53
All Years	-2	-1	-3	15	-1	110	0	124	122

All Values are in 1,000 acre feet

Restored DMC capacity would allow the CVP to convey more of its share of Delta excess, as defined under the COA. Although analysis performed for COA negotiations assume the DMC is operating at design capacity, the CVP has been limited in export of its negotiated share due to diminished DMC capacity. Restoring DMC capacity would allow the CVP to export more of its share of excess, and therefore would reduce the SWP export of unused CVP share. Restored DMC capacity would also allow the CVP to convey more stored water in years with high upstream storage, which would result in less spill in upstream reservoirs that SWP may also divert. Thus, the restored DMC capacity would allow for a greater CVP export of its share under COA resulting in reduced SWP export of approximately 45 TAF, as shown in Table 18.

Table 18. SWP Delivery Summary for 2035 No Action with 2070 Capacity and 2035 With Project

	Table A	Article 21	Article 56	Total
Wet	2777	291	290	3357
Abv. Norm	2486	79	153	2718
Blw. Norm	2385	48	229	2662
Dry	1361	21	137	1519
Critical	914	17	116	1047
All Years	2086	121	203	2411

All Values are in 1,000 acre feet

	Table A	Article 21	Article 56	Total
Wet	-26	-17	-11	-54
Abv. Norm	-28	-9	-18	-55
Blw. Norm	-24	-4	-1	-29
Dry	-33	0	2	-32
Critical	-43	0	-15	-58
All Years	-30	-8	-8	-45

All Values are in 1,000 acre feet

Table 19 contains average monthly values for flow and storage at key locations in the CVP and SWP system for 2035 No Action with 2070 DMC capacity, 2035 Future With Project, and the difference between these model scenarios. Although the maximum average monthly change in Delta outflow is approximately 1.6 percent, the average annual change is approximately 0.37 percent.

Table 19. Summary of Average Monthly System Effects

(2035 with Project compared to 2035 with 2070 capacity)

2035 NAA - 2070 Capacity	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Delta Outflow (cfs)	6,198	9,182	26,351	50,639	62,548	49,929	31,659	16,941	9,102	8,114	4,841	6,858
Jones Pumping Plant (cfs)	2,745	3,073	3,280	3,590	3,683	3,000	2,541	3,081	2,412	2,273	2,938	3,185
Banks Pumping Plant (cfs)	3,053	4,448	4,268	3,695	4,277	3,410	1,702	1,321	2,505	4,588	3,739	4,205
Sac. R. into Delta (cfs)	10,332	14,151	29,327	48,234	58,631	46,090	28,279	16,430	13,664	17,211	12,726	13,636
Sac. R. at Keswick (cfs)	5,702	5,520	7,769	9,945	11,756	9,834	6,347	8,706	10,115	13,094	9,248	6,283
Sac R. at NCP (cfs)	5,719	7,082	12,019	14,267	15,837	14,622	10,454	6,355	5,515	6,952	4,490	5,969
Feather R. blw Thermalito(cfs)	2,386	1,928	2,812	5,250	6,602	7,308	2,919	2,810	4,024	6,388	4,766	3,526
Lower Feather R. (cfs)	2,889	2,757	5,791	13,234	15,625	15,739	9,050	5,905	5,317	6,526	5,378	5,241
American R. at Nimbus (cfs)	1,317	2,537	4,152	6,262	6,872	4,405	3,822	3,007	1,766	2,761	1,761	1,753
American R. at H. St. (cfs)	1,147	2,382	4,000	6,084	6,650	4,191	3,532	2,712	1,492	2,291	1,460	1,504
SJ R. at Vernalis (cfs)	2,484	2,311	3,448	5,927	7,870	7,719	7,535	6,075	3,894	2,159	1,762	2,267
Shasta Storage (TAF)	2,734	2,781	2,948	3,216	3,465	3,802	4,126	4,035	3,711	3,189	2,914	2,818
Folsom Storage (TAF)	466	449	491	518	535	693	805	822	752	606	544	496
Oroville Storage (TAF)	1,618	1,611	1,803	2,083	2,359	2,577	2,827	2,864	2,640	2,216	1,923	1,734
CVP San Luis Storage (TAF)	186	295	442	607	726	812	815	765	575	324	179	162
SWP San Luis Storage (TAF)	343	421	523	639	756	807	746	632	504	442	363	361
2035 With Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Delta Outflow (cfs)	6,197	9,151	25,937	50,352	62,245	49,900	31,651	16,924	9,087	8,178	4,832	6,863
Jones Pumping Plant (cfs)	2,761	3,228	3,451	3,798	3,917	3,053	2,464	3,090	2,790	2,643	3,186	3,455
Banks Pumping Plant (cfs)	2,923	4,268	4,179	3,583	4,134	3,353	1,753	1,329	2,236	4,654	3,776	4,258
Sac. R. into Delta (cfs)	10,218	14,094	28,993	48,046	58,420	46,058	28,264	16,433	13,736	17,680	12,981	13,963
Sac. R. at Keswick (cfs)	5,652	5,488	7,515	9,812	11,574	9,718	6,310	8,710	10,365	13,406	9,406	6,493
Sac R. at NCP (cfs)	5,666	7,103	11,926	14,217	15,792	14,566	10,441	6,363	5,769	7,255	4,625	6,172
Feather R. blw Thermalito(cfs)	2,333	1,934	2,799	5,226	6,595	7,385	2,917	2,810	3,758	6,477	4,844	3,644
Lower Feather R. (cfs)	2,835	2,762	5,778	13,210	15,618	15,816	9,048	5,906	5,049	6,616	5,462	5,359
American R. at Nimbus (cfs)	1,310	2,495	4,080	6,223	6,850	4,408	3,841	3,002	1,850	2,834	1,783	1,751
American R. at H. St. (cfs)	1,139	2,343	3,928	6,046	6,628	4,194	3,552	2,707	1,572	2,359	1,473	1,504
SJ R. at Vernalis (cfs)	2,484	2,311	3,448	5,927	7,870	7,719	7,535	6,076	3,916	2,188	1,781	2,267
Shasta Storage (TAF)	2,675	2,726	2,908	3,184	3,443	3,787	4,113	4,022	3,682	3,145	2,861	2,754
Folsom Storage (TAF)	455	441	487	516	535	692	803	821	746	595	532	484
Oroville Storage (TAF)	1,617	1,610	1,802	2,084	2,360	2,574	2,824	2,861	2,653	2,224	1,925	1,730
CVP San Luis Storage (TAF)	152	271	428	606	739	827	824	772	565	288	128	127
SWP San Luis Storage (TAF)	338	408	508	618	731	785	731	620	483	430	358	363
Change from No Action	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Delta Outflow (cfs)	-1	-31	-414	-287	-303	-29	-8	-17	-15	65	-10	5
Jones Pumping Plant (cfs)	17	155	171	208	234	52	-77	9	378	370	247	271
Banks Pumping Plant (cfs)	-130	-179	-89	-112	-143	-57	51	7	-269	66	36	54
Sac. R. into Delta (cfs)	-114	-56	-334	-187	-211	-32	-14	2	72	469	255	327
Sac. R. at Keswick (cfs)	-50	-32	-254	-133	-182	-116	-37	4	251	312	159	210
Sac R. at NCP (cfs)	-53	22	-93	-51	-46	-56	-14	7	254	303	135	203
Feather R. blw Thermalito(cfs)	-53	5	-13	-24	-8	78	-1	0	-266	89	78	118
Lower Feather R. (cfs)	-54	5	-13	-24	-8	77	-2	0	-268	90	83	119
American R. at Nimbus (cfs)	-7	-42	-72	-39	-22	3	19	-5	84	73	21	-2
American R. at H. St. (cfs)	-7	-39	-72	-38	-22	4	19	-5	80	68	13	1
SJ R. at Vernalis (cfs)	0	0	0	0	0	0	0	0	22	30	19	0
Shasta Storage (TAF)	-59	-55	-40	-32	-22	-15	-14	-13	-29	-45	-53	-65
Folsom Storage (TAF)	-11	-8	-4	-2	0	-1	-2	-1	-6	-11	-12	-11
Oroville Storage (TAF)	-1	-1	0	1	2	-3	-3	-3	13	8	2	-4
CVP San Luis Storage (TAF)	-33	-24	-14	-1	12	15	9	7	-10	-36	-52	-35
SWP San Luis Storage (TAF)	-5	-13	-15	-21	-25	-22	-15	-12	-21	-12	-4	2

4.1.3 2070 Future With-Project Compared to Forecasted 2070 Future No Action Capacity

This section compares 2070 Future With-Project to 2070 No Action with 2070 DMC capacity. The more extreme changes in the 2070 WSIP hydrology relative to historically based hydrology results in CalSim II simulations of the CVP and SWP that are not fully consistent with Reclamation and DWR operating policy; however, use of this hydrology for analysis provides insight into how the effects of the DMC capacity may change under more extreme conditions. Therefore, a comparison of model output using the 2070 WSIP hydrology is considered to be a sensitivity analysis that may provide generalized information rather than more specific project effects.

Table 20 contains average monthly and annual Jones Pumping Plant export by water year type for 2070 No Action with 2070 DMC capacity, 2070 Future With Project, and the difference. Comparison of model scenarios show existing Jones Pumping Plant export has been reduced, due to subsidence, by an average annual of 103 TAF and restoring capacity would increase export by this amount. Reduced capacity using the 2070 WSIP hydrology has limited Jones Pumping Plant export of stored water during the June through October period, similar to evaluation using 2035 hydrology. Pumping of Delta excess flows in the November through March period is less than when using 2035 climate change hydrology as can be seen in Table 20.

Table 20. Jones Pumping Plant Export for 2070 No Action with 2070 Capacity and 2070 With Project

2070 No Action - 2070 Capacity Units: TAF

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	168	205	226	241	221	220	190	224	160	112	211	200	2377
AN	141	187	195	221	221	218	182	198	134	81	171	185	2132
BN	135	187	178	203	198	195	177	159	120	122	186	218	2078
D	164	159	166	201	204	165	145	152	113	150	144	199	1963
C	159	105	133	180	181	121	80	119	61	62	102	148	1452
All	157	174	186	214	207	188	160	177	124	111	169	193	2060

2070 With Project

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	172	219	232	264	239	203	174	227	179	123	254	216	2501
AN	141	188	186	234	246	225	181	196	162	85	244	194	2283
BN	127	204	185	207	206	202	170	156	155	126	217	220	2175
D	162	167	170	204	207	153	149	149	154	178	154	208	2056
C	164	107	134	167	185	119	80	117	76	80	102	159	1490
All	157	183	189	222	219	181	154	177	152	125	200	203	2164

2070 With Project -Minus- 2070 No Action - 2070 Capacity

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	4	14	5	23	19	-17	-16	3	20	11	43	15	124
AN	0	1	-9	13	26	8	-1	-1	28	4	73	9	151
BN	-8	17	7	4	8	6	-7	-2	35	4	30	2	96
D	-2	8	4	3	3	-12	4	-2	41	28	10	10	93
C	5	2	0	-13	4	-2	0	-2	16	17	0	11	38
All	0	10	3	8	12	-7	-5	0	28	14	31	10	103

Table 21 contains average monthly and annual flow from the DMC to the California Aqueduct through the Intertie by water year type. Comparison of model scenarios show an annual average reduction of 106 TAF in use of the Intertie with restored DMC capacity. This decrease occurs mostly in winter of all year types and in summer of wet year types.

Table 21. DMC to CA Intertie Flow for 2070 No Action with 2070 Capacity and 2070 With Project

2070 No Action - 2070 Capacity — Units: TAF

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	4	25	34	37	37	26	12	13	5	2	11	10	215
AN	0	23	24	25	34	25	12	3	0	0	9	0	153
BN	1	18	20	16	23	13	12	0	0	0	7	17	127
D	6	10	17	21	25	6	3	2	0	0	0	11	100
C	7	1	6	17	15	1	0	0	0	0	4	0	51
All	4	16	22	25	28	15	8	5	2	1	6	8	141

2070 With Project

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	1	9	11	16	15	5	0	0	0	0	2	1	60
AN	0	5	6	6	16	9	2	0	0	0	2	0	46
BN	0	7	5	2	5	3	2	0	0	0	3	2	29
D	1	3	5	1	4	0	1	0	0	0	0	2	17
C	4	0	0	1	0	0	0	0	0	0	0	0	5
All	1	6	6	7	9	3	1	0	0	0	1	1	35

2070 With Project -Minus- 2070 No Action - 2070 Capacity

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-2	-16	-23	-21	-22	-21	-12	-13	-5	-2	-9	-9	-155
AN	0	-17	-18	-19	-18	-16	-10	-3	0	0	-7	0	-107
BN	-1	-11	-14	-15	-19	-10	-10	0	0	0	-4	-15	-98
D	-5	-6	-12	-19	-21	-6	-2	-2	0	0	0	-9	-83
C	-3	-1	-6	-16	-15	-1	0	0	0	0	-3	0	-45
All	-3	-11	-16	-18	-20	-12	-7	-5	-2	-1	-5	-7	-106

Capacity reductions in the lower DMC limit the ability to meet full CVP contract demands for exchange, settlement, water service, and repayment contractors that divert water from Mendota Pool. This limitation generally occurs during the peak of irrigation season in June, July, and August. The average annual reduction in deliveries from Mendota Pool is approximately 127 TAF, as shown in Table 22.

Average annual south-of-Delta deliveries would increase by approximately 106 TAF/year with restored capacity, this is about 18 TAF/year less than delivery increases estimated using 2035 climate hydrology. Restored conveyance capacity would allow Reclamation to distribute contract deliveries more evenly to all CVP water service contractors according to the CVP M&I water shortage policy, which would result in an average annual decrease to north-of-Delta CVP contractors by 6 TAF.

Table 22. DMC Flow to Mendota Pool for 2070 No Action with 2070 Capacity and 2070 With Project

2070 No Action - 2070 Capacity Units: TAF

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	56	17	8	3	8	20	33	40	81	101	113	79	559
AN	61	19	11	8	14	20	36	70	110	114	114	85	662
BN	61	18	8	8	31	46	41	90	110	114	114	78	719
D	60	19	10	9	29	51	52	108	110	114	114	84	760
C	53	17	10	10	37	48	60	98	110	114	114	74	746
All	58	18	9	7	21	36	43	77	101	110	114	80	675

2070 With Project

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	56	17	8	3	8	20	33	40	107	148	154	79	673
AN	61	19	11	8	14	20	36	70	160	173	155	85	811
BN	60	18	8	8	31	46	41	90	158	171	153	78	862
D	60	19	10	9	29	51	52	108	159	172	153	84	906
C	53	17	10	10	37	48	60	98	140	152	134	74	833
All	58	18	9	7	21	36	43	77	140	162	151	80	802

2070 With Project -Minus- 2070 No Action - 2070 Capacity

Indx	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	0	0	26	47	41	0	114
AN	0	0	0	0	0	0	0	0	50	59	41	0	149
BN	0	0	0	0	0	0	0	0	47	57	39	0	143
D	0	0	0	0	0	0	0	0	49	58	39	0	145
C	0	0	0	0	0	0	0	0	30	38	20	0	87
All	0	0	0	0	0	0	0	0	39	52	37	0	127

Restored DMC capacity would allow the CVP to convey more of its share of Delta excess, as defined under COA. Although analysis performed for COA negotiations assume the DMC is operating at design capacity, the CVP has been limited in export of its negotiated share due to diminished DMC capacity. Restoring DMC capacity would allow the CVP to export more of its share of excess, and therefore would reduce the SWP export of unused CVP share. Restored DMC capacity would also allow the CVP to convey more stored water in years with high upstream storage, this results in less spill in upstream reservoirs that SWP may also divert. Thus, the restored DMC capacity would allow for a greater CVP export of its share under COA, resulting in reduced SWP export of approximately 35 TAF.

Because Jones Pumping Plant is operated as an integral component of the CVP, changes in pumping at Jones Pumping Plant due to restoration of DMC capacity would affect operations of a majority of CVP and SWP facilities. Table 23 contains average monthly values for flow and storage at key locations in the CVP and SWP system for 2070 No Action with 2070 DMC capacity, 2070 Future With-Project, and the difference between these model scenarios. Although the maximum average monthly change in Delta outflow is approximately 2.7 percent, the average annual change is approximately 0.25 percent.

Table 23. Summary of Average Monthly System Effects

(2070 with Project compared to 2070 with 2070 capacity)

2070 NAA - 2070 Capacity	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Delta Outflow (cfs)	7,290	7,723	27,513	57,004	71,588	53,225	28,990	13,774	8,586	8,979	5,389	7,208
Jones Pumping Plant (cfs)	2,553	2,921	3,025	3,473	3,699	3,056	2,684	2,880	2,088	1,810	2,756	3,244
Banks Pumping Plant (cfs)	2,001	3,882	3,872	3,830	4,742	3,580	1,712	1,167	2,614	4,041	2,856	3,659
Sac. R. into Delta (cfs)	10,495	12,331	28,905	53,436	66,136	47,980	25,561	13,514	14,449	17,490	12,333	13,655
Sac. R. at Keswick (cfs)	6,197	4,921	6,467	10,336	12,267	9,923	6,585	8,966	11,077	13,951	9,390	6,784
Sac R. at NCP (cfs)	6,127	6,345	11,735	14,467	15,933	14,830	10,652	6,330	6,583	7,996	4,769	6,542
Feather R. blw Thermalito(cfs)	2,211	1,651	3,105	6,830	9,622	8,276	2,244	2,239	4,043	5,874	3,983	3,098
Lower Feather R. (cfs)	2,656	2,373	6,000	15,747	19,539	16,803	7,118	4,155	5,000	6,110	4,796	4,837
American R. at Nimbus (cfs)	1,295	1,977	3,872	7,255	8,769	4,943	3,166	1,814	1,784	2,370	1,624	1,587
American R. at H. St. (cfs)	1,127	1,840	3,736	7,083	8,543	4,715	2,916	1,583	1,521	1,959	1,354	1,367
SJ R. at Vernalis (cfs)	2,418	2,223	4,229	6,793	9,648	9,319	8,034	6,050	2,767	1,720	1,554	2,057
Shasta Storage (TAF)	2,333	2,406	2,704	3,069	3,383	3,714	3,927	3,748	3,354	2,805	2,528	2,420
Folsom Storage (TAF)	368	364	415	470	499	658	749	725	628	500	439	398
Oroville Storage (TAF)	1,494	1,531	1,795	2,120	2,414	2,622	2,787	2,712	2,411	1,981	1,716	1,560
CVP San Luis Storage (TAF)	134	236	368	528	651	752	785	739	539	274	128	120
SWP San Luis Storage (TAF)	221	278	367	519	681	755	696	583	478	406	293	276
2070 With Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Delta Outflow (cfs)	7,263	7,516	27,600	56,721	71,385	53,124	28,969	13,738	8,587	9,037	5,372	7,220
Jones Pumping Plant (cfs)	2,557	3,082	3,067	3,611	3,911	2,947	2,594	2,875	2,553	2,037	3,257	3,419
Banks Pumping Plant (cfs)	2,014	3,895	3,642	3,657	4,552	3,642	1,750	1,179	2,280	3,993	3,076	3,566
Sac. R. into Delta (cfs)	10,486	12,298	28,803	53,116	65,952	47,835	25,543	13,487	14,561	17,697	13,019	13,749
Sac. R. at Keswick (cfs)	6,155	4,843	6,339	10,107	11,989	9,773	6,537	8,956	11,435	14,164	9,782	6,963
Sac R. at NCP (cfs)	6,100	6,318	11,723	14,455	15,925	14,737	10,634	6,331	6,953	8,207	5,164	6,709
Feather R. blw Thermalito(cfs)	2,237	1,667	3,162	6,774	9,715	8,253	2,245	2,220	3,705	5,895	4,238	3,029
Lower Feather R. (cfs)	2,683	2,388	6,058	15,690	19,632	16,779	7,118	4,136	4,663	6,134	5,070	4,763
American R. at Nimbus (cfs)	1,297	1,994	3,829	7,219	8,763	4,969	3,188	1,806	1,862	2,340	1,618	1,587
American R. at H. St. (cfs)	1,129	1,857	3,693	7,049	8,538	4,741	2,938	1,575	1,590	1,933	1,348	1,368
SJ R. at Vernalis (cfs)	2,418	2,223	4,229	6,793	9,648	9,319	8,034	6,050	2,791	1,749	1,573	2,057
Shasta Storage (TAF)	2,241	2,317	2,623	3,003	3,332	3,671	3,885	3,707	3,295	2,737	2,442	2,324
Folsom Storage (TAF)	363	357	411	469	498	655	745	721	620	494	434	393
Oroville Storage (TAF)	1,500	1,538	1,799	2,126	2,415	2,624	2,790	2,716	2,435	2,002	1,723	1,570
CVP San Luis Storage (TAF)	114	226	361	530	666	760	788	742	532	235	93	97
SWP San Luis Storage (TAF)	219	277	353	500	659	739	683	573	454	385	293	271
Change from No Action	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Delta Outflow (cfs)	-27	-206	87	-283	-202	-101	-21	-35	1	58	-17	12
Jones Pumping Plant (cfs)	4	161	43	138	212	-109	-90	-6	465	227	501	175
Banks Pumping Plant (cfs)	14	13	-229	-173	-190	62	38	11	-334	-48	220	-93
Sac. R. into Delta (cfs)	-9	-34	-102	-321	-184	-145	-18	-27	112	207	686	93
Sac. R. at Keswick (cfs)	-42	-78	-128	-229	-278	-150	-48	-10	358	213	392	180
Sac R. at NCP (cfs)	-27	-27	-12	-12	-8	-93	-18	0	370	211	395	167
Feather R. blw Thermalito(cfs)	26	17	57	-56	93	-23	1	-19	-338	22	255	-69
Lower Feather R. (cfs)	27	15	58	-57	93	-24	1	-19	-337	24	274	-74
American R. at Nimbus (cfs)	2	17	-43	-35	-6	26	22	-8	78	-30	-7	0
American R. at H. St. (cfs)	2	17	-42	-35	-6	26	22	-8	69	-26	-6	0
SJ R. at Vernalis (cfs)	0	0	0	0	0	0	0	0	24	30	18	0
Shasta Storage (TAF)	-92	-89	-81	-66	-51	-43	-41	-40	-59	-68	-86	-96
Folsom Storage (TAF)	-5	-6	-4	-1	-1	-3	-4	-3	-8	-6	-5	-5
Oroville Storage (TAF)	6	7	4	7	1	3	3	4	24	21	7	10
CVP San Luis Storage (TAF)	-20	-10	-7	2	15	8	3	3	-8	-39	-35	-23
SWP San Luis Storage (TAF)	-2	-1	-14	-19	-22	-17	-13	-10	-25	-21	-1	-5

Chapter 5 References

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Appendix E
Regulatory Settings

Appendix E Regulatory Settings

This appendix presents the federal, State of California (state), and local laws, rules and regulations, Executive Orders (EOs), and compliance requirements for the implementation of the Proposed Action as presented in the Environmental Assessment/Initial Study (EA/IS). Descriptions are organized by federal, state, and local requirements. Relevant laws, regulations and plans and the associated resources are presented in Table E-1.

Table E-1. Applicable Laws, Regulations, and Plans

Laws, Regulations, and Plans	Applicable Resources
Federal	
Advisory Council on Historic Preservation Section 106 Consultation	Cultural
Bald and Golden Eagle Protection Act	Biological Resources
Central Valley Project Improvement Act	Water Supply
Clean Air Act	Air Quality
Clean Water Act	Water Quality; Biological Resources
Earthquake Hazard Reduction Act of 1977	Geology, Seismicity, and Soils
EO 11990, Protection of Wetlands	Water Quality; Biological Resources
EO 13990, Protecting Public Health and the Environmental and Restoring Science to Tackle the Climate Crisis	Greenhouse gases (GHG)
EO 14008, Tackling the Climate Crisis at Home and Abroad	GHG
EO 13007, Accommodation of Sacred Sites	Indian Sacred Sites
512 DM 2, Departmental Responsibilities for Indian Trust Resources	Indian Trust Assets
EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	Environmental Justice
512 DM 2, Departmental Responsibilities for Indian Trust Resources	Indian Trust Assets
Endangered Species Act	Water Supply; Biological Resources
Migratory Bird Treaty Act of 1918	Biological Resources
National Historic Preservation Act	Cultural
Native American Graves Protection and Repatriation Act	Cultural
Paleontological Resources Preservation Act of 2009	Geology, Seismicity, and Soils
Principles and Requirements for Federal Investments in Water Resources	GHG
Resource Conservation and Recovery Act	Hazards and Hazardous Materials
Safe Drinking Water Act	Water Quality
Transportation Research Board Highway Capacity Manual, Sixth Edition	Traffic and Transportation
Uniform Building Code (International Building Code)	All Resources
US Department of the Interior (DOI), Reclamation National Environmental Policy Act (NEPA) Handbook	GHG
US DOI Secretarial Order No. 3398	GHG

Laws, Regulations, and Plans	Applicable Resources
State	
Alquist-Priolo Earthquake Fault Zoning Act	Geology and Soils
California Building Code	Geology and Soils, Noise and Vibration
California Clean Air Act	Air Quality
California Department of Fish and Wildlife (CDFW) Species Designations	Biological Resources
California Department of Transportation Guide for the Preparation of Traffic Impact Studies	Traffic and Transportation
California Department of Transportation, Highway Design Manual, Seventh Edition	Traffic and Transportation
California Endangered Species Act	Biological Resources
California Environmental Protection Agency (CalEPA) Unified Program	Hazards and Hazardous Materials
California Environmental Quality Act (CEQA) Guidelines	GHG, Cultural Resources
California EO S-3-05	GHG
California EO B-30-15 and Senate Bill 32	GHG
California Fish and Game Code Section 1600, Streambed Alterations	Biological Resources
California Fish and Game Code Section 1900-1913, Native Plant Protection Act	Biological Resources
California Fish and Game Code Sections 3500-3705, Migratory Bird Protection	Biological Resources
California Global Warming Solutions Act of 2006 (Assembly Bill [AB] 32)	GHG
California Natural Resources Agency Tribal Consultation Policy	Cultural
California Occupational Safety and Health Administration Standards	Hazards and Hazardous Materials
California Office of Historic Preservation	Cultural
California Porter-Cologne Water Quality Control Act	Water Quality, Biological Resources
California State Parks Guidelines	Recreation
California Water Code Section 13240, Regional Water Quality Control Plan	Water Quality
California Water Code, Water Rights	Water Supply
Hazardous Waste Control Act	Hazards and Hazardous Materials
Noise Element Guidelines	Noise and Vibration
Seismic Hazards Mapping Act	Geology and Soils
State Scenic Highways Program	Visual
State Water Resource Control Board Hazardous Waste Programs	Hazards and Hazardous Materials
Surface Mining and Reclamation Act of 1975	Geology and Soils
Local/ Regional	
Alameda County General Plan	Visual Resources, Geology and Soils, Utilities and Power
Alameda County Code of Ordinances	Noise and Vibration, Utilities and Power
Bay Area Air Quality Management District Air Quality Management Plan	Air Quality, GHGs
Fresno County General Plan	Visual Resources, Noise and Vibration, Hazards/Hazardous Materials, Biological Resources, Recreation, Geology and Soils, Utilities and Power

Laws, Regulations, and Plans	Applicable Resources
Fresno County Code of Ordinances	Noise and Vibration
Merced County General Plan	Water Quality, Visual Resources, Noise Vibration, Recreation, Geology, and Soils, Biological Resource, Utilities and Power, Cultural Resources, Hazards/Hazardous Materials
Merced County Code of Ordinances	Noise and Vibration, Geology and Soils
Merced County Office of Environmental Services	Hazards/ Hazardous Materials
San Joaquin County General Plan	Visual Resources, Noise and Vibration, Hazards/Hazardous Materials, Biological Resources, Geology and Soils, Utilities and Power
San Joaquin County Development Title	Noise and Vibration
San Joaquin Valley Air Pollution Control District (SJVAPCD) Air Quality Management Plans	Air Quality
SJVAPCD Programs	GHGs
Stanislaus County General Plan	Visual Resources, Geology and Soils, Utilities and Power
Stanislaus County Code of Ordinances	Noise and Vibration

Key: DM- Department of the Interior, Department Manual, EO- Executive Order, GHGs- Greenhouse Gases

E.1 Federal Requirements

E.1.1 Advisory Council on Historic Preservation

Advisory Council on Historic Preservation (ACHP) regulations[1] governing the Protection of Historic Properties establish procedures for compliance with Section 106 of the National Historic Preservation Act (NHPA). These regulations define the Criteria of Adverse Effect; outline the role of the State Historic Preservation Officer (SHPO) in the Section 106 review process; set forth documentation requirements; and describe procedures to be followed if significant historic properties are discovered during implementation of an undertaking. Effects on prehistoric and historic period cultural resources, as well as traditional cultural properties of importance to Native American communities, that are deemed significant (i.e., eligible for listing in the National Register of Historic Places (NRHP) under 36 CFR Part 60.4) must be considered in project planning and construction (ACHP 2016). The responsible Federal agency must consult with the SHPO and other parties regarding any proposed undertaking that may affect NRHP-eligible properties. The NHPA Section 106 process also requires that, if an undertaking will result in an adverse effect to historic properties, measures to avoid, minimize, or mitigate the adverse effect must be resolved through negotiated formal agreement in consultation with the SHPO and other consulting parties.

E.1.2 Bald and Golden Eagle Protection Act

Administered by the United States (U.S.) Fish and Wildlife Service (USFWS), the Bald and Golden Eagle Protection Act[2] provides for the protection of the bald eagle (*Haliaeetus leucocephalus*) and the golden eagle (*Aquila chrysaetos*) by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds. The act prohibits unregulated take and makes it illegal to kill, wound, pursue, shoot, shoot at, poison, capture, trap, collect, molest, or disturb bald or golden

[1] 36 Code of Federal Regulations [C.F.R.] Part 800.
[2] 16 U.S. Code [U.S.C.] 668-668c.

eagles. Surveys are required to determine whether nests will be disturbed and, if so, a buffer area with a specified radius around the nest must be established so that no disturbance or intrusion is allowed until the young have fledged and left the nest. Coordination with the USFWS is recommended for establishing an appropriate buffer (USFWS 2021a).

E.1.3 Central Valley Project Improvement Act (CVPIA)

On October 30, 1992, Public Law 102-575 was signed into law. This law included Title 34, the Central Valley Project Improvement Act (CVPIA), which amended previous authorizations of the Central Valley Project (CVP). The CVPIA mandated changes in management of the CVP, requiring fish and wildlife protection, restoration, and mitigation as project purposes equal to that of agricultural irrigation, municipal and industrial (M&I) supplies, and power generation (Bureau of Reclamation [Reclamation] 2022).

E.1.4 Clean Air Act

The U.S. Environmental Protection Agency (USEPA) is responsible for implementation of the Federal Clean Air Act (CAA).[3] The CAA was enacted in 1955 and was amended in 1963, 1965, 1967, 1970, 1977, 1990, and 1997. Under authority of CAA, USEPA established National Ambient Air Quality Standards (NAAQS) for the following criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), inhalable particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), fine particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$), and sulfur dioxide (SO_2) (USEPA 2021a).

CAA requires States to classify air basins (or portions thereof) as either “attainment” or “nonattainment” with respect to criteria air pollutants, based on whether the NAAQS have been achieved, and to prepare State Implementation Plans (SIPs) containing emission reduction strategies to maintain the NAAQS for those areas designated as attainment and to attain the NAAQS for those areas designated as nonattainment.

E.1.4.1 General Conformity

Section 176 (c) of the CAA[4] requires any entity of the federal government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable SIP required under Section 110 (a) of the CAA[5] before the action is otherwise approved. In this context, conformity means that such federal actions must be consistent with a SIP’s purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of those standards. Each federal agency must determine that any action proposed that is subject to the regulations implementing the conformity requirements will, in fact, conform to the applicable SIP before the action is taken. This Project is subject to the General Conformity Rule because it involves a Federal agency (Reclamation).

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[3] 42 U.S.C. Chapter 85, as amended.

[4] 42 U.S.C. 7506[c].

[5] 42 U.S.C. 7410[a].

The general conformity regulations apply to a proposed federal action in a nonattainment or maintenance area if the total of direct[6] and indirect[7] emissions of the relevant criteria pollutants and precursor pollutants caused by the proposed action equal or exceed certain *de minimis* amounts, thus requiring the federal agency to make a determination of general conformity. A federal agency can indirectly control emissions by placing conditions on federal approval or federal funding.

Table E-2 presents the *de minimis* amounts for nonattainment areas. The *de minimis* threshold for all maintenance areas is 100 tons per year (tpy), except for Pb, which has a *de minimis* threshold of 25 tpy.

Table E-2. General Conformity De Minimis Thresholds

Pollutant	Classification of Emissions Type	De Minimis Threshold (tpy)
O_3 (VOCs or NOx)	Serious NAA	50
O_3 (VOCs or NOx)	Severe NAA	25
O_3 (VOCs or NOx)	Extreme NAA	10
O_3 (VOCs or NOx)	Other NAA	100
CO	Not applicable	100
SO_2	Not applicable	100
NO_2	Not applicable	100
PM_{10}	Moderate NAA	100
PM_{10}	Serious NAA	70
$PM_{2.5}$	Direct emissions	100
$PM_{2.5}$	SO_2 precursor	100
$PM_{2.5}$	NOx precursor	100
$PM_{2.5}$	VOC or ammonia precursor[1]	100
Pb	Not applicable	25

Source: 40 CFR 93.153

Note:

1 Pollutant not subject to de minimis threshold if the State does not determine it to be a significant precursor to $PM_{2.5}$ emissions.

Key: CO = carbon monoxide; NAA = nonattainment area; NO_2 = nitrogen dioxide; NO_x = nitrogen oxides; O_3 = ozone; Pb = lead; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SO_2 = sulfur dioxide; tpy = tons per year; VOC = volatile organic compounds

If the regulating Federal agency determines that the general conformity regulations do not apply to the proposed action (meaning the project emissions do not exceed the *de minimis* thresholds in a nonattainment or maintenance area), no further analysis or documentation is required.

6 Direct emissions are those that are caused or initiated by the Federal action and occur at the same time and place as the federal action.

7 Indirect emissions are reasonably foreseeable emissions that are further removed from the Federal action in time and/or distance and can be practicably controlled by the Federal agency on a continuing basis (40 C.F.R. 93.152).

E.1.5 Clean Water Act

Growing public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act Amendments of 1972. As amended in 1977, this law became commonly known as the Clean Water Act (CWA).[8]

The CWA implemented requirements to set water quality standards for all known contaminants in surface waters. Section 303(d) of the 1972 CWA requires states, territories, and authorized tribes to develop a list of water quality-impaired segments of waterways. The 303(d) list includes water bodies that do not meet water quality standards for the specified beneficial uses of that waterway, even after point sources (e.g., wastewater treatment plant discharges) of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for water bodies on their 303(d) lists and implement a process, called Total Maximum Daily Loads (TMDLs), to meet water quality standards (USEPA 2021b).

TMDLs are intended to address all significant stressors that cause, or threaten to cause, water body beneficial use impairments, including point sources, nonpoint sources (e.g., runoff from fields, streets, range, or forest land), and naturally occurring sources (e.g., runoff from undisturbed lands). The TMDL process is a tool for implementing water quality standards and is based on the relationship between point source pollution and its deleterious effects on ambient in-stream conditions. The TMDL establishes the maximum allowable loadings of a pollutant that can be assimilated[9] by a water body while still meeting applicable water quality standards. The TMDL provides the basis for the establishment of water quality-based controls. These controls should provide the pollution reduction necessary for a water body to meet water quality standards. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The TMDLs allocation calculation for each water body must include a margin of safety to ensure that the water body can be used for the beneficial uses the State has designated. Additionally, the calculation also must account for seasonal variation in water quality (USEPA 2021b). For example, pollutant loads might be greater during winter months with higher flows, however, the rivers may have more assimilative capacity for such pollutants.

TMDLs may be based on readily available information and studies. In some cases, complex studies or models are needed to understand how stressors are causing water body impairment. In many cases, simple analytical efforts provide an adequate basis for stressor assessment and implementation planning. TMDLs are developed to provide an analytical basis for planning and implementing pollution controls, land management practices, and restoration projects needed to protect water quality. States are required to include approved TMDLs and associated implementation measures in state water quality management plans. Within California, TMDLs implementation is regulated through regional Basin Plans.

Water quality of waters of the U.S. subjected to a discharge of dredged or fill material is regulated under Section 404 of the CWA. These actions must not violate federal or state water quality standards. Specifically, in the State of California, the applicable Regional Water Quality Control Board (RWQCB) administers Section 401 and either issues or denies water quality certifications depending upon whether the proposed discharge or fill material complies with applicable state and federal laws. The CWA also requires that a permit be obtained from USEPA and the U.S. Army

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[8] 33 U.S.C. Section 1251 et seq.

[9] As known as assimilative capacity: the ability of a body of water to cleanse itself; to receive waste waters or toxic substances without deleterious effects and without damage to aquatic life or humans who consume the water.

Corps of Engineers (USACE) when discharge of dredged or fill material into wetlands and waters of the U.S. occurs. Section 404 of the CWA requires USEPA and USACE to issue individual and general permits for these activities.

In addition to complying with state and federal water quality standards, point sources that discharge into waters of the U.S. must obtain a National Pollutant Discharge Elimination System (NPDES) permit under provisions of Section 402 of the CWA, when exemptions do not apply. In California, the SWRCB and RWQCBs are responsible for the implementation of the NPDES permitting process at the State and regional levels, respectively. The NPDES permit process also provides a regulatory mechanism for the control of non-point source pollution created by runoff from construction and industrial activities, and general and urban land use, including runoff from streets. To prevent polluted stormwater runoff from being washed into municipal separate storm sewer systems (MS4s), certain operators are required to obtain NPDES permits. The 1990 Phase I regulation requires medium and large cities or certain counties with populations of 100,000 or more to obtain NPDES permit coverage for their stormwater discharges. The 1999 Phase II regulation requires small MS4s in U.S. Census Bureau defined urbanized areas to obtain NPDES permit coverage for their stormwater discharges. Phase II also includes nontraditional MS4s such as public universities, departments of transportation, hospitals and prisons. There are approximately 855 Phase I MS4s and 6,695 Phase II MS4s (USEPA 2022a).

Projects involving construction activities (e.g., clearing, grading, or excavation) with land disturbance greater than one acre must file a Notice of Intent (NOI) with the applicable RWQCB to indicate their intent to comply with the State General Permit for Stormwater Discharges Associated with Construction Activity (General Permit). The State General Permit specifies Best Management Practices (BMPs), to achieve compliance as well as numeric action levels to achieve federal standards to minimize sediment and pollutant loadings. The General Permit requires preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) as well as a Rain Event Action Plan (REAP) prior to construction. The SWPPP and REAP are intended to help identify the sources of sediment and other pollutants and assess the effectiveness of BMPs in preventing or reducing pollutants in stormwater discharges and authorized nonstormwater discharges.

E.1.6 Earthquake Hazard Reduction Act of 1977, as amended

The Earthquake Hazard Reduction Act of 1977[10] established a national goal of reducing the risks of life and property from future earthquakes in the U.S. through the establishment and maintenance of an earthquake program including prediction and hazard assessment research, seismic monitoring and information dissemination. The Act established the Earthquake Hazard Reduction Program to promote the adoption of earthquake hazard reduction measures by federal, state, and local governments. Section 8 of the Act calls for the adoption of standards for assessing and enhancing the seismic safety of buildings constructed for or leased by the federal government (42 USC 7701 et. seq.) (National Earthquake Hazards Reduction Program 2008).

E.1.7 Executive Order 11990, Protection of Wetlands

Executive Order 11990 requires federal agencies to take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. This requirement extends to actions involved with construction activities or increased storage in

[10] Public Law 95-124, 42 U.S.C. 7701 et. seq., as amended by Public Laws 101-614, 105-47, 106-503, and 108-360.

existing reservoirs which would affect wetlands. Federal agencies must provide opportunities for early public review of any plans or proposals for new construction in wetlands (National Archives 2016).

E.1.8 Executive Order 13990, Protecting Public Health and the Environmental and Restoring Science to Tackle the Climate Crisis

Executive Order 13990 (January 20, 2021) directs federal agencies to immediately review and take action to address federal regulations that conflict with national objectives including reducing greenhouse gas emissions and bolstering resilience to the impacts of climate change (U.S. Department of Energy 2021). Section 7 of EO 13990 revoked EO 13783- Promoting Energy Dependence and Economic Growth and rescinded the Council on Environmental Quality's "Draft National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions" (Federal Register 2017).

E.1.9 Executive Order 14008, Tackling the Climate Crisis at Home and Abroad

Executive Order 14008 (January 27, 2021) places the climate crisis at the forefront of foreign policy and national security planning. Section 211 of EO 14008 requires the head of each federal agency to draft and submit an action plan that describes steps the agency can take with regard to its facilities and operations to bolster adaptation and increase resilience to the impacts of climate change (The White House 2021).

E.1.9.1 Department of Interior Climate Action Plan

On October 7, 2021, the U.S. Department of Interior (DOI) released the Climate Action Plan which outlines how DOI will use science as the foundation for planning and decision-making related to climate change risks, impacts and vulnerabilities (DOI 2021a).

E.1.10 Executive Order 13007, Accommodation of Sacred Sites

Executive Order 13007 (May 24, 1996) requires that federal agencies accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoids adversely affecting the physical integrity of such sacred sites.

E.1.11 Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order 12898 (February 16, 1994) requires each federal agency to identify and address disproportionately high and adverse human health or environmental effects, including social and economic effects of its program, policies, and activities on minority populations and low-income populations.

E.1.12 512 DM 2, Departmental Responsibilities for Indian Trust Resources

Indian Trust Assets (ITA) are legal interests in property held in trust by the U.S. for Indian tribes or individuals. Department of the Interior's policy is to recognize and fulfill its legal obligations to identify, protect, and conserve the trust resources of federally recognized Indian tribes and individual Indians, to the extent required by relevant statutes and regulations; and to consult with tribes on a government-to-government basis whenever plans or actions affect tribal trust resources, trust assets, or tribal health and safety (512 DM 2). Under this policy, Reclamation is committed to carrying out its activities in a manner that avoids adverse impacts to ITAs, when possible, and mitigates or compensates for such impacts when it cannot avoid the impacts.

E.1.13 Endangered Species Act

Under the ESA, the Secretary of the Interior and the Secretary of Commerce have joint authority to list a species as threatened or endangered (16 U.S.C. Section 1533[c]). The ESA prohibits the "take" of endangered or threatened fish and wildlife species, the take of endangered or threatened plants in areas under federal jurisdiction or in violation of state law, or adverse modifications to their critical habitat. Under the ESA, the definition of "take" is to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." USFWS and the National Marine Fisheries Service (NMFS) also interpret the definition of "harm" to include significant habitat modification that could result in the take of a species.

If an activity would result in the take of a federally-listed species, one of the following is required: an incidental take permit under Section 10(a) of the ESA for non-federal projects or an incidental take statement issued under Section 7 of the ESA for federal projects. Such authorization typically requires various measures to avoid and minimize species take, and to protect the species and avoid jeopardy to the species' continued existence.

Pursuant to the requirements of Section 7 of the ESA, a federal agency reviewing a proposed project which it may authorize, fund, or carry out must determine whether any federally-listed threatened or endangered species, or species proposed for federal listing, may be present in the project area and determine whether implementation of the proposed project is likely to affect the species. In addition, the federal agency is required to determine whether a proposed project is likely to jeopardize the continued existence of a listed species or any species proposed to be listed under the ESA or result in the destruction or adverse modification of critical habitat proposed or designated for such species (16 U.S.C. 1536[3], [4]).

Where a federal agency is not authorizing, funding, or carrying out a project, take that is incidental to the lawful operation of a project may be permitted pursuant to Section 10(a) of the ESA through approval of a habitat conservation plan (HCP).

The ESA requires the federal government to designate "critical habitat" for any species it lists under the ESA. "Critical habitat" is defined as: 1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to the species conservation, and those features that may require special management considerations or protection; and 2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation (USFWS 2021b).

E.1.13.1 C.1.9.1 Biological Opinions

The following Biological Opinions (BOs) are relevant to the Project:

Coordinated Long-Term Operation of the CVP and SWP

Most recently, Reclamation reinitiated consultation on coordinated long-term operation of the CVP and SWP and completed an Environmental Impact Statement (EIS) in 2019 and issued a ROD on February 18, 2020 (Reclamation 2020) upon receiving new USFWS and NMFS Biological Opinions on October 21, 2019 (USFWS 2019, NMFS 2019). Reclamation is currently in active litigation and has negotiated an "interim operations plan" that allows for deviations from the 2020 ROD and 2019 Final EIS. On September 30, 2021, Reclamation and DWR again requested reinitiation of consultation with the USFWS and NMFS due to anticipated modifications to the proposed action that may cause effects to ESA-listed species or designated critical habitat that was not analyzed in the 2019 USFWS and NMFS Biological Opinions. On October 1, 2021, both agencies agreed to the reinitiation.

O&M Program for the South-Central California Area

Reclamation consulted with the USFWS under the ESA for operation and maintenance (O&M) activities occurring on Reclamation lands under the jurisdiction of the South-Central California Area Office. The USFWS issued a BO on February 17, 2005 (USFWS 2005). The BO considers the effects of routine O&M of Reclamation's facilities used to deliver water to the study area, as well as certain other facilities within the jurisdiction of the South-Central California Area Office, on California tiger salamander, vernal pool fairy shrimp, valley elderberry longhorn beetle, blunt-nosed leopard lizard, vernal pool tadpole shrimp, San Joaquin wooly-threads, California red-legged frog, giant garter snake, San Joaquin kit fox, and on proposed critical habitat for the California red-legged frog and California tiger salamander.

E.1.14 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA)[11] decrees that all migratory birds and their parts (including eggs, nests and feathers) are fully protected. The MBTA protects nearly all native North American bird species. Under the MBTA, taking, killing, or possessing migratory birds is unlawful. Under the MBTA, surveys are required to determine whether nests will be disturbed and, if so, a buffer area with a specified radius around the nest must be established so that no disturbance or intrusion is allowed until the young have fledged and left the nest. The size of the buffer area would vary depending on species and local conditions (e.g., presence of busy roads) and the professional judgment of the project biologist. Coordination with the USFWS is recommended for establishing an appropriate buffer (USFWS 2021c).

E.1.15 National Historic Preservation Act

The NHPA of 1966[12] requires federal agencies to consider the preservation of prehistoric and historic period resources. The NHPA authorizes the Secretary of the Interior to expand and maintain the NRHP, and it establishes the ACHP as an independent federal entity. Section 106 of the Act[13] requires federal agencies to take into account the effects of their undertakings on historic properties and affords the ACHP an opportunity to comment on the undertaking prior to the licensing or approval of the expenditure of funds on any undertaking that may affect properties listed, or eligible for listing, in the NRHP. The implementing regulations at 36 CFR Part 800 identify the steps that must be followed to comply with Section 106 of the NHPA. These steps include consultation with the SHPO (ACHP 2004).

The Project is subject to NHPA Section 106 compliance, to include consultation with the SHPO and other Section 106 consulting parties as required. Section 106 of the NHPA requires federal agencies to consider the effects of the undertaking on historic properties and to afford the ACHP and the SHPO a reasonable opportunity to comment on any undertaking that would adversely affect properties listed or eligible for listing in the NRHP. Section 302706 (a) of the NHPA allows

[11] 16 U.S.C. 703-712.
[12] 54 U.S.C Section 300101 et seq.
[13] 54 U.S.C Section 300108.

properties of traditional religious and cultural importance to Indian tribes to be determined eligible for inclusion in the NRHP. Under the NHPA, a "historic property" or significant cultural resource is one that meets the following NRHP criteria.[14]

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:

A. That are associated with events that have made a significant contribution to the broad patterns of our history, or
B. That are associated with the lives of persons significant in our past, or
C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction, or
D. That have yielded, or may be likely to yield, information important in prehistory or history.

The federal review of projects is typically referred to as the Section 106 process. Section 106 review normally involves a four-step procedure that is detailed in the implementing regulations (36 CFR Part 800):

1. *Establish undertaking.* Determine whether the proposed federal action is an undertaking;
2. *Identification of historic properties.* Determine scope of identification efforts, phased identification and evaluation, evaluate historic significance, results of identification and evaluation;
3. *Assessment of adverse effects.* Apply criteria of adverse effect, finding of no adverse effect, consulting party review, results of assessment;
4. *Resolution of adverse effects.* Continue consultation, resolve adverse effects, memorandum of agreement.

Once cultural resources are identified in the project area of potential effects (APE), they must be evaluated under the four NRHP criteria found at 36 C.F.R. Part 60.4 pursuant to 36 C.F.R. Part 800.4(c). If the agency determines historic properties are within the APE, then the effect of the undertaking on historic properties is assessed as outlined in 36 CFR 800.5. The effect can be either no adverse effect or adverse effect. Adverse effects must be resolved in consultation with and through agreement among the responsible federal agency or agencies, the SHPO, and other Section 106 consulting parties pursuant to 36 C.F.R. Part 800.6.

E.1.16 Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act (NAGPRA) is a U.S. federal law enacted in 1990 that requires federal agencies and institutions that receive federal funding to return Native American cultural items to lineal descendants, Indian tribes, Alaska Native Corporations, or Native Hawaiian organizations through excavated or discovered items on federal or tribal land. Cultural items include human remains, funerary objects, sacred objects, and objects of cultural patrimony. Consultation with all parties is a critical component for addressing identification,

[14] 36 C.F.R. Part 60.4.

treatment, and disposition of Native American cultural items (U.S. DOI Bureau of Land Management n.d.).

E.1.17 Paleontological Resources Preservation Act

The Paleontological Resources Preservation Act (PRPA) of 2009[15] requires the U.S. Department of Agriculture and the DOI to manage and protect paleontological resources on federal land using scientific principles and expertise. The law, which applies only to federal land, includes criminal and civil penalties for fossil theft and vandalism. The law also provides authority for issuing permits for collecting paleontological resources (Federal Register 2009).

Paleontological resources do not include any materials associated with an archaeological resource as defined in Section 3(1) of the Archaeological Resources Protection Act of 1979,[16] or any cultural item as defined in Section 2 of the NAGPRA.[17]

E.1.18 Principles and Requirements for Federal Investments in Water Resources

Reclamation is subject to *Principles and Requirements for Federal Investments in Water Resources* (Council on Environmental Quality 2013). This document requires areas of risk and uncertainty to be identified, described, and considered when analyzing potential investments in water resources. It specifically requires climate change impacts to be accounted for and addressed.

E.1.19 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) of 1976, administered by the USEPA, governs the disposal of solid and hazardous waste. Under RCRA, USEPA was given authority of "cradle-to-grave" control of hazardous waste, and this is the current approach for hazardous waste management. Three programs were established under RCRA including the solid waste program, hazardous waste program, and underground storage tank (UST) program. Under the law, controls for the generation, transport, treatment, storage, and disposal of hazardous waste are strictly mandated. Only active and future facilities are controlled under RCRA (USEPA 2022b). There have been three amendments to RCRA, including the Hazardous and Solid Waste Amendments of 1984, the Federal Facility Compliance Act of 1992, and the Land Disposal Program Flexibility Act of 1996 (USEPA 2022b).

E.1.20 Safe Drinking Water Act

The Federal Safe Drinking Water Act (SDWA)[18] was enacted in 1974 to protect the quality of drinking water in the U.S. This law focuses on all waters actually or potentially designated for drinking use, whether from aboveground or underground sources. The SDWA authorized the USEPA to establish safe standards of purity for specified contaminants and required all owners or operators of public water systems to comply with primary (health-related) standards. State governments, which assume this power from the USEPA, also encourage attainment of secondary standards (nuisance-related). Contaminants of concern in a domestic water supply are those that either pose a health threat or in some way alter the aesthetic acceptability of the water. These types of contaminants are currently regulated by the USEPA through primary and secondary maximum

[15] 16 USC 470aaa-aaa-11.
[16] 16 U.S.C. 470bb(1).
[17] 25 U.S.C. 3001.
[18] 42 U.S.C. Section 300f et seq.

contaminant levels (MCLs). As directed by the SDWA amendments of 1986, the USEPA has been expanding its list of primary MCLs. MCLs have been proposed or established for approximately 100 contaminants.

E.1.21 Transportation Research Board Highway Capacity Manual, Sixth Edition

The Highway Capacity Manual (HCM), Sixth Edition provides methods for quantifying highway capacity. In its current form, it serves as a fundamental reference on concepts, performance measures, and analysis techniques for evaluating the multimodal operation of streets, highways, freeways, and off-street pathways. In this edition, the latest research in highway capacity, quality of service, Active Traffic and Demand Management, and travel time reliability are incorporated to keep user's needs and present times. The HCM consists of four dimensions (Transportation Research Board 2016):

1. *Quantity of travel*. The magnitude of use of a transportation facility or service;
2. *Quality of travel*. Users' perceptions of travel on a transportation facility or service with respect to their expectations;
3. *Accessibility*. The ease with which travelers can engage in desired activities; and
4. *Capacity*. The ability of a transportation facility or service to meet the quantity of travel demanded of it.

E.1.22 Uniform Building Code (International Building Code)

The design and construction of engineered facilities in the state of California must comply with the requirements of the Uniform Building Code (UBC). The International Code Council (ICC) was established in 1994 as a nonprofit organization dedicated to developing a single set of comprehensive and coordinated national model construction codes, or Uniform Building Codes. The founders of the ICC are Building Officials and Code Administrators International, Inc., International Conference of Building Officials, and Southern Building Code Congress International, Inc. Since the early twentieth century, these nonprofit organizations developed the three separate sets of model codes used throughout the U.S. Although regional code development has been effective and responsive in the past, a single set of codes was developed. The nation's three model code groups responded by creating the ICC and by developing codes without regional limitations, the International Codes (International Code Council 2022).

E.1.23 United States Department of the Interior, Bureau of Reclamation National Environmental Policy Act Handbook

The Reclamation *NEPA Handbook* (Reclamation 2012) recommends that climate change be considered, as applicable, in every NEPA analysis. The *NEPA Handbook* acknowledges that there are two interpretations of climate change regarding Reclamation actions: 1) Reclamation's action is a potentially significant contributor to climate change and 2) climate change could affect a Reclamation proposed action. The *NEPA Handbook* recommends considering different aspects of climate change (e.g., relevance of climate change to the proposed action, time frame for analysis, and relevant regional/local projections of climate change) to determine the extent to which it should be discussed under NEPA.

E.1.24 United States Department of the Interior Secretarial Order No. 3398

In 2021, DOI issued a Secretarial Order (SO) that continues the implementation of EO 13990 by rescinding documents inconsistent with EO 13990. The order rescinds SO 3355 "Streamlining National Environmental Policy Reviews and Implementation of EO 13807", "Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects" (DOI 2021b).

E.2 State Requirements

E.2.1 Alquist-Priolo Earthquake Fault Zoning Act

The 1972 Alquist-Priolo Earthquake Fault Zoning Act[19] requires local agencies to regulate development within earthquake fault zones to reduce the hazards associated with surface fault ruptures. It also regulates construction in earthquake fault zones.

E.2.2 California Building Code

Minimum standards for structural design and construction are outlined in the California Building Standards Code (CBSC)[20] (California Department of General Services 2022). The CBSC is based on the UBC, which is widely used throughout the U.S. and has been modified for California conditions with numerous, more detailed and/or more stringent regulations.

E.2.2.1 Geology, Seismicity, and Soils

The CBSC requires that "classification of the soil at each building site…be determined when required by the building official" and that "the classification be based on observation and any necessary test of the materials disclosed by borings or excavations." In addition, the CBSC states that "the soil classification and design-bearing capacity shall be shown on the (building) plans, unless the foundation conforms to specified requirements." The CBSC provides standards for various aspects of construction, including but not limited to excavation, grading, and earthwork construction; fill placement and embankment construction; construction on expansive soils; foundation investigations; and liquefaction potential and soil strength loss. In accordance with California law, project design and construction would be required to comply with provisions of the CBSC (California Department of General Services 2022).

E.2.2.2 Noise and Vibration

The CBSC provides acoustical regulations for both exterior-to-interior sound insulation, as well as sound and impact isolation between adjacent spaces of various occupied units. Title 24 regulations generally state that interior noise levels generated by exterior noise sources must not exceed 45 A-weighted decibels (dBA) L_{dn}/Community Noise Equivalent Level (CNEL), with windows closed, in any habitable room for general residential uses (California Department of General Services 2022).

E.2.3 California Clean Air Act

The California Clean Air Act (CCAA) substantially added to the authority and responsibilities of the State's air pollution control districts. The CCAA establishes an air quality management process that

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[19] California Public Resources Code [PRC] Section 2621 et seq.
[20] Title 24, California Code of Regulations.

generally parallels the federal process. The CCAA, however, focuses on attainment of the California Ambient Air Quality Standards (CAAQS) that, for certain pollutants and averaging periods, are typically more stringent than the comparable NAAQS. The CCAA requires that the CAAQS be met as expeditiously as practicable but does not set precise attainment deadlines. Instead, the act established increasingly stringent requirements for areas that will require more time to achieve the standards (California Environmental Protection Agency [CalEPA] 2020a).

The air quality attainment plan requirements established by the CCAA are based on the severity of air pollution problems caused by locally generated emissions. Upwind air pollution control districts are required to establish and implement emission control programs commensurate with the extent of pollutant transport to downwind districts.

The California Air Resources Board (CARB) is responsible for developing emission standards for on-road motor vehicles and some off-road equipment in the State. In addition, CARB develops guidelines for the local districts to use in establishing air quality permit and emission control requirements for stationary sources subject to the local air district regulations.

E.2.4 California Department of Fish and Wildlife Species Designations

The California Department of Fish and Wildlife (CDFW) maintains an informal list of species called "species of special concern." These are broadly defined as plant and wildlife species that are of concern to CDFW because of population declines and restricted distributions and/or because they are associated with habitats that are declining in California. These species are inventoried in the California Natural Diversity Database (CNDDB) regardless of their legal status. Impacts on species of special concern may be considered significant.

E.2.5 California Department of Transportation Highway Design Manual, Seventh Edition

The 7th Edition Highway Design Manual (HDM) establishes uniform policies and procedures for state highway design functions of the California Department of Transportation. It is neither intended as, nor does it establish, a legal standard for these functions but are for the information and guidance of the officers and employees of the Department (Caltrans 2019a).

The HDM is not intended to be a substitute for engineering knowledge, experience, or judgment. In no event will the Department be liable for costs of procurement of substitute goods, loss of profits, or for any indirect, special, consequential, or incidental damages, however caused, by use of the HDM. The Department will not be liable for any claims in connection with the use of the HDM, including without limitation, liability arising from third-party claims, liability related to the quality of calculations or the safety or quality or structures, liability for scheduling delays or re-design of structures, or other similar liability design, retrofit or rework.

E.2.6 California Department of Transportation Guide for the Preparation of Traffic Impact Studies

Traffic analysis in the State of California is guided by standards set at the State level by the California Department of Transportation (Caltrans), and by local jurisdictions. State highways fall under the jurisdiction of Caltrans. Other roadways fall under the local jurisdiction, either city or county, in which they are located.

Each jurisdiction has adopted standards regarding the desired performance level of traffic conditions on the circulation system within its jurisdiction. A performance measure called "Level of Service"

(LOS) is used to characterize traffic operating conditions of a circulation element. Progressively worsening traffic operating conditions are given the letter grades "A" through "F."

While most motorists consider LOS A, B, and C as satisfactory travel conditions, LOS D is considered marginally acceptable. Congestion and delay are considered unacceptable to most motorists and are given the LOS E or F ratings.

E.2.7 California Endangered Species Act

CDFW is responsible for administration of the California Endangered Species Act (CESA). CESA requires incidental take authorization or permits for certain projects undertaken by public agencies. For projects where CESA compliance is required, and that affect a species that is both State and federal listed, compliance with the federal ESA will satisfy the CESA if CDFW determines that the federal incidental take authorization is "consistent" with the CESA. Projects that result in a "take" of a State-listed species require an incidental take permit under the CESA. The State act also lends protection to species that are considered rare enough by the scientific community and trustee agencies to warrant special consideration, particularly with regard to protection of isolated populations, nesting or den locations, communal roosts, and other essential habitat.

E.2.7.1 Fully Protected Species under California Fish and Game Code

Protection of fully protected species is described in four sections of the California Fish and Game Code that list 37 fully protected species (California Fish and Game Code Sections 3511, 4700, 5050, and 5515) (California Legislative Information 1998). These statutes prohibit take or possession at any time of fully protected species.

E.2.8 California Environmental Protection Agency Unified Program

The CalEPA Unified Program was developed to protect Californians from hazardous waste and materials. CalEPA has certified 81 local government agencies as California Unified Program Agencies (CUPAs), including Merced County Department of Public Health, which is responsible for implementing the hazardous waste and materials standards for five different State agencies including: CalEPA, Department of Toxic Substances Control (DTSC), Governor's Office of Emergency Services, CalFire and the SWRCB (CalEPA 2020a). Under the Unified Program, the administration, permit, inspection and enforcement activities are consolidated for the following environmental and emergency management programs (CalEPA 2020b).

- Aboveground Petroleum Storage Act Program
- Area Plans for Hazardous Materials Emergencies
- California Accidental Release Prevention (CalARP) Program
- Hazardous Materials Release Response Plans and Inventories (Business Plans)
- Hazardous Material Management Plan and Hazardous Material Inventory Statements (California Fire Code)
- Hazardous Waste Generator and Onsite Hazardous Waste Treatment (tiered permitting) Programs
- Underground Storage Tank (UST) Program

A more in-depth discussion of some of these programs that have applicability are described below.

E.2.8.1 Hazardous Material Management Plan and Hazardous Material Inventory Statements

The Hazardous Material Business Plans (HMBP) program mandates the creation of a planning document by businesses and other entities who handle hazardous materials of certain quantities. The Business Plan should include, among other things, an inventory of hazardous materials, a site location map, emergency plan and training program for their employees. These plans are to be submitted electronically to the California Environmental Reporting System. The local CUPA agency may be contacted for assistance with preparation of Business Plans. The CUPA will verify this information and provide it to "local emergency responders such as firefighters, health officials, planners, public safety officers, health care providers, regulatory agencies and other interested" parties. This information is prepared in response to federal community right-to-know laws (California Office of Emergency Services [CalOES] 2020a).

E.2.8.2 California Accidental Release Prevention Program

The CalARP program was developed to assist with prevention of harmful substances releases which could seriously harm the public and/or the environment. Businesses that handle certain quantities of regulated substances are required to prepare a Risk Management Plan that includes an engineering analysis of potential accident scenarios with mitigation measures. The mitigation measures, when implemented, would reduce the accident potential at a business. CalARP is implemented at the local government level (CUPA) who work directly with the regulated business (CalOES 2020b):

E.2.8.3 California Area Plan Program

The Area Plan Program requires CUPAs to prepare a plan utilizing information from CalARP and HMBP. The Area Plan includes emergency response procedures to minimize impacts from a hazardous material release or threatened release. Provisions for multiagency coordination and notification during emergency responses are also to be addressed in the Area Plan (CalOES 2020c).

E.2.9 California Environmental Quality Act Guidelines

E.2.9.1 Greenhouse Gas Emissions

On March 18, 2010, the California Natural Resources Agency (CNRA) adopted amendments to the CEQA Guidelines to include provisions for evaluating the significance of greenhouse gas (GHG) emissions. The amended guidelines give the Lead Agency leeway in determining whether GHG emissions should be evaluated quantitatively or qualitatively but requires that the following factors be considered when assessing the significance of impacts from GHG emissions (Section 15064.4) (CEQA 2022):

- The extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting
- Whether the project emissions exceed a threshold of significance that the lead agency determines apply to the project
- The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions

The amended guidelines also specify that Lead Agencies must analyze potentially significant impacts associated with placing projects in locations susceptible to hazardous conditions (e.g., floodplains, coastlines, and wildfire risk areas), including those that could be affected by climate change (Section 15126.2(a)).

Furthermore, the guidelines also suggest measures to mitigate GHG emissions, including implementing project features to reduce emissions, obtaining carbon offsets to reduce emissions, or sequestering GHG.

E.2.9.2 Cultural Resources

CEQA is the central law governing cultural resources at the State level. CEQA Guidelines Section 15064.5 states that a project may have a significant impact on the environment if it causes a substantial adverse change in the significance of a historical resource. Pursuant to Section 15064.5(a)(3), a historical resource is a resource that is included in, or eligible for inclusion in, the California Register of Historical Resources (CRHR); a resource listed in a local register of historical resources, as defined in PRC Section 5020.1(k) or identified as significant in a historical resource survey meeting the requirements of PRC Section 5024.1(g); or any object, building, structure, site, area, place, record, or manuscript that a lead agency determines to be significant. Resources automatically listed in the CRHR are those formally determined eligible for, or listed in, the NRHP, State Historical Landmarks numbered 770 or higher, and California Points of Historical Interest. If a lead agency determines that a cultural resource constitutes a historical resource, the provisions of PRC Section 21084.1 and CEQA Guidelines Section 15064.5 would apply. If a cultural resource does not meet the criteria for a historical resource, it may yet be regarded as a "unique" archaeological resource (PRC Section 21083.2). CEQA Guidelines Section 15064.5(c)(4) notes that if a resource is neither a unique archaeological resource nor a historical resource, the effects of a project on that resource shall not be considered a significant effect on the environment. Human remains, including those interred outside formal cemeteries, are protected under several State laws, including PRC Section 5097.98 and Health and Safety Code Section 7050.5 (CEQA 2022).

Signed in 2014, Assembly Bill (AB) 52 amends CEQA and creates a new category of environmental resource: "tribal cultural resources." These resources are defined as any site, feature, place, cultural landscape, sacred place, or object that has cultural value to a California Native American tribe. The bill further establishes a consultation process with all California Native American tribes listed by the Native American Heritage Commission, regardless of their federal recognition status.

E.2.10 California Executive Order S-3-05

On June 1, 2005, former California Governor Arnold Schwarzenegger signed EO S-03-05. This EO established the following GHG emission reduction targets for California:

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

The order also requires the Secretary of CalEPA to report to the Governor and the State Legislature biannually on progress made toward meeting the GHG emission targets, commencing in January 2006. The Secretary of the CalEPA is also required to report about impacts on water supply, public health, agriculture, the coastline, and forestry. Mitigation and adaptation plans to combat these impacts must also be developed.

California GHG emissions were estimated to be 446.06 million tonnes (metric tons) of CO_2 (carbon dioxide) equivalent (CO_2e) in 2010, compared to 467.19 million tonnes of CO_2e in 2000 (CARB

2019). The GHG emissions inventory indicates that emissions decreased by over 21 million tonnes of CO_2e over the decade, representing a four percent decrease in statewide emissions. Thus, the State was successful in meeting the first milestone of S-3-05.

E.2.11 California Executive Order B-30-15 and Senate Bill 32

California Governor Edmund G. Brown issued EO B-30-15 to reduce California GHG emissions to 40 percent below 1990 levels by 2030. The order aligns California's GHG reduction targets with the United Nations Climate Change Conference in Paris. In 2016, Senate Bill 32 codified the EO B-30-15 target and directed State regulatory agencies to develop rules and regulations to meet the 2030 State target.

E.2.12 California Fish and Game Code Section 1600, Streambed Alterations

Section 1600 et seq. of the California Fish and Game Code, administered by CDFW, states that "it is unlawful for any person to substantively divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake designated by the department, or use any material from the streambeds, without first notifying the department of such activity." Streambed alteration must be permitted by CDFW through a Streambed Alteration Agreement. CDFW defines streambeds as "a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life" and lakes as "natural lakes and man-made reservoirs." CDFW jurisdiction includes ephemeral, intermittent, and perennial watercourses, and can extend to habitats adjacent to watercourses, including flood plains. Wetlands near watercourses would also be considered "habitats adjacent to watercourses." A Lake and Streambed Alteration Agreement application may need to be submitted for construction actions disturbing the bed and bank of rivers or reservoirs.

E.2.13 California Fish and Game Code Section 1900 – 1913, Native Plant Protection Act

The Native Plant Protection Act[21] prohibits the take, possession, or sale within the state of any plants with a state designation of rare, threatened, or endangered (as defined by CDFW).

E.2.14 California Fish and Game Code Sections 3500 - 3705, Migratory Bird Protection

Sections 3500 through 3705 of the California Fish and Game Code regulate the taking of migratory birds and their nests. These codes prohibit the taking of nesting birds, their nests, eggs, or any portion thereof during the nesting season. Typically, the breeding/nesting season is from March 1 through August 30. Depending on each year's seasonal factors, the breeding season can start earlier and/or end later. Several species of migratory birds are known to occur in the area of analysis (California Fish and Game Code 3500-3705).

E.2.15 California Global Warming Solutions Act of 2006 (AB 32)

California AB 32, the Global Warming Solutions Act of 2006, codifies the state's GHG emissions targets by requiring the state's global warming emissions to be reduced to 1990 levels by 2020 and directs CARB to enforce the statewide cap that began to phase in during 2012. In 2007, CARB

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[21] California Fish and Game Code 1900-1913.

recommended and adopted a 1990 GHG emissions level and 2020 emissions limit of 427 million metric tons CO_2e ($MMTCO_2e$); however, this limit has subsequently been updated to 431 $MMTCO_2e$ using the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report global warming potentials (GWPs) (CARB 2020). The limit is a statewide limit and does not require individual sectors or facilities to reduce emissions equally.

Key AB 32 milestones are as follows (CARB 2014):

- January 1, 2009 – Scoping Plan adopted indicating how emissions will be achieved from significant sources of GHGs via regulations, market mechanisms, and other actions.
- During 2009 – CARB staff drafted rule language to implement its plan and held a series of public workshops on each measure (including market mechanisms).
- January 1, 2010 – Early action measures took effect.
- During 2010 – CARB conducted series of rulemakings, after workshops and public hearings, to adopt GHG regulations, including rules governing market mechanisms.
- January 1, 2011 – Completion of major rulemakings for reducing GHGs, including market mechanisms.
- January 1, 2012 – GHG rules and market mechanisms adopted by CARB and are legally enforceable.
- November 14, 2012 – CARB held first quarterly auction of GHG emissions allowances as part of the cap-and-trade program.
- January 1, 2013 – Cap-and-trade program began with a GHG emissions cap that declines over time.
- September 17, 2013 – CARB issued first carbon offset credits as part of the cap-and-trade program.
- May 22, 2014 – CARB approved First Update to the Climate Change Scoping Plan.
- December 31, 2020 – Deadline for achieving 2020 GHG emissions cap.

CARB has been proactive in its implementation of AB 32 and has met each of the milestones identified above that have already passed and is on track to meet the last milestone.

E.2.16 California Natural Resources Agency Tribal Consultation Policy

Under EO B-10-11 it is policy that every state agency and Department subject to executive control to implement effective government-to-government consultation with California Indian Tribes. The purpose of California Natural Resources Agency Tribal Consultation Policy is to ensure effective government-to-government consultation between the Natural Resources Agency, its Departments of the Natural Resources Agency and Indian tribes and tribal communities. It is only by engaging in open, inclusive and regular communication efforts that the interests of California's Tribes and tribal communities will be recognized and understood in the larger context of complex decision-making. The goal of the policy is to engage in the timely and active process of respectfully seeking, discussing and considering the views of California Indian Tribes, Tribal communities and Tribal Consortia in an effort to resolve concerns of as many parties as possible.

E.2.17 California Occupational Safety and Health Administration Standards

The California Division of Occupational Safety and Health Administration (CalOSHA) enforces laws and regulations related to the safety and health of workers in the workplace. Laws and regulations enforced by CalOSHA include regulations related to construction and handling of carcinogens and asbestos (CalOSHA 2020).

E.2.18 California Office of Historic Preservation

The California Office of Historic Preservation (OHP) implements the policies of the NHPA on a Statewide level and maintains the State Historic Resources Inventory database. SHPO is responsible for the operation and management of the OHP and implements historic preservation programs within the State's jurisdiction while serving as a consulting party in the federal process described above.

E.2.19 California Porter-Cologne Water Quality Control Act

The California Porter-Cologne Water Quality Act (Porter-Cologne Act) was enacted in 1969 and established the SWRCB. The Porter-Cologne Act defines water quality objectives as the limits or levels of water constituents that are established for reasonable protection of beneficial uses, described in detail in Appendix H. Unlike the CWA, the Porter-Cologne Act applies to both surface and groundwater. The Porter-Cologne Act requires that each of nine semiautonomous RWQCB establish water quality objectives, while acknowledging that water quality may be changed to some degree without unreasonably affecting beneficial uses. Beneficial uses, together with the corresponding water quality objectives, are defined as standards, according to CWA regulations. Therefore, the regional plans provide the regulatory framework for meeting State and federal requirements for water quality control. Changes in water quality are only allowed if the change is consistent with the most restrictive beneficial use designation identified by the State, does not unreasonably affect the present or anticipated beneficial uses, and does not result in water quality less than that prescribed in the Regional Water Quality Control Plans (Basin Plans) (SWRCB 2022a).

E.2.19.1 State Water Resources Control Board Water Right Decision 1485 (D-1485)

The SWRCB Water Right Decision 1485 (D-1485) amended the water right permits of DWR and Reclamation for the SWP and CVP facilities. The decision was in exercise of the SWRCB's reserved jurisdiction to establish or revise terms and conditions for salinity control and for protection of fish and wildlife, and to coordinate the terms of the various permits for the two projects. The decision established that water quality standards in the Delta must be satisfied prior to any export from the Delta to other areas for any purpose. These standards must be maintained as first priority operating criteria for any and all projects or parts thereof that may be constructed and operated under the permits considered in the decision. It also required the establishment of a monitoring program to ensure collection of the data necessary to measure compliance with the water quality standards (D-1485).

E.2.19.2 State Water Resources Control Board Water Right Decision 1641 (D-1641)

SWRCB Decision-1641 presents the current water right requirements to implement the Delta flow-dependent objectives. In SWRCB Decision-1641, the SWRCB assigned responsibilities to Reclamation and DWR for meeting these requirements. These responsibilities require that the CVP and the SWP be operated to protect water quality, and that DWR and/or Reclamation will ensure that the flow-dependent water quality objectives are met in the Delta (SWRCB 2000).

E.2.20 California State Parks Guidelines

The California State Parks system does not have regulations regarding noise impacts on campgrounds. For CEQA purposes, the park system defines significant adverse noise impacts as an increase above background that would be clearly discernible and objectionable to park users (California Department of Parks and Recreation 2006).

E.2.21 California Water Code Section 13240, Regional Water Quality Control Plans

The California Water Code (Section 13240) requires the preparation and adoption of Regional Water Quality Control Plans (Basin Plans), and the CWA (Section 303) supports this requirement. According to Section 13050 of the California Water Code, Basin Plans consist of a designation or establishment for the waters within a specified area of beneficial uses to be protected, water quality objectives to protect those uses, and an implementation program needed for achieving the objectives. State law also requires that Basin Plans conform to the policies set forth in the Water Code, beginning with Section 13000, and any State policy for water quality control. The Basin Plans are regulatory references for meeting the State and federal requirements for water quality control (40 CFR 131.20). One significant difference between the State and federal programs is that California's basin plans also establish standards for groundwater in addition to surface water.

Basin Plans complement other WQCPs adopted by the SWRCB, such as the WQCP for Temperature Control and Ocean Waters. The SWRCB and the regional water boards maintain each Basin Plan in an updated and readily available edition that reflects the current water quality control programs.

Three different Water Quality Control Plans govern water bodies within the Delta-Mendota Canal (DMC) Subsidence Correction study area.

- The *Central Valley Region Basin Plan* covers the drainage areas of the entire Sacramento and San Joaquin River basins, involving an area bound by the crests of the Sierra Nevada on the east and the Coast Range and Klamath Mountains on the west. The area covered in this WQCP extends some 400 miles, from the California – Oregon border to the headwaters of the San Joaquin River.
- *San Francisco Bay/Sacramento-San Joaquin Delta Estuary Plan* establishes water quality objectives for water bodies within the region to protect beneficial uses. The WQCP includes beneficial uses to be protected, water quality objectives, and a program to help achieve the water quality objectives. This plan supplements other water quality control plans, by the SWRCB and RWQCBs, relevant to the Bay-Delta Estuary watershed. These other plans and policies establish water quality standards and requirements for parameters such as toxic chemicals, bacterial contamination, and other factors which have the potential to adversely affect beneficial uses or cause nuisance conditions (SWRCB 2021). On December 12, 2018, the SWRCB adopted amendments to the Water Quality Control Plan for the San Francisco/Sacramento – San Joaquin Delta Estuary (Bay-Delta Plan) pursuant to Resolution No. 2018-0059. On August 8, 2022, the SWRCB published a Notice of Preparation to announce that they are proposing a regulation that would implement lower San Joaquin River flows and southern Delta salinity objectives in the Bay-Delta Plan. Public comments were solicited for this project in September 2022 (SWRCB 2022b).

- *Water Quality Control Plan for the Tulare Lake Basin* covers the drainage area of the San Joaquin Valley south of the San Joaquin River. The Basin encompasses approximately 10.5 million acres, of which approximately 3.25 million acres are in federal ownership (SWRCB 2021). The WQCP includes existing and potential beneficial uses, water quality objectives, and an implementation plan.

E.2.22 California Water Code, Water Rights

The California Water Code establishes state policy, laws, statutes, and definitions for water rights. The Water Code established the SWRCB, delegating adjudicatory and regulatory functions of the state to the SWRCB in the field of water resources. Regulations pertaining to water law are found in Title 23, Sections 640 to 1024. After the enactment of the State Water Commission Act in 1914, the state required any person or agency seeking to use surface water, without an existing riparian right, to apply for and receive approval for such use from the SWRCB. Water rights permits granted by the SWRCB include detailed descriptions of the amounts, conditions, and construction timetables under which the proposed water project must comply. Prior to permit issuance, the SWRCB must take into account all prior rights and the availability of water in the basin. The SWRCB must also consider the flows needed to preserve in-stream uses such as recreation and fish and wildlife habitat. The SWRCB may impose additional conditions to ensure that these criteria are satisfied, and it may use its continuing authority to enforce and revise the conditions of water right permits over time. The SWRCB is also empowered to revoke a permit or issue cease and desist orders if conditions of the permit are not being met.

E.2.23 Hazardous Waste Control Act

The Hazardous Waste Control Act was passed in 1972 by the State Legislature. The Hazardous Waste Control Law[22] mandates regulatory standards for the generation, handling, processing, storage, transportation, and disposal of hazardous wastes through a "cradle-to-grave" system. The California DTSC and local CUPAs are responsible for administration of the California Hazardous Waste Control Program (California Department of Toxic Substances Control 2018).

E.2.24 Noise Element Guidelines (Health and Safety Code Section 46050.1)

The State of California provides guidance for the preparation of general plans and noise ordinances. In 1976, the State Department of Health Services (now the Department of Public Health) issued *Noise Element Guidelines* (Health and Safety Code Section 46050.1). In 1977, the State Office of Noise Control (ONC) published a model noise ordinance and mandated that each county develop a noise element as part of its general plan (Section 65203[f] of the California Government Code). The purpose of this element is to identify and appraise noise problems in the community. The ONC's model ordinance recommends limits on temporary construction noise levels and operational noise levels in residential, commercial, and industrial areas.

The State's *General Plan Guidelines* recommend that local governments "'analyze and quantify' noise levels and the extent of noise exposure through actual measurement and the use of noise modeling." In addition to other requirements, the guidelines state that "technical data relating to mobile and point sources must be collected and synthesized into a set of noise control policies and programs

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[22] Health and Safety Code Section 25100 et seq.

that 'minimizes the exposure of community residents to excessive noise"' (California Office of Planning and Research [OPR] 2017).

As part of the county-level planning process, analysis of existing conditions and community tolerance for noise are used to dictate the normally acceptable community noise exposure. Measured in dBA, a normally acceptable community noise exposure is used by the State to signify satisfactory land use in relation to noise exposure. Other terms used by the State to analyze community noise exposure are:

- **Normally Acceptable -** Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
- **Conditionally Acceptable -** New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.
- **Normally Unacceptable -** New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
- **Clearly Unacceptable -** New construction or development should generally not be undertaken.

Table E-3 displays land use categories and community noise exposure levels.

Table E-3. Noise Compatible Land Use Planning

Land Use	Normally Acceptable L_{dn} or CNEL (dBA)[1]	Conditionally Acceptable L_{dn} or CNEL (dBA)[1]	Normally Unacceptable L_{dn} or CNEL (dBA)[1]	Clearly Unacceptable L_{dn} or CNEL (dBA)[1]
Residential – Low Density Single Family, Duplex, Mobile Homes	50-60	55-70	70-75	75+
Residential – Multifamily	50-65	60-70	70-75	75+
Transient Lodging – Motels, Hotels	50-65	60-70	70-80	80+
Schools, Libraries, Churches, Hospitals, Nursing Homes	50-70	60-70	70-80	80+
Auditoriums, Concert Halls, Amphitheaters	N/A	50-70	N/A	65+
Sports Arena, Outdoor Spectator Sports	N/A	50-75	N/A	70+
Playgrounds, Neighborhood Parks	50-70	N/A	67-75	72+
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50-75	N/A	70-80	80+
Office Buildings, Business Commercial and Professional	50-70	67-77	75+	N/A
Industrial, Manufacturing, Utilities, Agriculture	50-75	70-80	75+	N/A

Source: OPR 2017

Note:

1 Ranges in the community noise exposure levels (and any subsequent overlaps in the different categories) reflect the differing noise goals of a community, the community's sensitivity to noise, and the community's assessment of the relative importance of noise pollution (OPR 2017).

Key: L_{dn} = day-night average level; CNEL = Community Noise Equivalent Level; dBA = A-weighted decibel scale; N/A – = Not Applicable

E.2.25 Seismic Hazards Mapping Act

The 1990 Seismic Hazards Mapping Act[23] was enacted to minimize loss of life and property from strong ground shaking, liquefaction, landslides, or other ground failures as a result of earthquakes. The Act requires the California Geological Survey (CGS) to identify and map areas with the potential for liquefaction, landslides, or ground shaking. These maps are used by cities and counties in their land use permitting process and to adequately prepare the safety element of their general plans (California Department of Conservation [DOC] 2019). Cities and counties are required to regulate development within mapped Seismic Hazard Zones. Permit review is the primary mechanism for local regulation of development; cities and counties are prohibited from issuing development permits for sites in Seismic Hazard Zones until appropriate site-specific geologic or geotechnical investigations have been carried out, and measures to reduce potential damage have been incorporated into the development plans.

E.2.26 State Scenic Highway Program

California's Scenic Highway Program was created by the Legislature in 1963. Applicable State regulations protecting visual resources stem from the protection of State scenic highways running

23 PRC Section 2690-2699.6.

through or near the project area. There are two officially designated State scenic highway, State Route (SR) 152 and Interstate 5 (I-5) from SR 152 to SR 205 near the City of Tracy, in the area of analysis (Caltrans 2019b). Caltrans has full control and possession of all State highways, and the Scenic Highway Program is under their stewardship as well. Scenic highway legislation establishes the State's responsibility to protect and enhance California's scenic beauty by identifying portions of the State highway system and adjacent scenic corridors, which require special conservation treatment. The legislation also assigns responsibility for regulating land use and development along scenic highways to the appropriate local governmental agencies (Caltrans 2008).

E.2.27 State Water Resource Control Board Hazardous Waste Programs

The California SWRCB is responsible for several programs related to cleanup and management of hazardous waste sites in California including: the Site Cleanup Program, UST Program, Department of Defense Program, and Land Disposal (SWRCB 2018). All of these programs are administered by the Central Valley RWQCB in Merced County (SWRCB 2018). The Cleanup Program regulates unauthorized releases to soils and groundwater, and in some cases surface waters or sediments. The purpose of the UST Program is to "protect public health and safety and the environment from releases of petroleum and other hazardous substances from tanks." The Land Disposal program regulates the discharge of waste "to land for treatment, storage and disposal" (SWRCB 2018).

E.2.28 Surface Mining and Reclamation Act of 1975

The Surface Mining and Reclamation Act (SMARA) of 1975[24] addresses surface mining and requires mitigation to reduce adverse impacts to public health, property, and the environment. Through the law, the State Geologist instated mineral land classifications to help identify and protect mineral resources in the State that may be subject to urban development pressures or other "irreversible land uses" which would inhibit mineral extraction (DOC and State Mining and Geology Board [SMGB] 2007). Following classification by the State Geologist, the SMGB designates lands containing mineral deposits as being of regional or statewide significance (DOC and SMGB 2007).

The SMARA applies to anyone (including a government agency) that disturbs more than one acre or removes more than 1,000 cubic yards of material through surface mining activities, even if activities occur on federally managed lands (DOC and SMGB 2007). Local city and county governments are required to develop ordinances for permitting that provide the regulatory framework for mining and reclamation activities. The SMGB reviews local ordinances to ensure they comply with SMARA (DOC and SMGB 2007).

According to SMARA regulations, the State Geologist shall classify land into Mineral Resource Zones (MRZs) solely on the basis of geologic factors and without regard to existing land use. There are no areas designated as having regional mineral significance within the construction area of the Proposed Action; there are two areas near the Project area that are classified as MRZ-2, or areas of prime importance due to the presence of known economic mineral deposits. One of these sites is located in south City of Tracy in San Joaquin County, approximately half a mile from the DMC; the other is located in the City of Newman in Stanislaus County, approximately a mile from the DMC (DOC 2022). However, neither of these sites are within the DMC ROW.

[24] PRC, Division 2, Chapter 9, Section 2710 et. Seq.

E.3 Local/Regional Requirements

E.3.1 Alameda County General Plan

As required by state law, counties have developed their own general plans. At a minimum, these documents must address the topics of land use, transportation, housing, conservation, open space, noise, and safety. These documents serve as a statement of county goals, policies, standards, and implementation programs for the physical development of a county.

The following goals and policies from Alameda County General Plan are relevant to the DMC Subsidence Correction Project Resources. The Alameda County General Plan was adopted in 2000 (Alameda County 2000).

E.3.1.1 Visual Resources

The Land Use section of the East County Area Plan of the Alameda County General Plan (2000) contains the following goals and policies that pertain to visual resources:

- **Goal:** To preserve unique visual resources and protect sensitive viewsheds.
    - **Policy 105:** The County shall preserve the following major visually-sensitive ridgelines largely in open space use: (1) the ridgelines of Pleasanton, Main, and Sunol Ridges west of Pleasanton; (2) The ridgelines of Schafer, Shell, Skyline, Oak and Divide Ridges west of Dublin and the ridgelines above Doolan Canyon east of Dublin; (3) The ridgelines above Collier Canyon and Vasco Road and the ridgelines surrounding Brushy Peak north of Livermore; (4) The ridgelines above the vineyards south of Livermore; and (5) The ridgelines above Happy Valley south of Pleasanton.

E.3.1.2 Geology and Soils

The Safety Element of the Alameda County General Plan (2000) contains the following goals and policies that pertain to soils, geology, and seismicity:

- **Goal 1:** To minimize risks to lives and property due to seismic and geologic hazards.
    - **Policy P1:** To the extent possible, projects should be designed to accommodate seismic shaking and should be sited away from areas subject to hazards induced by seismic shaking (landsliding, liquefaction, lurking, etc.) where design measures to mitigate the hazards will be uneconomic or will not achieve a satisfactory degree of risk reduction.
    - **Policy P3:** Aspects of all development in hillside areas, including grading, vegetation removal and drainage, should be carefully controlled in order to minimize erosion, disruption to natural slope stability, and landslide hazards.
    - **Policy P4:** Within areas of demonstrated or potential slope instability, development should be undertaken with caution and only after existing geological and soil conditions are known and considered. In areas subject to possible widespread major landsliding, only very low-density development should be permitted, consistent with site investigations; grading in these areas should be restricted to minimal amounts required to provide access.
    - **Policy P11:** All construction in unincorporated areas shall conform to the Alameda County Building Ordinance, which specifies requirements for the structural design of foundations and other building elements within seismic hazard areas.

- **Policy P14:** In order to minimize off-site impacts of hillside development, new construction on landslide-prone or potentially unstable slopes shall be required to implement drainage and erosion control provisions to avoid slope failure and mitigate potential hazards.

- **Goal 3:** To reduce hazards related to flooding and inundation.
  - **Policy P2:** Surface runoff from new development shall be controlled by on-site measures including, but not limited to structural controls and restrictions regarding changes in topography, removal of vegetation, creation of impervious surfaces, and periods of construction such that the need for off-site flood and drainage control improvements is minimized and such that runoff from development will not result in downstream flood hazards.

The Environmental Health and Safety section of the East County Area Plan of the Alameda County General Plan (2000) contains the following goals and policies that pertain to geology, soils, and seismicity:

- **Goal:** To minimize the risks to lives and property due to soil and slope instability hazards.
  - **Policy 307:** The County shall encourage Zone 7, cities, and agricultural groundwater users to limit the withdrawal of groundwater in order to minimize the potential for land subsidence.
- **Goal:** To minimize risks to lives and property due to seismic and geologic hazards.
  - **Policy 309:** The County shall not approve new development in areas with potential for seismic and geologic hazards unless the County can determine that feasible measures will be implemented to reduce the potential risk to acceptable levels, based on site-specific analysis. The County shall review new development proposals in terms of the risk caused by seismic and geologic activity.

E.3.1.3 Utilities and Power

The Public Services and Facilities section of the East County Area Plan of the Alameda County General Plan (2000) contains the following goals and policies that pertain to utilities and power:

- **Goal:** To provide infrastructure and services necessary to accommodate East County holding capacities in a logical, cost-effective, and timely manner.
  - **Policy 221:** Basic rural services should normally be provided by Alameda County and other existing service districts.
- **Goal:** To ensure the prompt and efficient provision of police, fire, and emergency medical facility and service needs.
  - **Policy 241:** The County shall provide effective law enforcement, fire, and emergency medical services to unincorporated areas.
  - **Policy 242:** The County shall reserve adequate sites for sheriff, fire, and emergency medical facilities in unincorporated locations within East County.
  - **Policy 245:** The County shall adhere to the provisions of the Alameda County Fire Protection Master Plan.

- **Goal:** To ensure the safe and efficient disposal or recycling of wastes.
  - **Policy 247:** The County shall conform its solid waste policies and programs to the Recycling Plan prepared by the Recycling Board, and generally coordinate its hazardous and solid waste management with the Alameda County Waste Management Authority's goals, policies, and plans, except to the extent that they are inconsistent with the Initiative or the Recycling Plan.
  - **Policy 249:** The County shall support efforts to provide solid waste resource recovery facilities and household hazardous waste collection facilities convenient to residences, businesses, and industries.
- **Goal:** To provide an adequate, reliable, efficient, safe, and cost-effective water supply to the residents, businesses, institutions, and agricultural uses in East County.
  - **Policy 251:** The County shall work with the Alameda County Flood Control and Conservation District (Zone 7), local water retailers, and cities to develop a comprehensive water plan to assure effective management and long-term allocation of water resources, to develop a contingency plan for potential short-term water shortages, and to develop uniform water conservation programs. The water plan should include a groundwater pump monitoring and cost allocation system in order to facilitate groundwater management and to recover the cost of purchased water stored in the groundwater basin. In developing this plan, the East Bay Regional Park District (EBRPD) shall be consulted regarding potential direct or indirect effects of water use on EBRPD recreation facilities.
  - **Policy 252:** The County shall encourage Zone 7 to pursue new water supply sources and storage facilities only to the extent necessary to serve the rates and levels of growth established by the Initiative and by the general plans of the cities within its service area.
  - **Policy 260:** The County shall require major projects to mitigate projected water consumption by applying one or more Best Management Practices that reduce water consumption off-site.
- **Goal:** To provide efficient and cost-effective sewer facilities and services.
  - **Policy 268:** The County shall continue to pursue adequate sewage export capacity for unincorporated residential, commercial, and industrial development, consistent with the East County Area Plan, through participation in the Tri-Valley Wastewater Authority or by other means.
- **Goal:** To provide efficient, cost-effective, and environmentally sound storm drainage and flood control facilities.
  - **Policy 277:** The County shall work with the Alameda County Flood Control and Water Conservation District (Zone 7) to provide for development of adequate storm drainage and flood control systems to serve existing and future development.
  - **Policy 278:** The County shall promote flood control measures that advance the goals of recreation, resource conservation (including water quality and soil conservation), groundwater recharge, preservation of natural riparian vegetation and habitat, and the preservation of scenic values of the county's arroyos and creeks.

- **Goal:** To provide efficient and cost-effective utilities.
  - **Policy 285:** The County shall facilitate the provision of adequate gas and electric service and facilities to serve existing and future needs while minimizing noise, electromagnetic, and visual impacts on existing and future residents.
  - **Policy 286:** The County shall work with PG&E to design and locate appropriate expansion of gas and electric systems.

E.3.2 Alameda County Code of Ordinances

E.3.2.1 Noise and Vibration

The Alameda County Code (Section 6.60.040) sets exterior noise standards for the county. General limitations state that it is prohibited to create noise which causes the exterior noise level when measured at any single- or multiple-family residence, school, hospital, church, public library in the incorporated or unincorporated area to exceed the noise level standards described below in Table E-4. If measured ambient noise levels exceed the applicable noise level standard in any category above, the applicable standard shall be adjusted so as to equal the ambient noise level.

Table E-4. Single- or Multiple-Family Residence, School, Hospital, Church, or Public Library Properties Noise Standards

Category	Cumulative number of minutes in any one-hour time period	Noise Level Standards, dBA	
		Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
1	30	50	45
2	15	55	50
3	5	60	55
4	1	65	60
5	0	70	65

Source: Alameda County 2022

Note: Noise level standards shall be reduced by 5 dBA for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. If the intruding noise source is continuous and cannot be reasonably discontinued or stopped for a time period to allow for ambient noise level to be measured, the noise level measured while the source is in operation shall be directly compared to the applicable noise level standards.

Key: dBA = decibel A scale

The Alameda County Code (Section 6.60.070.E) states that the provisions of Chapter 6.60 (Noise ordinances) do not apply to noise sources associated with construction, provided said activities do not take place before 7 a.m. or after 7 p.m. on any day except Saturday or Sunday, or before 8 a.m. or after 5 p.m. on Saturday or Sunday.

E.3.2.2 Utilities and Power

Chapter 13 of the Alameda County Code of Ordinances provides the general provisions regarding sewer service systems, stormwater management and discharge control, watercourse protection, underground utility districts, water service system, and more.

E.3.3 Bay Area Air Quality Management District Air Quality Management Plan

The Bay Area Air Quality Management District (BAAQMD) is tasked with regulating stationary sources of air pollution in the nine counties that surround San Francisco Bay: Alameda, Contra

Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, southwestern Solano, and southern Sonoma counties. The air district's *2017 Clean Air Plan* includes a range of control measures designed to decrease emissions of the air pollutants that are most harmful to Bay Area residents: particulate matter, ozone, and toxic air contaminants; to reduce emissions of methane and other "super-GHGs" that are potent climate pollutants in the near-term; and to decrease emissions of carbon dioxide by reducing fossil fuel combustion (BAAQMD 2020). The plan lays the groundwork for a long-term effort to reduce Bay Area GHG emissions 40 percent below 1990 levels by 2030 and 80 percent below 1990 levels by 2050 (BAAQMD 2017).

E.3.4 Fresno County General Plan

As required by state law, Fresno County has developed its own General Plan. The following goals and policies from the *Fresno County General Plan* are relevant to the DMC Subsidence Correction Project resources. The *Fresno County General Plan*, adopted in 2000, established the plan's time horizon as 15 to 25 years (Fresno County 2000).

E.3.4.1 Visual Resources

The Agriculture and Land Use Element of the *Fresno County General Plan* (2000) contains the following goals and policies that pertain to visual resources:

- **Goal OS-K:** To conserve, protect, and maintain the scenic quality of Fresno County and discourage development that degrades areas of scenic quality.
    - **Policy OS-K.1:** The County shall encourage the preservation of outstanding scenic views, panoramas, and vistas wherever possible. Methods to achieve this may include encouraging private property owners to enter into open space easements for designated scenic areas.
    - **Policy OS-K.2**: The County shall identify and map significant scenic resources within the County and shall develop a program to manage these resources.
    - **Policy OS-K.3:** The County should preserve areas of natural scenic beauty and provide for public access to scenic vistas by purchasing sites for park use.
    - **Policy OS-K.4:** The County should require development adjacent to scenic areas, vistas, and roadways to incorporate natural features of the site and be developed to minimize impacts to the scenic qualities of the site.
- **Goal OS-L:** To conserve, protect, and maintain the scenic quality of land and landscape adjacent to scenic roads in Fresno County.
    - **Policy OS-L.6:** The County shall request city, State, and Federal agencies to maintain County-designated landscaped drives, scenic drives, and scenic highways under their jurisdictions in a manner consistent with the goals and policies in this section.
    - **Policy OS-L.7**: The County shall encourage the State of California to landscape urban freeway and highway routes which pass through Fresno County.
    - **Policy OS-L.8:** The County shall encourage cities within Fresno County to develop complementary policies and principles to enhance the visual qualities of streets and highways within their boundaries.

E.3.4.2 Noise and Vibration

The Noise Element of the *Fresno County General Plan* (2000) contains the following goals and policies that pertain to noise and vibration:

- **Goal HS-G:** To protect residential and other noise-sensitive uses from exposure to harmful or annoying noise levels; to identify maximum acceptable noise levels compatible with various land use designations; and to develop a policy framework necessary to achieve and maintain a healthful noise environment.
    - **Policy HS-G.5:** Where noise mitigation measures are required to achieve acceptable levels according to land use compatibility or the Noise Control Ordinance, the County shall place emphasis of such measures upon site planning and project design. These measures may include, but are not limited to, building orientation, setbacks, earthen berms, and building construction practices. The County shall consider the use of noise barriers, such as soundwalls, as a means of achieving the noise standards after other design-related noise mitigation measures have been evaluated or integrated into the program.

E.3.4.3 Hazards/Hazardous Materials

The Health and Safety Element of the *Fresno County General Plan* (2000) contains the following goals and policies that pertain to hazards and hazardous materials:

- **Goal HS-F: To** minimize the risk of loss of life, injury, serious illness, and damage to property resulting from the use, transport, treatment, and disposal of hazardous materials and hazardous wastes.
    - **Policy HS-F.1:** The County shall require that facilities that handle hazardous materials or hazardous wastes be designed, constructed, and operated in accordance with applicable hazardous materials and waste management laws and regulations.
    - **Policy HS-F.2:** The County shall require that applications for discretionary development projects that will use hazardous materials or generate hazardous waste in large quantities include detailed information concerning hazardous waste reduction, recycling, and storage.
    - **Policy HS-F.3:** The County, through its Hazardous Materials Incident Response Plan, shall coordinate and cooperate with emergency response agencies to ensure adequate countywide response to hazardous materials incidents.
    - **Policy HS-F.4:** For redevelopment or infill projects or where past site uses suggest environmental impairment, the County shall require that an investigation be performed to identify the potential for soil or groundwater contamination. In the event soil or groundwater contamination is identified or could be encountered during site development, the County shall require a plan that identifies potential risks and actions to mitigate those risks prior to, during, and after construction.

E.3.4.4 Biological Resources

The Open Space and Conservation Element of the *Fresno County General Plan* (2000) contains the following goals and policies that pertain to biological resources:

- **Goal OS-D**: To conserve the function and values of wetland communities and related riparian areas throughout Fresno County while allowing compatible uses where appropriate. Protection of these resource functions will positively affect aesthetics, water quality, floodplain management, ecological function, and recreation/tourism.
  - **Policy OS-D.1**: The County shall support the "no-net-loss" wetlands policies of the US Army Corps of Engineers, the US Fish and Wildlife Service, and the California Department of Fish and Game. Coordination with these agencies at all levels of project review shall continue to ensure that appropriate mitigation measures and the concerns of these agencies are adequately addressed.
  - **Policy OS-D.2**: The County shall require new development to fully mitigate wetland loss for function and value in regulated wetlands to achieve "no-net-loss" through any combination of avoidance, minimization, or compensation. The County shall support mitigation banking programs that provide the opportunity to mitigate impacts to rare, threatened, and endangered species and/or the habitat which supports these species in wetland and riparian areas.
  - **Policy OS-D.3**: The County shall require development to be designed in such a manner that pollutants and siltation do not significantly degrade the area, value, or function of wetlands. The County shall require new developments to implement the use of Best Management Practices (BMPs) to aid in this effort.
  - **Policy OS-D.4**: The County shall require riparian protection zones around natural watercourses and shall recognize that these areas provide highly valuable wildlife habitat. Riparian protection zones shall include the bed and bank of both low- and high-flow channels and associated riparian vegetation, the band of riparian vegetation outside the high-flow channel, and buffers of 100 feet in width as measured from the top of the bank of unvegetated channels and 50 feet in width as measured from the outer edge of the dripline of riparian vegetation.
- **Goal OS-E**: To help protect, restore, and enhance habitats in Fresno County that support fish and wildlife species so that populations are maintained at viable levels.
  - **Policy OS-E.1**: The County shall support efforts to avoid the "net" loss of important wildlife habitat where practicable. In cases where habitat loss cannot be avoided, the County shall impose adequate mitigation for the loss of wildlife habitat that is critical to supporting special-status species and/or other valuable or unique wildlife resources. Mitigation shall be at sufficient ratios to replace the function, and value of the habitat that was removed or degraded. Mitigation may be achieved through any combination of creation, restoration, conservation easements, and/or mitigation banking. Conservation easements should include provisions for maintenance and management in perpetuity. The County shall recommend coordination with the US Fish and Wildlife Service and the California Department of Fish and Game to ensure that appropriate mitigation measures and the concerns of these agencies are adequately addressed. Important habitat and habitat components include nesting, breeding, and foraging areas, important spawning grounds, migratory routes, migratory stopover areas, oak woodlands, vernal pools, wildlife movement corridors, and other unique wildlife habitats (e.g., alkali scrub) critical to protecting and sustaining wildlife populations.

- **Policy OS-E.10**: The County shall support State and Federal programs to acquire significant fish and wildlife habitat areas for permanent protection and/or passive recreation use.
- **Policy OS-E.11**: The County shall protect significant aquatic habitats against excessive water withdrawals that could endanger special-status fish and wildlife or would interrupt normal migratory patterns.
- **Policy OS-E.12**: The County shall ensure the protection of fish and wildlife habitats from environmentally-degrading effluents originating from mining and construction activities that are adjacent to aquatic habitats.
- **Policy OS-E.13**: The County should protect to the maximum extent practicable wetlands, riparian habitat, and meadows since they are recognized as essential habitats for birds and wildlife.

- **Goal OS-F**: To preserve and protect the valuable vegetation resources of Fresno County.
  - **Policy OS-F.1**: The County shall encourage landowners and developers to preserve the integrity of existing terrain and natural vegetation in visually-sensitive areas such as hillsides and ridges, and along important transportation corridors, consistent with fire hazard and property line clearing requirements.
  - **Policy OS-F.2**: The County shall require developers to use native and compatible non-native plant species, especially drought-resistant species, to the extent possible, in fulfilling landscaping requirements imposed as conditions of discretionary permit approval or for project mitigation.

E.3.4.5 Recreation

The Open Space and Conservation Element of the *Fresno County General Plan* (2000) contains the following goals and policies that pertain to recreation:

- **Goal OS-H**: To designate land for and promote the development and expansion of public and private recreational facilities to serve the needs of residents and visitors.
  - **Policy OS-H.1**: The County shall promote the continued and expanded use of national forest, national park, and other recreational areas to meet the recreational needs of County residents.
  - **Policy OS-H.5**: The County shall encourage Federal, State, and local agencies currently providing recreation facilities to maintain, at a minimum, and improve, if possible, their current levels of service.
  - **Policy OS-H.7**: The County shall encourage the development of public and private campgrounds and recreational vehicle parks where environmentally appropriate. The intensity of such development should not exceed the environmental carrying capacity of the site and its surroundings.
  - **Policy OS-H.8**: The County shall encourage development of private recreation facilities to reduce demands on public agencies.
  - **Policy OS-H.11**: The County shall support the policies of the San Joaquin River Parkway Master Plan to protect the San Joaquin River as an aquatic habitat, recreational amenity, aesthetic resource, and water source.

- **Policy OS-H.13**: The County shall require that structures and amenities associated with the San Joaquin River Parkway be designed and sited to ensure that such features do not obstruct flood flows, do not create a public safety hazard, or result in a substantial increase in off-site water surface elevations, and that they conform to the requirements of other agencies having jurisdiction. For permanent structures, such as bridge overcrossings, the minimum level of flood design protection shall be the greater of the Standard Project Flood (which is roughly equivalent to a 250-year event) or the riverine requirements of other agencies having jurisdiction to ensure flood flows are not dammed and to prevent flooding on surrounding properties.

- **Goal OS-I**: To develop a system of hiking, riding, and bicycling trails and paths suitable for active recreation and transportation and circulation.
  - **Policy OS-I.1**: The County shall develop a countywide Recreational Trail Master Plan, integrated with existing County facilities, similar facilities in cities and adjoining counties, and on State and Federal land. The recreational trail system shall be oriented to providing safe, off-street access from urban areas to regional recreation facilities of countywide importance.
  - **Policy OS-I.14**: The Fresno County General Services Department shall maintain trails located within County parks, along but separated from the roadway, along irrigation canals, flood control channels, abandoned railroad rights-of-way or easements, utility easements, and along floodplains.

E.3.4.6 Geology and Soils

The Agriculture and Land Use Element of the *Fresno County General Plan* (2000) contains the following goals and policies that pertain to geology and soils:

- **Goal LU-A:** To promote the long-term conservation of productive and potentially-productive agricultural lands and to accommodate agricultural-support services and agriculturally-related activities that support the viability of agriculture and further the County's economic development goals.
  - **Policy LU-A.18:** The County shall encourage land improvement programs to increase soil productivity in areas containing lesser quality agricultural soils.
  - **Policy LU-A.19:** The County shall encourage landowners to participate in programs that reduce soil erosion and increase soil productivity. To this end, the County shall promote coordination between the Natural Resources Conservation Service, Resource Conservation Districts, UC Cooperative Extension, and other agencies and organizations.
- **Goal LU-B:** To preserve the unique character of the Westside Rangelands, which includes distinctive geologic and topographic landforms, watersheds, important agricultural activities, and significant biological resources, while accommodating agriculture, grazing, recreation, resource recovery, and other limited uses that recognize the sensitive character of the area.
  - **Policy LU-B.12:** The County shall require a preliminary soils report for discretionary development projects when the project site is subject to moderate or high-risk landslide potential and has slopes in excess of 15 percent. If the preliminary soil report indicates soil conditions could be unstable, a detailed geologic report by a registered geologist and

registered civil engineer, or a registered engineering geologist, shall be required indicating the suitability of any proposed or additional development.

The Health and Safety Element of the *Fresno County General Plan* (2000) contains the following goals and policies that pertain to soil, geology, and seismic hazards:

- **Goal HS-D:** To minimize the loss of life, injury, and property damage due to seismic and geologic hazards.
    - **Policy HS-D.1:** The County shall continue to support scientific geologic investigations that refine, enlarge, and improve the body of knowledge on active fault zones, unstable areas, severe ground shaking, avalanche potential, and other hazardous geologic conditions in Fresno County.
    - **Policy HS-D.2:** The County shall ensure that the General Plan and/or County Ordinance Code is revised, as necessary, to incorporate geologic hazard areas formally designated by the State Geologist (e.g., Earthquake Fault Zones and Seismic Hazard Zones). Development in such areas, including public infrastructure projects, shall not be allowed until compliance with the investigation and mitigation requirements established by the State Geologist can be demonstrated.
    - **Policy HS-D.3:** The County shall require that a soils engineering and geologic-seismic analysis be prepared by a California-registered engineer or engineering geologist prior to permitting development, including public infrastructure projects, in areas prone to geologic or seismic hazards (i.e., fault rupture, ground shaking, lateral spreading, lurchcracking, fault creep, liquefaction, subsidence, settlement, landslides, mudslides, unstable slopes, or avalanche).
    - **Policy HS-D.4:** The County shall require all proposed structures, additions to structures, utilities, or public facilities situated within areas subject to geologic-seismic hazards as identified in the soils engineering and geologic-seismic analysis to be sited, designed, and constructed in accordance with applicable provisions of the Uniform Building Code (Title 24 of the California Code of Regulations) and other relevant professional standards to minimize or prevent damage or loss and to minimize the risk to public safety.
    - **Policy HS-D.8:** The County shall require a soils report by a California-registered engineer or engineering geologist for any proposed development, including public infrastructure projects, that requires a County permit and is located in an area containing soils with high “expansive” or “shrink-swell” properties. Development in such areas shall be prohibited unless suitable design and construction measures are incorporated to reduce the potential risks associated with these conditions.
    - **Policy HS-D.9:** The County shall seek to minimize soil erosion by maintaining compatible land uses, suitable building designs, and appropriate construction techniques. Contour grading, where feasible, and revegetation shall be required to mitigate the appearance of engineered slopes and to control erosion.

E.3.4.7 Utilities and Power

The Public Facilities and Services Element of the *Fresno County General Plan* (2000) contains the following goals and policies that pertain to utilities and power:

- **Goal PF-C:** To ensure the availability of an adequate and safe water supply for domestic and agricultural consumption.
  - **Policy PF-C.9:** The County shall work with local irrigation districts to preserve local water rights and supply.
  - **Policy PF-C.11:** The County shall assure an on-going water supply to help sustain agriculture and accommodate future growth by allocation of resources necessary to carry out the water resource management programs.
  - **Policy PF-C14:** The County shall require that water supplies serving new development meet US Environmental Protection Agency and California Department of Health Services and other water quality and quantity standards.
  - **Policy PF-C.29:** The County shall, in order to reduce excessive water usage, required tiered water pricing within County Service Areas and County Waterworks Districts.
- **Goal PF-D:** To ensure adequate wastewater collection and treatment and the safe disposal of wastewater.
  - **Policy PF-D.2:** The County shall require that any new community sewer and wastewater treatment facilities serving residential subdivisions be owned and maintained by a County Service Area or public entity approved by the County.
- **Goal PF-E:** To provide efficient, cost-effective, and environmentally sound storm drainage and flood control facilities that protect both life and property and to divert and retain runoff for groundwater replenishment.
  - **Policy PF-E.2**: The County shall encourage the agencies responsible for flood control of storm drainage to coordinate the multiple use of flood control and drainage facilities with other public agencies.
  - **Policy PF-E.12**: The County shall coordinate with the local agencies responsible for flood control or storm drainage to ensure that future drainage system discharges comply with applicable State and Federal pollutant discharge requirements.
  - **Policy PF-E.16:** The County shall minimize sedimentation and erosion through control of grading, cutting of trees, removal of vegetation, placement of roads and bridges, and use of off-road vehicles. The County shall discourage grading activities during the rainy season, unless adequately mitigated, to avoid sedimentation of creeks and damage to riparian habitat.
  - **Policy PF-E.21**: The County shall require the use of feasible and practical best management practices (BMPs) to protect streams from the adverse effects of construction activities, and shall encourage the urban storm drainage systems and agricultural activities to use BMPs.
- **Goal PF-F:** To ensure the safe and efficient disposal or recycling of solid waste generated in the county in an effort to protect the public health and safety.

- **Policy PF**-F.**7**: The County has designated the American Avenue Landfill as the regional landfill to serve the incorporated and unincorporated areas of the county. The publicly-operated Coalinga and Clovis landfills may continue to operate provided the sites are operated economically and in compliance with all environmental laws and regulations. Existing publicly-operated landfills may be expanded.

- **Goal PF-G:** To protect life and property by deterring crime and ensuring the prompt and efficient provision of law enforcement service and facility needs to meet the growing demand for police services associated with an increasing population.
  - **Policy PF**-**G.1**: The County shall ensure the provision of effective law enforcement services to the unincorporated areas in the county.
  - **Policy PF-G.2:** The County shall strive to maintain a staffing ratio of two (2) sworn officers serving unincorporated residents per 1,000 residents served. (This count of officers includes all ranks of deputy sheriff personnel and excludes all support positions and all sworn officers serving county wide population interests such as bailiffs, and sworn officers serving contract cities and grant specific populations).
- **Goal PF-H:** To ensure the prompt and efficient provision of fire and emergency medical facility and service needs, to protect residents of and visitors to Fresno County from injury and loss of life, and to protect property from fire.
  - **Policy PF-H.1:** The County shall work cooperatively with local fire protection districts to ensure the provision of effective fire and emergency medical services to unincorporated areas within the county.
- **Goal PF-J:** To provide efficient and cost-effective utilities that serve the existing and future needs of people in the unincorporated areas of the county.
  - **Policy PF-J.1:** The County shall encourage the provision of adequate gas and electric, communications, and telecommunications service and facilities to serve existing and future needs.
  - **Policy PF-J.2**: The County shall work with local gas and electric utility companies to design and locate appropriate expansion of gas and electric systems, while minimizing impacts to agriculture and minimizing noise, electromagnetic, visual, and other impacts on existing and future residents.

E.3.5 Fresno County Code of Ordinances

The Fresno County Code (Section 8.40.040.A) sets exterior noise standards for the county. General limitations state that it is prohibited to create noise which causes the exterior noise level when measured at any affected single- or multiple-family residence, school, hospital, church, or public library to exceed the noise level standards as set forth in Table E-5.

Table E-5. Fresno County Exterior Noise Standards

Category	Cumulative number of minutes in any one-hour time period	Noise Level Standards, dBA	
		Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
1	30	50	45
2	15	55	50
3	5	60	55
4	1	65	60
5	0	70	65

Source: Fresno County 2022
Key: dBA = decibel A scale

The County's ordinance (Section 8.40.060.C) exempts activities with construction, provided such activities do not take place before 6 a.m. or after 9 p.m. on any day except Saturday or Sunday, or before 7 a.m. or after 5 p.m. on Saturday or Sunday are from the other noise provisions in Chapter 8.40 (Noise Control).

E.3.6 Merced County General Plan

As required by State law, counties have developed their own general plans. At a minimum, these documents must address the topics of land use, transportation, housing, conservation, open space, noise, and safety. These documents serve as statements of county goals, policies, standards, and implementation programs for the physical development of a county.

The following goals and policies from the *2030 Merced County General Plan* are relevant to the DMC Subsidence Correction Project resources. The *2030 Merced County General Plan*, adopted in 2013, has established the year 2030 as the plan's time horizon (Merced County 2013).

E.3.6.1 Water Quality

The Water Element contains the following goal and policies related to water quality (Merced County 2013):

- **Goal W-2**: Protect the quality of surface and groundwater resources to meet the needs of all users.
  - **Policy W-2.1**: Ensure that land uses and development on or near water resources will not impair the quality or productive capacity of these water resources.
  - **Policy W-2.2**: Prepare updated development regulations, such as best management practices, that prevent adverse effects on water resources from construction and development activities.
  - **Policy W-2.3**: Encourage the use of natural channels for drainage and flood control to benefit water quality and other natural resource values.
  - **Policy W-2.4**: Encourage agriculture and urban practices to comply with the requirements of the RWQCB for irrigated lands and confined animal facilities, which mandate agricultural practices that minimize erosion and the generation of contaminated runoff to ground or surface waters by providing assistance and incentives

- **Policy W-2.7**: Monitor and enforce provisions of the USEPA NPDES program to control non-point source water pollution.
- **Policy W-2.8**: Coordinate with the SWRCB, RWQCB, and other responsible agencies to ensure that sources of water contamination (including boron, salt, selenium and other trace element concentrations) do not enter agricultural or domestic water supplies and will be reduced where water quality is already affected.

E.3.6.2 Visual Resources

The Natural Resources Element and a Recreation and Cultural Resources Element provide goals and policies for visual resources in the county. The following policies are relevant to the protection of visual resources in the project area:

- **Goal NR-4:** Scenic Resources: Protect scenic resources and vistas.
  - **Policy NR-4.1**: Scenic Resource Preservation: Promote the preservation of agricultural land, ranch land, and other open space areas as a means of protecting the County's scenic resources.
  - **Policy NR-4.2:** Special Review Process for Structures Adjacent to Scenic Highways: Coordinate with Caltrans, during the review of proposed structures and activities located adjacent to State-designated scenic highways, to ensure that scenic vistas and local scenic values are not significantly degraded.
  - **Policy NR-4.4:** New Roads: Consider the surrounding landscape, topography, and existing scenic values when determining the location and construction of new roads.
  - **Policy NR-4.5:** Light Pollution Reduction: Require good lighting practices, such as the use of specific light fixtures that reduce the light pollution, minimize light impacts, and preserve views of the night sky.
- **Goal RCR-1:** Preserve, enhance, expand, and manage Merced County's diverse system of regional parks, trails, recreation areas, and natural resources for the enjoyment of present and future residents and park visitors.
  - **Policy RCR-1.11**: Scenic Resource and Public Land Protection: Encourage the use of regional parks and open space areas as a mechanism to preserve the County's natural scenic beauty and protect land for public purposes.

E.3.6.3 Noise and Vibration

The plan includes noise standards for new noise-sensitive land uses such as residences, hospitals, and churches that are affected by transportation noise sources, as shown in Table E-6 (Merced County 2013). Table E-7 summarizes the interior and exterior noise level standards for noise-sensitive areas affected by existing nontransportation noise sources.

Table E-6. Noise Standards for New Uses Affected by Traffic, Railroad and Airport Noise in Merced County

New Land Use	Sensitive Outdoor Area[1] – L_{dn} (dBA)	Sensitive Indoor Area[2] – L_{dn} (dBA)
All residential[3]	65	45
Transient Lodging[3,4]	65	45
Hospitals & Nursing Homes[3,4,5]	65	45
Theaters & Auditoriums[4]	---	35
Churches, Meeting Halls, Schools, Libraries, etc.[4]	65	40
Office Buildings[4]	65	45
Commercial Buildings[4]	---	50
Playgrounds, Parks, etc.	70	---
Industry[4]	65	50

Source: Merced County 2013

Notes:

[1] Sensitive Outdoor Areas include primary outdoor activity areas associated with any given land use at which noise-sensitivity exists and the location at which the County's exterior noise level standards are applied.

[2] Sensitive Interior Areas includes any interior area associated with any given land use at which noise-sensitivity exists and the location at which the County's interior noise level standards are applied. Examples of sensitive interior spaces include, but are not limited to, all habitable rooms of residential and transient lodging facilities, hospital rooms, classrooms, library interiors, offices, worship spaces, theaters. Interior noise level standards are applied within noise-sensitive areas of the various land uses with windows and doors in the closed positions.

[3] Railroad warning horn usage shall not be included in the computation of Ldn.

[4] Only the interior noise level standard shall apply if there are no sensitive exterior spaces proposed for these uses.

[5] Since hospitals are often noise-generating uses, the exterior noise level standards are applicable only to clearly identified areas designated for outdoor relaxation by either hospital staff or patients.

Table E-7. Nontransportation Noise Standards Median (L_{50}) / Maximum (L_{max})[1]

Receiving Land Use	Outdoor Daytime (dBA)	Outdoor Nighttime (dBA)	Interior Day or Night (dBA)
All residential	55 / 75	50 / 70	35 / 55
Transient Lodging[4]	55 / 75	---	35 / 55
Hospitals and Nursing Homes[5,6]	55 / 75	---	35 / 55
Theaters and Auditoriums[6]	---	---	30 / 50
Churches, Meeting Halls, Schools, Libraries, etc.[6]	55 / 75	---	35 / 60
Office Buildings[6]	60 / 75	---	45 / 65
Commercial Buildings[6]	55 / 75	---	45 / 65
Playgrounds, Parks, etc.[6]	65 / 75	---	---
Industry[6]	60 / 80	---	50 / 70

Source: Merced County 2013

Notes:

[1] These standards must be reduced by 5 dB for sounds consisting primarily of speech or music, and for recurring impulsive sounds. If the existing ambient noise level exceeds the standards in this table, then the noise level standards shall be increased at 5 dB increments to encompass the ambient.

[2] Sensitive Outdoor Areas include primary outdoor activity areas associated with any given land use at which noise-sensitivity exists and the location at which the County's exterior noise level standards are applied.

[3] Sensitive Interior Areas includes any interior area associated with any given land use at which noise-sensitivity exists and the location at which the County's interior noise level standards are applied. Examples of sensitive interior spaces include, but are not limited to, all habitable rooms of residential and transient lodging facilities, hospital rooms, classrooms, library interiors, offices, worship spaces, theaters. Interior noise level standards are applied within noise-sensitive areas of the various land uses with windows and doors in the closed positions.

[4] Outdoor activity areas of transient lodging facilities are not commonly used during nighttime hours.

[5] Since hospitals are often noise-generating uses, the exterior noise level standards are applicable only to clearly identified areas designated for outdoor relaxation by either hospital staff or patients.

[6] The outdoor activity areas of these uses (if any) are not typically used during nighttime hours.

These standards are enforced to protect noise-sensitive land uses in the county and do not pertain to short-term construction noise.

E.3.6.4 Recreation

The Recreation and Cultural Resources Element provides policy context to achieve the county's vision for recreation opportunities. The following goal and policies are relevant to the protection of recreation in the project area:

- **Goal RCR-1:** Preserve, enhance, expand, and manage Merced County's diverse system of regional parks, trails, recreation areas, and natural resources for the enjoyment of present and future residents and park visitors.
    - **Policy RCR-1.1:** Public Recreation Land Use – Encourage the continuation and expansion of existing public recreation land uses, including, but not limited to, public beaches, parks, recreation areas, wild areas, and trails.
    - **Policy RCR-**1.6: Require buffering between nonrecreational land uses and sensitive public recreation lands through site design and other techniques when the nonrecreational land use may significantly impact recreational lands.

- **Policy RCR-**1.7: Consider agriculture as a compatible land use and appropriate buffer for public and private recreation areas.
- **Policy RCR-**1.9: Require that areas proposed for the California Recreational Trails System be reviewed during project proposals for consideration of easements and integration into County recreation facilities.
- **Policy RCR-1.11:** Scenic Resource and Public Land Protection – Encourage the use of regional parks and open space areas as a mechanism to preserve the County's natural scenic beauty and protect land for public resources.
- **Policy RCR-1.12:** Recreation Services – Support recreation services to promote the full use of recreation facilities within their design capacity, and improve connections and access to a wide range of recreation opportunities in order to improve the quality of life for residents and visitors.

E.3.6.5 Geology and Soils

The Health and Safety Element outlines the following goals and policies related to seismic and geologic hazards (Merced County 2013):

- **Goal HS-1:** Minimize the loss of life, injury, and property damage of County residents due to seismic and geologic hazards.
  - **Policy HS-1.1:** Require that all new habitable structures be located and designed in compliance with the Alquist-Priolo Special Studies Zone Act and related State earthquake legislation.
  - **Policy HS-1.2:** Support efforts to obtain financial assistance from Federal and State agencies in order to implement corrective seismic safety measures required for existing County buildings and structures.
  - **Policy HS-1.3:** Require all new structures located within dam inundation areas to conform to standards of dam safety as required by the State Division of Safety of Dams.
  - **Policy HS-1.4:** Require earthquake resistant design for proposed critical structures such as hospitals, fire stations, emergency communication centers, private schools, high occupancy buildings, bridges and freeway overpasses, and dams that are subject to County permitting requirements.
  - **Policy HS-1.5:** Encourage educational programs to inform the public of earthquake dangers in Merced County.
  - **Policy HS-1.6:** Prohibit habitable structures on areas of unconsolidated landslide debris or in areas vulnerable to landslides.
  - **Policy HS-1.7:** Discourage construction and grading on slopes in excess of 30 percent.
  - **Policy HS-1.8**: Require that the provisions of the International Building Code be used to regulate projects subject to hazards from slope instability.
  - **Policy HS-1.9:** Require and enforce all standards contained in the International Building Code related to construction on unstable soils.

The Natural Resources Element addresses goals, objectives, and policies related to soil and mineral resources in the county (Merced County 2013). Applicable policies include:

- **Goal NR-3:** Facilitate orderly development and extraction of mineral resources while preserving open space, natural resources, and soil resources and avoiding or mitigating significant adverse impacts.
  - **Policy NR-3.1:** Protect soil resources from erosion, contamination, and other effects that substantially reduce their value or lead to the creation of hazards.
  - **Policy NR-3.2:** Require minimal disturbance of vegetation during construction to improve soil stability, reduce erosion, and improve stormwater quality.
  - **Policy NR-3.3:** Encourage landowners to participate in programs that reduce soil erosion and increase soil productivity. This shall include promoting and coordinating the efforts of University of California Cooperative Extension, various Resource Conservation Districts, and other similar agencies and organizations.

E.3.6.6 Biological Resources

The main goals and policies governing biological resources falls under the natural resources element at the regional or local level in Merced County and are outlined in the *2030 Merced County General Plan* (Merced County 2013). The most inclusive of these is Goal NR-1, which addresses preservation and protection through private and public sectors for the biological resources in the county.

- **Goal NR-1**: Preserve and protect, through coordination with the public and private sectors, the biological resources of the County.
  - **Policy NR-1.1**: Habitat Protection- Identify areas that have significant long-term habitat and wetland values including riparian corridors, wetlands, grasslands, rivers and waterways, oak woodlands, and vernal pools, and provide information to landowners.
  - **Policy NR-1.2**: Protected Natural Lands- Identify and support methods to increase the acreage of protected natural lands and special habitats, including but not limited to, wetlands, grasslands, and vernal pools, potentially through the use of conservation easements.
  - **Policy NR-1.4**: Important Vegetative Resource Protection- Minimize the removal of vegetative resources which stabilize slopes, reduce surface water runoff, erosion, and sedimentation.
  - **Policy NR-1.5:** Wetland and Riparian Habitat Buffer- Identify wetlands and riparian habitat areas and designate a buffer zone around each area sufficient to protect them from degradation, encroachment, or loss.
  - **Policy NR-1.11**: On-Going Habitat Protection and Monitoring- Cooperate with local, State, and Federal agencies to ensure that adequate on---going protection and monitoring occurs adjacent to rare and endangered species habitats or within identified significant wetlands.
  - **Policy NR-1.12:** Wetland Avoidance- Avoid or minimize loss of existing wetland resources by careful placement and construction of any necessary new public utilities and facilities, including roads, railroads, high speed rail, sewage disposal ponds, gas lines, electrical lines, and water/wastewater systems.
  - **Policy NR-1.13:** Wetland Setbacks- Require an appropriate setback, to be determined during the development review process, for developed and agricultural uses from the delineated edges of wetlands.

- **Policy NR-1.15:** Urban Forest Protection and Expansion- Protect existing trees and encourage the planting of new trees in existing communities. Adopt an Oak Woodland Ordinance that requires trees, larger than a specified diameter, that are removed to accommodate development be replaced at a set ratio.
- **Policy NR-1.17:** Agency Coordination- Coordinate with private, local, State, and Federal agencies to assist in the protection of biological resources and prevention of degradation, encroachment, or loss of resources managed by these agencies.

E.3.6.7 Utilities and Power

The Public Facilities and Services Element of the *2030 Merced County General Plan* (2013) provides the following goals and policies that are relevant to utilities and power:

- **Goal W-1:** Ensure the adequate wastewater collection, treatment, and disposal within the County.
  - **Policy PFS-2.1:** Water and Sewer Expansion – Encourage public sewer system operators to maintain and expand their systems to meet the development needs of the County.
- **Goal PFS-3:** Ensure the management of stormwater in a safe and environmentally sensitive manner through the provision of adequate storm drainage facilities that protect people, property, and the environment.
  - **Policy PFS-3.4**: Agency Coordination – Coordinate with the USACE and other appropriate agencies to develop stormwater detention/retention facilities and recharge facilities that enhance flood protection and improve groundwater recharge.
- **Goal PFS-4**: Ensure the safe and efficient disposal and recycling of solid and hazardous waste generated in the County.
  - **Policy PFS-4.7:** Solid Waste Reduction – Support and promote feasible waste reduction, recycling, and composting efforts.
- **Goal PFS-5:** Ensure the provision of adequate utilities to the residents of Merced County.
  - **Policy PFS-5.1:** Adequate Utility Facilities and Services - Encourage the provision of adequate gas and electric, communications, and telecommunications service and facilities to serve the needs of existing and future residents and businesses
- **Goal PFS-6:** Ensure the provision of timely and adequate law enforcement through proper management and staffing of the Sheriff Department in Merced County.
  - **Policy PFS-6.1:** Encourage optimum staffing levels for both sworn Sheriff Deputies and civilian support staff in order to provide quality law enforcement services in Merced County.
  - **Policy PFS-6.2:** Sheriff Department Response Time Standards – Strive to achieve and maintain appropriate Sheriff Department response times for all call priority levels to provide adequate law enforcement services for all County residents.
- **Goal PFS-7:** Provide adequate fire and emergency medical facilities and services to protect County residents from injury and loss of life, and to protect property from fire.

- o **Policy PFS-7.1**: Fire Staffing and Response Time Standards - Strive to maintain fire department staffing levels and response times consistent with National Fire Protection Association standards.
- o **Policy PFS-7.2:** Fire Protection Service Expansion - Strive to expand fire protection service in areas that are currently underserved or areas that experience growth in order to maintain adequate levels of service.
- o **Policy PFS-7.3:** Water Service Standards - Require all development within unincorporated communities to be served by water supplies, storage, and conveyance facilities supplying adequate volume, pressure, and capacity for fire protection.

E.3.6.8 Cultural Resources

The main goals and policies governing cultural resources at the regional or local level in Merced County are outlined in the *2030 Merced County General Plan* (Merced County 2013). The most inclusive of these is Goal RCR-2, which calls for the protection and preservation of cultural, archaeological, and historic resources to maintain the unique character of Merced County.

E.3.6.9 Hazards/ Hazardous Materials

The Health and Safety Element of the *2030 Merced County General Plan* (2013) provides the following goals and policies that are relevant to hazards and hazardous materials:

- **Goal HS-3:** Minimize the exposure of County residents and public and private property to the effects of urban and wildland fires.
  - o **Policy HS-3.1**: Require adequate water supplies be available for fire suppression prior to occupancy of any structure in urban areas where a public water system does not exist prior to occupancy of any structures located in the County.
  - o **Policy HS-3.5**: Encourage and maintain vegetation "clear zones" around new and existing residential structures in areas designated as having a high or extreme fire hazard severity and assist property owners in identifying how the clear zones should be maintained.
  - o **Policy HS-3.8**: Encourage cluster developments in areas identified as subject to high or extreme fire hazard in order to provide for more localized and effective fire protection measures, such as consolidations of fuel build-up abatement, firebreak maintenance, firefighting equipment access, and water service provision.
  - o **Policy HS-3.10**: Require safe all-weather access for fire and other emergency equipment as part of the subdivisions and building permit application review process.
  - o **Policy HS-3.11**: Encourage the construction of safe all-weather access for fire and emergency equipment to serve existing residential uses in areas designated as having a very high fire hazard severity.
- **Goal HS-5:** Protect Merced County residents, visitors, and property through providing for the safe use, storage, transport, and disposal of hazardous materials and wastes.
  - o **Policy HS-5.1**: Require that hazardous materials are used, stored, transported, and disposed of in a safe manner, in compliance with local, State, and Federal safety standards.

- **Policy HS-5.4**: Require new development and redevelopment proposals that have suspected or historic contamination to address hazards concerns and protect soils, surface water, and groundwater from hazardous materials contamination by conducting Phase I Environmental Site Assessments according to the American Society for Testing and Materials standards and applicable DTSC remediation guidelines. Also, complete additional Phase II Environmental Site Assessments and soil investigations, and any identified or needed remediation when preliminary studies determine such studies are recommended.

E.3.7 Merced County Code of Ordinances

E.3.7.1 Noise

The Merced County Code (Section 10.60.030) sets sound level limitations for the county. General limitations state that no sound source should exceed the background sound level at the receiving property line by 10 dBA or more during the daytime hours (7 a.m. to 10 p.m.) and by 5 dBA or more during the nighttime hours (10 p.m. to 7 a.m.). The maximum permissible sound levels for residential property are 65 dBA L_{dn} or 75 dBA $L_{max.}$ The maximum permissible sound levels for property other than residential property are 70 dBA L_{dn} or 80 dBA L_{max} (Merced County 2009).

The County's ordinance exempts construction activities, "provided that all construction in or adjacent to urban areas shall be limited to the daytime hours between 7 a.m. and 6 p.m., and all construction equipment shall be properly muffled and maintained." Operation of construction equipment outside of these daytime hours or at any time on a weekend day or legal holiday is prohibited (Merced County 2022a).

E.3.7.2 Vibration

Section 18.41.090 of the Merced County Code states that no use shall create any disturbing ground vibration based on typical human reaction beyond the boundaries of the site (Merced County 2022a)

E.3.7.3 Geology, Seismicity, and Soils

The Merced County Code Title 16, Chapter 16.16 requires construction projects within the county's jurisdiction to follow the International Building Code standards and California State Amendments to the code (Ord. 1856 Section 2, 2009). Among other important specifications, the International Building Code includes requirements and standards for geotechnical investigations (Section 1803); excavation, grading, and fill (Section 1804); structural design (Chapter 16); and earthquake loads (Section 1613).

Chapter 18.43 establishes the county's surface mining and reclamation ordinance. Merced's ordinance was certified in 1997. The purpose of the county's ordinance is to regulate surface mining and reclamation operations consistent with the county general plan and the SMARA at the State level. The county's SMARA ordinance was certified by the SMGB in 1997.

Chapter 18.41 of the county code sets performance standards to ensure compatibility between land uses by limiting such things as fumes, odor, noise, and dust. Section 030 covers dust mitigation from construction activities including clearing, grading, earth moving and other site preparation activities. The ordinance requires the application of water to prevent dust from leaving the project site.

E.3.8 Merced County Office of Environmental Services

Emergency preparedness, coordination and direction of wide-scale disasters and emergencies are provided by the Merced County Office of Environmental Services (OES). The Merced County OES coordinates planning, response, recovery, and mitigation activities with many partners including incorporated and unincorporated cities, special districts, and some private agencies. The Merced County OES and their partner agencies coordinate and maintain Emergency Operations Plans according to the National Incident Management System for the County. Contained within the Merced County Emergency Operations Plan is guidance for handling and managing large-scale incidents and disasters including public health threats (Merced County 2022b).

E.3.9 San Joaquin County General Plan

As required by state law, San Joaquin County has developed its own general plan. The following goals and policies are relevant to the DMC Subsidence Correction Project resources. The *San Joaquin County General Plan*, adopted in 2016, has established the year 2035 as the plan's time horizon (San Joaquin County 2016).

E.3.9.1 Visual Resources

The Community Development Element of the *San Joaquin County General Plan* (2016) contains the following goals and policies that pertain to visual resources:

- **Goal LU-8:** Protect open space for its recreational, agricultural, safety, and environmental value and provide adequate parks and open space areas throughout the County.
  - **Policy LU-**8.3: Waterway Conservation and Restoration - The County shall encourage the conservation and restoration of rivers, creeks, and sloughs as multi-functional open space corridors that complement adjoining development and connect city and County recreation facilities (e.g., parks).

The Natural and Cultural Resources Element of the *San Joaquin County General Plan* (2016) contains the following goals and policies that pertain to visual resources:

- **Goal NCR-7:** To protect and enhance the unique scenic features of San Joaquin County.
  - **Policy NCR-7.1:** Scenic Roadways – The County shall protect the visual character of designated scenic roadways.
  - **Policy NCR-7.2:** Views from Public Lands and Roadways - The County shall ensure that views of waterways, hilltops, and oak groves from public land and public roadways are protected and public access is provided to them whenever possible.
  - **Policy NCR-7.3:** Designate Scenic Routes - The County shall preserve scenic views from roadways by designating scenic routes based on the following criteria: leads to a recreational area; provides a representative sampling of the scenic diversity within the County; exhibits unusual natural or man-made features of interest; provides opportunities to view activities outside the normal routine of most people; provides a route for people to view the Delta waterways; and links two scenic routes or connects with scenic routes of cities or other towns.
  - **Policy NCR-7.7:** Reducing Light Pollution - The County shall encourage project designs, lighting configurations, and operational practices that reduce light pollution and preserve views of the night sky.

E.3.9.2 Noise and Vibration

The Public Health and Safety Element of the *San Joaquin County General Plan* (2016) outlines noise level standards in the county. Table E-8 summarizes the noise level standards for noise-sensitive uses (such as residential development, lodging, hospitals, nursing homes, schools, and day care centers) at outdoor activity areas affected by non-transportation noise sources in the County.

Table E-8. Non-Transportation Noise Level Performance Standards for Noise-Sensitive Uses at Outdoor Activity Areas[1]

Noise Level Descriptor	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Hourly Leq dB	50	45
Maximum Level, dB	70	65

Source: San Joaquin County 2016

Notes: These standards apply to new or existing residential areas affected by new or existing non-transportation sources. Each of the noise level standards specified shall be reduced by 5 dB for impulsive noise, single tone noise, or noise consisting primarily of speech or music.

[1] Where the location of outdoor activity areas is unknown or not applicable, the noise standard shall be applied at the property line of the receiving land use. When determining the effectiveness of noise mitigation measures, the standards shall be applied on the receiving side of noise barriers or other property line noise mitigation measures.

Key: dB =decibel; Leq = sound level

E.3.9.3 Hazards/ Hazardous Materials

The Public Health and Safety Element of the *San Joaquin County General Plan* (2016) provides the following goals and policies that are relevant to hazards and hazardous materials:

- **Goal PHS-1:** To maintain a level of disaster preparedness necessary for the protection of public and private property, and the health, safety, and welfare of people living and working in San Joaquin County.
  - **Policy PHS-1.1**: The County shall maintain adequate facilities equipment and staffing to respond effectively to emergencies.
  - **Policy PHS-1.3**: The County shall maintain and implement the following emergency and hazard mitigation plans to provide emergency planning, mitigation, response, and recovery activities to the community:
    - Emergency Operations Plan
    - Mountain House Community Emergency Operations Plan
    - Multi-Hazard Functional Plan
    - Local Hazard Mitigation Plan, and
    - Flood Safety Plan and Contingency Mapping
- **Goal PHS-4**: To minimize the risk of wildland and urban fire hazards.
  - **Policy PHS-4.1**: The County shall maintain and implement the Community Wildfire Protection Plan as a mechanism for community input and identification of areas with high fire hazard risk.

- **Policy PHS-4.3**: The County shall implement State recommendations for fire prevention in Fire Hazard Severity Zones and require new and/or existing development to provide clearance around structures, use fire-resistant ground cover, build with fire-resistant roofing materials, participate in fuel load reduction, and take other appropriate measures.
- **Policy PHS 4.6**: The County shall encourage well-organized and efficient coordination among fire agencies, CalFire, and the County.

- **Goal PHS-7**: To protect County residents, visitors, and property from hazardous materials and wastes.
  - **Policy PHS-7.3**: The County shall require the use, storage, and disposal of hazardous materials and wastes to comply with local, State, and Federal Safety standards.
  - **Policy PHS-7.4**: The County shall maintain and implement the County Hazardous Waste Management Plan.
  - **Policy PHS-7.6**: The County shall require businesses that use or store materials and wastes on-site to prepare Hazardous Materials Management Plans (Business Plans) that map and inventory all hazardous materials and contain contingency plans for accidents, designate an individual or individuals as emergency coordinator(s), and ensure that all employees understand the potential for accidents and the appropriate response. Plans must follow the requirements for Federal, State, and/or local defined special flood hazard areas.
  - **Policy PHS-7.7**: The County shall maintain and implement the County Hazardous Materials Area Plan for emergency response to a release or threatened release of hazardous material within the unincorporated County.
  - **Policy PHS-7.13**: The County shall provide areas for hazardous waste disposal facilities sufficient to meet the needs of the county residents and businesses.

E.3.9.4 Biological Resources

The main goals and policies governing biological resources falls under the natural and cultural resources element at the regional or local level in San Joaquin County and are outlined in the 2016 *San Joaquin County General Plan* (San Joaquin County 2016). The most inclusive of these is Goal NCR-2, which addresses preservation and protection of wildlife habitat areas for the maintenance and enhancement of biological diversity and ecological integrity.

E.3.9.5 Geology and Soils

The Public Health and Safety Element of the *San Joaquin County General Plan* (2016) contains the following goals and policies that pertain to geology, seismicity, and soils:

- **Goal PHS-3:** To protect life and property from seismic and geologic hazards.
  - **Policy PHS-3.5:** Subsidence or Liquefaction - The County shall require that all proposed structures, utilities, or public facilities within County-recognized areas of near-surface subsidence or liquefaction be located and constructed in a manner that minimizes or eliminates potential damage.
  - **Policy PHS-3.6:** Subsidence in the Delta – The County shall promote regional and local efforts to reduce subsidence in the Delta.

- **Policy PHS-3.7:** Erosion Control: The County shall encourage the planting of vegetation to decrease loss of soil by erosion.
- **Policy PHS-3.8:** Soil Conservation and Restoration – the County shall support soil conservation and restoration efforts of the U.S. Soil Conservation Service and the Resource Conservation Districts.

E.3.9.6 Utilities and Power

The Public Facilities and Services Element of the *San Joaquin County General Plan* (2016) contains the following goals and policies that pertain to geology, seismicity, and soils:

- **Goal IS-1:** To provide residents and businesses quality, cost-effective, and sustainable public facilities and services.
  - **Policy IS-1.2:** Infrastructure Standards - The County shall require new developments that include improvements to existing infrastructure or new infrastructure to meet the requirements and standards of the County or other agencies providing services.
- **Goal IS-3:** To increase efficiency of County facilities, services, and operations to conserve resources and reduce greenhouse gas emissions.
  - **Policy IS-3.2:** Sustainable Plans and Operations - The County shall integrate sustainability concepts, greenhouse gas reduction strategies, and climate change resiliency planning into County facility and service plans and operations.
  - **Policy IS-3.5**: New Fleet and Equipment Purchases - The County shall purchase lower-emission and/or electric vehicles and energy efficient equipment when purchasing new fleet vehicles and maintenance/construction equipment.
  - **Policy IS**-3.6**:** Clean Energy and Fuel Sources - The County shall use available clean energy and fuel sources where feasible to operate its buildings, vehicles, and maintenance/construction equipment.
- **Goal IS-4:** To ensure reliable supplies of water for unincorporated areas to meet the needs of existing and future residents and businesses, while promoting water conservation and the use of sustainable water supply sources.
  - **Policy IS-4.1:** Water Agency Support - The County shall support efforts of local water agencies, special district, and water conservation districts to ensure that adequate high-quality water supplies are available to support existing and future residents and businesses.
  - **Policy IS-4.2:** Interagency Cooperation - The County shall work with local water agencies to address existing and future water needs for the County.
  - **Policy IS-4.11**: Integrated Regional Water Management - The County shall support and participate in the development, implementation, and update of an integrated regional water management plan.
  - **Policy IS-4.13:** Water Quality Standards - The County shall require that water supplies serving new development meet State water quality standards. If necessary, the County shall require that water be treated to meet State standards and that a water quality monitoring program be in place prior to issuance of building permits.

- **Goal IS-5:** To maintain an adequate level of service in the water systems serving unincorporated areas to meet the needs of existing and future residents and businesses, while improving water system efficiency.
  - **Policy IS-5.1:** Adequate Water Treatment and Distribution Facilities - The County shall ensure, through the development review process, that adequate water, treatment and distribution facilities are sufficient to serve new development and are scalable to meet capacity demands when needed. Such needs shall include capacities necessary to comply with water quality and public safety requirements.
- **Goal IS-6:** To ensure wastewater treatment facilities and septic systems are available and adequate to collect, treat, store, and safely dispose of wastewater.
  - **Policy IS-6.1:** Wastewater System Maintenance and Expansion - The County shall encourage public wastewater system operators to maintain and expand their systems to meet the development needs of the County.
  - **Policy IS-6.3:** Adequate Wastewater Facilities - The County shall ensure through the development review process that wastewater collection, treatment, and disposal facilities are sufficient to serve existing and new development and are scalable to meet capacity demands when needed.
  - **Policy IS-6.6:** Wastewater Treatment System Standards - The County shall require that the development, operation and maintenance of wastewater treatment systems meet the requirements and standards of the wastewater treatment agency and the County, including the requirements and standards of the County Environmental Health Department.
- **Goal IS-7:** To manage stormwater from existing and future development using methods that reduce potential flooding, maintain natural water quality, enhance percolation for groundwater recharge, and provide opportunities for reuse.
  - **Policy IS-7.1**: Adequate Stormwater Facilities - The County shall require that stormwater drainage facilities are properly designed, sited, constructed, and maintained to efficiently capture and dispose of runoff and minimize impacts to water quality.

The Public Health and Safety Element of the *San Joaquin County General Plan* (2016) contains the following goals and policies that pertain to utilities and power:

- **Goal PHS-4:** To minimize the risk of wildland and urban fire hazards.
  - **Policy PHS-4.6:** Fire Protection Coordination - The County shall encourage well-organized and efficient coordination among fire agencies, CalFire, and the County.

E.3.10 San Joaquin County Development Title

The San Joaquin County Development Title presents noise provisions that all land uses, and properties shall be subject to within the county. Section 9-1025.9, Part C states that noise sources associated with construction, provided such activities do not take place before 6 a.m. or after 9 p.m. on any day, are excluded from the other noise provisions laid out in the chapter.

E.3.11 San Joaquin Valley Air Pollution Control District Air Quality Management Plans

The SJVAPCD has jurisdiction over the San Joaquin Valley Air Basin, which includes O_3, PM_{10}, and $PM_{2.5}$ nonattainment areas.

The air districts have adopted a series of air quality management plans to meet the CAAQS and NAAQS. These plans require, among other emissions-reducing activities, control technology for existing sources; control programs for area sources and indirect sources; a permitting system designed to ensure no net increase in emissions from any new or modified permitted sources of emissions; transportation control measures; sufficient control strategies to achieve a five percent or more annual reduction in emissions (or 15 percent or more in a three-year period) for volatile organic compound (VOC), nitrogen oxides (NO_x), CO, and PM_{10}; and demonstration of compliance with CARB's established reporting periods for compliance with air quality goals.

E.3.12 San Joaquin Valley Air Pollution Control District Programs

The SJVAPCD is the local agency that is primarily responsible for regulating emissions from stationary sources. It also develops plans and implements control measures as required by State and federal requirements. To assist the Lead Agency with analyzing GHG emission and climate change impacts under CEQA, the SJVAPCD adopted two policies:

- "Addressing GHG Emission Impacts for Stationary Source Projects Under CEQA When Serving as the Lead Agency" (SJVAPCD 2009a)
- "Guidance for Valley Land-use Agencies in Addressing GHG Emission Impacts for New Projects under CEQA" (SJVAPCD 2009b)

The SJVAPCD has not adopted a quantitative threshold for evaluating the significance of GHG emissions; however, the SJVAPCD's guidance document for Valley land-use agencies (2009b) would be most relevant for assessing GHG-related impacts from the proposed restoration activities. In this guidance document, the SJVAPCD relies on the implementation of best performance standards (BPS), defined as the most effective achieved-in-practice means of reducing or limiting GHG emissions from a GHG emissions source, for evaluating a project's significance. Projects implementing BPS would be determined to have less than significant individual and cumulative impacts on global climate change.

If a project does not implement BPS, then quantification of project-specific GHG emissions would be required. If project-related emissions would be reduced or mitigated by at least 29 percent compared to business as usual,[25] then the project would be determined to have a less than significant individual and cumulative impact for GHG.

E.3.13 Stanislaus County General Plan

As required by state law, Stanislaus County has developed its own general plan. The following goals and policies from the *Stanislaus County General Plan* are relevant to the DMC Subsidence Correction

[25] Business as usual is referenced in the CARB's AB 32 Scoping Plan as the business-as-usual emissions occurring in 2020 if the average baseline emissions during the 2002-2004 period were grown to 2020 levels, without controls. Therefore, 2002–2004 emissions factors, on a unit of activity basis, multiplied by the activity expected to occur in 2020, is an appropriate representative of 2020 business as usual (BAU)." (SJVAPCD 2009b).

Project resources. The *Stanislaus County General Plan* was adopted in 2016 and has an estimated time horizon of 15 to 30 years (Stanislaus County 2016).

E.3.13.1 Visual Resources

The Conservation/Open Space Element of the *Stanislaus County General Plan* (2016) contains the following goals and policies that pertain to visual resources:

- **Goal 1:** Encourage the protection and preservation of natural and scenic areas throughout the County.
    - **Policy 2:** Assure compatibility between natural areas and development.

E.3.13.2 Geology and Soils

The Land Use Element of the *Stanislaus County General Plan* (2016) contains the following goals, policies, and implementation measures that pertain to soils, geology, and/or seismicity:

- **Policy 4:** Urban development shall be discouraged in areas with growth-limiting factors such as high water table or poor soil percolation, and prohibited in geological fault and hazard areas, flood plains, riparian areas, and airport and private airstrip hazard areas, unless measures to mitigate the problems are included as part of the application.
    - **Implementation Measure 2:** Applications for development in areas with growth-limiting factors such as high water table, poor soil percolation, geological fault areas, flood plains, and airport hazard areas shall include measures to mitigate the problems.

The Conservation/Open Space Element of the *Stanislaus County General Plan* (2016) contains the following policies and implementation measures that pertain to soils, geology, and/or seismicity:

- **Policy 6:** Preserve natural vegetation to protect waterways from bank erosion and siltation.
    - **Implementation Measure 2:** Continue to encourage best management practices for agriculture and coordinate with soil and water conservation efforts of Stanislaus County Farm Bureau, Resource Conservation Districts, the U.S. Soil Conservation Service, and local irrigation districts.
- **Policy 16:** Discourage development on lands that are subject to flooding, landslide, faulting, or any natural disaster to minimize loss of life and property.
    - **Implementation Measure 1:** Enforce the provisions of the Alquist-Priolo Earthquake Fault Zoning Act.
    - **Implementation Measure 3:** Development proposals in an area identified as having unstable soils (bluff, landslide areas in the foothills, etc.) shall include measures for mitigating possible hazards.
    - **Implementation Measure 4:** The County shall enforce the subdivision ordinance requirement for soils reports, which may be required to include a geologic report.
    - **Implementation Measure 5:** The County shall utilize the CEQA process to ensure that development does not occur that would be subject to natural disasters.
    - **Implementation Measure 6:** Development proposals shall be reviewed for conformance with all applicable Hazard Mitigation Plans and consistency with policies of the Safety Element.

The Safety Element of the *Stanislaus County General Plan* (2016) contains the following policies and implementation measures that pertain to soils, geology, and/or seismicity:

- **Policy 3:** Development should not be allowed in areas that are particularly susceptible to seismic hazard.
    - **Implementation Measure 1:** The County shall enforce the Alquist-Priolo Earthquake Fault Zoning Act.
    - **Implementation Measure 2:** Development in areas of geologic hazard shall be considered for approval only where the development includes an acceptable evacuation route.

The Agricultural Element of the *Stanislaus County General Plan* (2016) contains the following policies and implementation measures that pertain to soils, geology, and/or seismicity:

- **Policy 3.7:** The County shall encourage the conservation of soil resources.
    - **Implementation Measure 1:** The County shall continue to provide soil management information and coordinate with soil conservation efforts of local, state, and federal agencies.
    - **Implementation Measure 3:** The County shall continue to refer proposed developments whenever appropriate to Resource Conservation Districts and irrigation districts for their review and analysis of impacts on soil resources.

E.3.13.3 Utilities and Power

The Land Use Element of the *Stanislaus County General Plan* (2016) contains the following goals, policies, and implementation methods that pertain to utilities and power:

- **Goal 4:** Ensure that an effective level of public service is provided in unincorporated areas.
    - **Policy 24:** Future growth shall not exceed the capabilities/capacity of the provider of services such as sewer, water, public safety, solid waste management, road systems, schools, health care facilities, etc.
        - **Implementation Measure 9:** The County will coordinate development with existing irrigation, water, utility, and transportation systems by referring projects to appropriate agencies and organizations for review and comment.

The Conservation/Open Space Element of the *Stanislaus County General Plan* (2016) contains the following goals, policies, and implementation methods that pertain to utilities and power:

- **Goal 7:** Support efforts to minimize the disposal of solid waste through source reduction, reuse, recycle, composting, and transformation activities.
    - **Policy 22:** The County will support the solid waste management hierarchy established by the California Public Resources Code, Section 40051, and actively promote the goals and objectives specified in the Countywide Integrated Waste Management Plan.
    - **Policy 23:** The County will protect existing solid waste management facilities, including the waste-to-energy plant and the Fink Road landfill, against encroachment by land uses that would adversely affect their operation or their ability to expand.

E.3.14 Stanislaus County Code of Ordinances

E.3.14.1 Noise

The Stanislaus County Code[26] sets exterior noise level standards for the county. General limitations state that no sound source should exceed the noise level standards, as described in Table E-9, when measured at any property situated in either the incorporated or unincorporated area of the county. In the event that the measured ambient noise level exceeds the applicable noise level standard above, the ambient noise level shall become the applicable exterior noise level standard.

Table E-9. Exterior Noise Level Standards

Designated Noise Zone	Maximum A-Weighted Sound Level as Measured on a Sound Level Meter (LMAX)	
	Daytime (7 a.m. to 9:59 p.m.)	Nighttime (10 p.m. to 6:59 a.m.)
Noise Sensitive	45	45
Residential	50	45
Commercial	60	55
Industrial	75	75

Source: Stanislaus County 2022

Note: Noise level standards set forth in this table shall be reduced by 5 dBA for pure tone noises, noises consisting primarily of speech or music, or recurring impulsive noise. The noise zone definition of any parcel not located within the four designated noise zones shall be determined by the director of Stanislaus County planning and community development department, or designee, based on the permitted uses of the land use zoning district in which the parcel is located.

Key: Commercial = parcels located within a commercial or highway frontage land use zoning district; Industrial = all parcels located within an industrial land use zoning district; Noise Sensitive = any public or private school, hospital, church, convalescent home, cemetery, sensitive wildlife habitat, or public library regardless of its location within any land use zoning district; Residential = all parcels located within a residential land use zoning district.

Section 10.46.060 of the Stanislaus County Code, which details additional noise standards that apply to some sound sources, states that no person shall operate any construction equipment so as to cause an average sound level greater than 75 dB between the hours of 7 p.m. and 7 a.m. at or beyond the property line of any property upon which a dwelling unit is located.

Section 10.46.080J of the Stanislaus County Code states that the Noise Control provisions outlined in Chapter 10.46 shall not apply to construction or maintenance activities performed by or at the direction of any public entity or public utility.

E.3.14.2 Vibration

Section 10.46.070 of the Stanislaus County Code states that the operation or permit of operation of any device that creates vibration above the vibration perception threshold of any individual at or beyond the property boundary of the source if on private property, or at 150 feet from the source if on a public space is prohibited. "Vibration perception threshold" refers to the minimum ground-borne or structure-borne vibration motion necessary to cause a reasonable person to be aware of the vibration by such direct means as sensation by touch, visual observation of moving objects, a measured motion velocity of 0.01 inches per second over the range of 1 to 100 Hz, or by another means.

[26] Section 10.46.050.

E.4 References

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Appendix F
Existing Conditions
Supporting Information

Appendix F Existing Conditions Supporting Information

This appendix presents the existing conditions for the following resources in the study area: visual quality, hazardous materials, recreation, geology, seismicity, and soils, and utilities and power.

F.1 Visual Quality

The activities described by the Proposed Action would primarily take place within the Delta-Mendota Canal (DMC) right-of-way (ROW), but it is important to consider how those activities would impact the visual character of the landscape surrounding the ROW. The landscape is mostly composed of rural agricultural lands, grassy rolling hills, fields, and roads; occasional structures (industrial, commercial, or residential) are also present along its length, or visible in the distance. Figure F-1 presents a view of the canal and its context in the surroundings.

Source: Numan Mizyed. Taken October 2020

Figure F-1. Bridge at Mile Post 26.21

The DMC's location in the midst of agricultural land makes it prone to low viewership; most of the DMC's viewers are travelers on nearby roads, typically moving at relatively high velocities and therefore not receptive to small visual details. Roads that approach close to the DMC are typically low-trafficked, traveled by people who live or work on the land nearby and not frequented by people driving to or from recreational activities. Interstate 580 (I-580) and Interstate 5 (I-5) are the exceptions to this, as these routes are heavily trafficked.

F.1.1 California State Scenic Highways

There are four segments of designated State Scenic Highways (SSHs) that may be in viewing range of the DMC, and therefore may be impacted by the construction that would occur as a result of the Proposed Action. Because the four segments of SSHs are connected sequentially, they will be referred to collectively as one SSH. The SSH (sections of I-580 and I-5) is located in Alameda, San Joaquin, Stanislaus, and Merced Counties and run parallel to the DMC for approximately 58.8 miles (Caltrans 2018).

To evaluate the relevance of the SSH in the visual resources impact evaluation, a desktop survey was conducted using Microsoft Bing maps to determine the distance of the SSH from the DMC, and whether the DMC is an integral part of the conserved viewshed associated with the SSH. At two-mile intervals along the SSHs, beginning just south of the intersection of I-580 and Interstate 205 (I-205) where the designated SSH originates, the distance from the SSH to the DMC (determined by drawing a perpendicular line from the SSH until it intersected the DMC) was recorded and a qualitative visual analysis was performed using the "streetside view" feature of Google maps. The survey found that the DMC and its associated infrastructure is not clearly visible from any of the 31 sites evaluated along the SSH, and the average distance from the SSH to the DMC is 3,895 feet (0.74 mile). The closest distance between the SSH and the DMC is 593 feet (0.11 mile) at mile 42 of the SSH, and the furthest distance between them is 10,296 feet (1.95 miles) at mile 14 of the SSH.

Although not captured in the desktop survey that recorded visual data every two miles on the SSH, there were two locations found along the length of the SSH at which the DMC is clearly visible. These two locations are the points where the DMC crosses under the SSH. At these locations, the DMC and associated infrastructure is clearly visible before it quickly veers away from the SSH to be hidden from view. Combined, these two locations at which the DMC span approximately 0.24-mile total, which is approximately 0.01 percent of the SSH length.

F.2 Hazards and Hazardous Materials

F.2.1 Hazardous Materials and Waste

A search for hazardous waste, water dischargers, toxin releases, Superfund sites, Brownfields, and Toxic Substances Control Act site was conducted via the U.S. Environmental Protection Agency's (USEPA's) National Environmental Policy Act (NEPA) Assist tool. Within the study area (0.5-mile radius from Project activities), there are at least 50 hazardous waste sites and 10 water discharger sites (USEPA 2022a). Hazardous waste sites are sites that are required, under the RCRA, to provide information about their activities and contain generators, transporters, treaters, storers, or disposers of hazardous waste. Because the area surrounding the DMC is composed primarily of agricultural land, many hazardous waste sites in the vicinity of the study area are associated with agricultural production activities and may include contaminants such as fertilizers, pesticides, or herbicides. Other hazardous waste areas are related to gasoline/petroleum due to the study area's location parallel to I-5, a major highway. Water dischargers are sites such as municipal and industrial wastewater treatment facilities whose discharge of pollutants is tracked by the USEPA through a permitting program. No toxin release, Superfund, Brownfields, or Toxic Substances Control Act sites are present in the study area (USEPA 2022a).

Underground storage tanks (USTs) can pose a risk of hazardous material leakage. Even a small amount of petroleum or hazardous substance leaking from a UST can contaminate surface water, soil, or groundwater. USEPA has developed a UST Finder that contains a national map of underground storage tanks and leaking underground storage tanks. According to this tool, there are seven USTs within the study area (USEPA 2022b). Table F-1 describes these UST facilities and their statuses. There are no currently active leaking underground storage tank cleanup sites within the study area (California State Water Resources Control Board 2022).

Table F-1. Underground Storage Tanks Within the Study Area

Facility Name	Facility ID	Distance from DMC ROW (miles)	Facility Status	Land Use	County/City
Patterson Mobil	CA10731430	0.15	Open UST	Developed, Open Space	Stanislaus/Patterson
Patterson Valero	CA10788715	0.14	Open UST	Developed, Medium Intensity	Stanislaus/Patterson
Rania Oil Company	CA10178527	0.14	Open UST	Developed, Medium Intensity	Stanislaus/Patterson
Chevron Patterson	CA10178541	0.2	Open UST	Non-Developed	Stanislaus/Patterson
Pilot 1080 – Patterson	CA10712407	0.4	Open UST	Developed, Open Space	Stanislaus/Patterson
Chevron #2	CA10497520	0.37	Open UST	Non-Developed	Merced/Gustine
Gustine Shell	CA10497526	0.38	Open UST	Non-Developed	Merced/Gustine

Source: USEPA 2022b
Key: UST = Underground Storage Tank

F.2.2 Wildfire

The study area is located within the San Joaquin Valley, which is at low to moderate risk for wildfire and is mostly not located in a state responsibility area fire hazard severity zone (California Department of Forestry and Fire Protection 2020). The highest potential for wildfire is in the foothills and mountainous areas west of the study area (the Coast Range), which have steep terrain and conditions conducive to volatile wildfires. The topography of the study area is relatively flat, reducing the risk of fast-spreading wildfire. The study area is located almost entirely within non-wildland/non-urban areas, though the potential for a wildfire to occur is present due to its proximity to wildland areas with moderate to high risk of fire.

F.2.3 Airports Tracy Municipal Airport

The Tracy Municipal Airport is owned by the City of Tracy and operated as a Division of the Parks and Recreation Department. The facility is a General Aviation Airport which serves private, business, and corporate tenants and customers within the Central Valley and I-5 corridor (City of Tracy 2022). From February 2019 to February 2020, the facility fielded operations of an average of 161 aircrafts per day. Approximately two-thirds of these operations were transient general aviation, one-third were local general aviation, and less than one percent were air taxi operations (AirNav 2022).

F.3 Recreation

Recreational facilities are located within Stanislaus County, Merced County, and Fresno County. Figure F-2 shows the immediate and surrounding recreation facilities along the DMC. The only recreational facility within the DMC ROW that has the potential to be impacted by Project activities is the Mendota Pool Park, located at the terminus of the DMC in Fresno County. Mendota Pool Park includes 20.3 acres of trail and a main picnic area spanning approximately 0.5 miles. The primary activities available at the park include trail walking, picnicking, and fishing (Mapcarta n.d.). In addition to the Mendota Pool Park, there are several reservoirs offering recreational activities that may be impacted by changes to operations under the Proposed Action. These reservoirs are described below:

Folsom Lake

Folsom Lake State Recreation Area is located in the Sierra-Nevada foothills about 25 miles east of Sacramento. The lake and recreation areas offer opportunities for hiking, biking, camping, horseback riding, and water-based recreation: swimming, water-skiing, boating, and fishing. The lake has a surface area of 11,500 acres and 75 miles of shoreline (California Department of Parks and Recreation [CDPR] 2022a).

Lake Oroville

Lake Oroville is located five miles northeast of the City of Oroville within the Lake Oroville State Recreation area in the western foothills of the Sierra Nevada. The lake and recreation area offers opportunities for camping, hiking, horseback riding, and water-based recreation: swimming, water-skiing, boating, and fishing. At its maximum elevation, the lake includes approximately 15,500 surface acres for recreation and 167 miles of shoreline (CDPR 2022b).

Shasta Lake

The Shasta Unit is one of three units that comprise Whiskeytown – Shasta-Trinity National Recreation Area. Shasta Lake, located 10 miles north of Redding, forms the core of the Shasta Unit and offers recreationists opportunities for hiking, camping, mountain biking, and water-based recreation: water-skiing, boating, swimming, and fishing. Shasta lake has a surface area of 30,000 acres with 370 miles of shoreline (United States Department of Agriculture, United States Forest Service 2022).

San Luis Reservoir

San Luis Reservoir State Recreation Area is located five miles west of Interstate-5 in the hills of the western San Joaquin Valley near Pacheco Pass. San Luis Reservoir offers opportunities for camping, picnicking, hiking, boating, and fishing. San Luis Reservoir has a surface area of 12,700 acres with 65 miles of shoreline (CDPR 2022c).

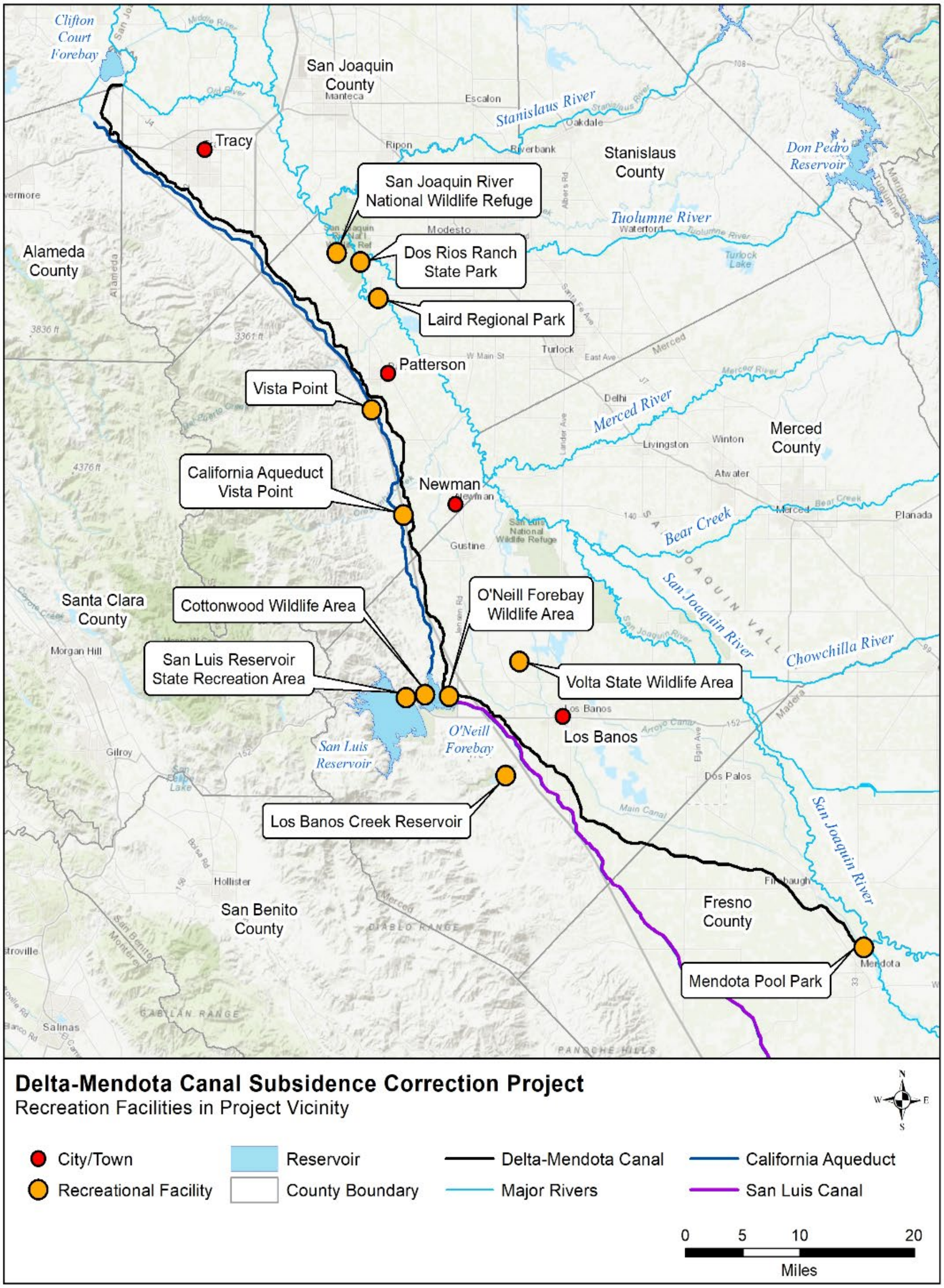


Figure F-2. Recreation Facilities Near the Delta-Mendota Canal

F.4 Geology, Seismicity, and Soils

F.4.1 Geology

The DMC is located in the Great Valley geomorphic province and is bordered on the east by the Sierra Nevada geomorphic province and on the west by the Coast Ranges geomorphic province. The Great Valley is an alluvial plain of two major rivers – the San Joaquin and Sacramento Rivers – and their tributaries, about 50 miles wide and 400 miles long in the central part of California. The northernmost part of the Great Valley is termed the Sacramento Valley and its southernmost part is the San Joaquin Valley. The Great Valley is a trough in which sediments have been deposited almost continuously since the Jurassic era (about 160 million years ago). Oil fields have been found in the southern part of the San Joaquin Valley and along anticlinal uplifts on its southwestern margin (California Geological Survey [CGS] 2002).

The geology of the Great Valley is mostly composed of marine and continental sedimentary rocks that date back to the Pleistocene-Holocene era. The geology of the Project area, which lies within the Great Valley, is characterized by formations of alluvium, lake, playa, and terrace deposits that are unconsolidated and semi-consolidated, in addition to Pliocene and/or Pleistocene sandstone, shale and gravel deposits that are loosely deposited (CGS 2015a).

F.4.1.1 Paleontological Resources

As defined in the Paleontological Resources Preservation Act of 2009, the term "paleontological resource" refers to any fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of life on earth. In general, fossils are greater than 5,000 years old (middle Holocene) and are typically preserved in sedimentary rock, although preservation in low-grade metamorphic rocks and volcanic rocks can occur under certain conditions. Paleontological sensitivity is defined as the potential for a geologic unit to produce scientifically significant fossils. This is determined using a qualitative measurement of fossil data, including rock type, history of the geologic unit in producing significant fossils, and fossil localities that are recorded from that geologic unit. In areas of high sensitivity, full-time monitoring by a professionally trained paleontologist is recommended during any type of ground disturbance (Society of Vertebrate Paleontology [SVP] 2010).

A record search of the University of California Museum of Paleontology (UCMP) databases found that there have been many invertebrate fossils found in Alameda, San Joaquin, Stanislaus, Merced, and Fresno counties at varying distances from the DMC (UCMP 2022). Because there have been fossils discovered in the vicinity of the canal and the canal is located in an area characterized by formations of alluvium deposited during the Pleistocene-Holocene era, the Project area is considered to be in a moderately high paleontologically sensitive area based on sensitivity evaluation techniques described by the SVP (SVP 2010).

F.4.2 Soil

The Project area is located within the San Joaquin Valley, which has a history of significant regional land subsidence; between 1926 and 1970, land subsidence exceeding 27 feet (8.5 meters) was recorded in the most affected regions of the valley (Poland et al. 1975). Between 2003-2010, the northern portion of the DMC remained relatively stable whereas the southern portion was impacted by a large subsidence feature south of the town of El Nido. The most affected area extends from around Merced to Mendota, and the maximum subsidence was at least half a meter between the years of 2008-2010 (United States Geological Survey [USGS] 2013). According to the Bureau of

Reclamation's *Delta-Mendota Canal Subsidence Project – Feasibility Study of Structural Alternatives*, completed in 2021, regional groundwater use is anticipated to allow for an additional two feet of inelastic subsidence in the Central Valley until full implementation of the Sustainable Groundwater Management Act (SGMA), with residual elastic subsidence forecast to continue through the design life of the canal. Thus, the conveyance capacity of the DMC is expected to continue decreasing as a result of regional land subsidence until at least 2040.

F.4.2.1 Expansive Soils

Expansive properties, or linear extensibility, refer to a soil's potential to experience considerable changes in volume, either shrinking or swelling, with changes in moisture content (Mokhtari and Dehghani 2012). Therefore, the expansive nature of soils is characterized by their shrink-swell capacity. Changes in soil volume/linear extensibility are often expressed as a percentage, and in soil surveys the percentage represents the overall change for the whole soil.

Soils composed primarily of sand and gravel are not considered expansive (i.e., the soil volume does not change with a change in moisture content). Soils containing clay may possess expansive characteristics. The magnitude of shrink-swell capacity in expansive soils is influenced by the amount of expansive silt or clay in the soil, thickness of the expansive soil zone, climate, and thickness of the active zone (depth at which the soils are not affected by dry or wet conditions). When expansive soils swell, the change in volume can have significant impacts of the loads that are placed on them, such as buildings, and can result in structural distress or damage (Mokhtari and Dehghani 2012).

Soils are classified as having low, moderate, high, and very high potential for volume changes. The linear extensibility is expressed by percentages; the range of valid values is from zero to 30 percent (U.S. Department of Agriculture [USDA] Natural Resources Conservation Service [NRCS] 2022). Table F-2 summarizes shrink-swell classes and the associated linear extensibility percentage. If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures (USDA NRCS 2022).

Table F-2. Shrink-Swell Classes

Shrink-Swell Class	Linear Extensibility
Low	<3%
Moderate	3-6%
High	6-9%
Very High	>9%

USDA NRCS 2022

Soils in the Project area are mostly in the moderate to very high shrink-swell classes due to the high amount of clay that is present; see Section F.4.2.3 for more details. These classifications are strongly correlated with the land subsidence occurrences that characterize the San Joaquin Valley; the expansive properties of the soils in this Project area are highly susceptible to volume changes and therefore conducive to subsidence.

F.4.2.2 Soil Stability

Soil stability refers to the capacity of land to limit the redistribution and loss of soil resources by wind and water. Land that experiences little soil movement is characterized as being stable; land that experiences some soil movement is characterized as moderately stable; and land that undergoes large amounts of soil movement is characterized as unstable (Deng and Du 2011).

Wind Erodibility Index

The wind erodibility index, as reported by USDA NRCS, is a numerical value indicating the susceptibility of soil to wind erosion, measured in the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion. Soils are typically vulnerable to wind erosion when: the soil is dry, loose, and finely granulated; the soil surface is smooth with little or no vegetation present; fields are sufficiently large, and therefore susceptible to erosion; and there is sufficient wind velocity to move soil. Soils that are fall into these categories and are most vulnerable to windblown erosion are coarser textured soils like sandy loams, loamy sands, and sands. Usually soils that have high wind erodibility have lower linear extensibility, and vice versa (USDA NRCS 2022). Table F-3 summarizes the wind erodibility class and associated tons per acre per year that are lost to wind erosion.

Table F-3. Wind Erodibility Classes

Wind Erodibility Class	Wind Erosion (tons per acre per year)
Low	0 - 56
Moderate	57 - 180
High	181 – 310
Very High	>310

Source: USDA NRCS 2022

F.4.2.3 Soils Within the Project Area

Upper Reach of the Delta-Mendota Canal: Alameda, Contra Costa, San Joaquin, Stanislaus, and Merced Counties

The upper reach of the DMC (the portion north of San Luis Reservoir) passes through the southeastern corner of Contra Costa County, the northeastern corner of Alameda County, San Joaquin County, Stanislaus County, and Merced County. These areas are characterized by mostly loamy clay, gravelly clay loam, and clay soils, which fall into the moderate to very high shrink-swell classes but have relatively low wind erodibility. These soils are not flooded frequently and are moderately well drained. Table F-4 describes the main soil types that characterize the upper reach of the DMC.

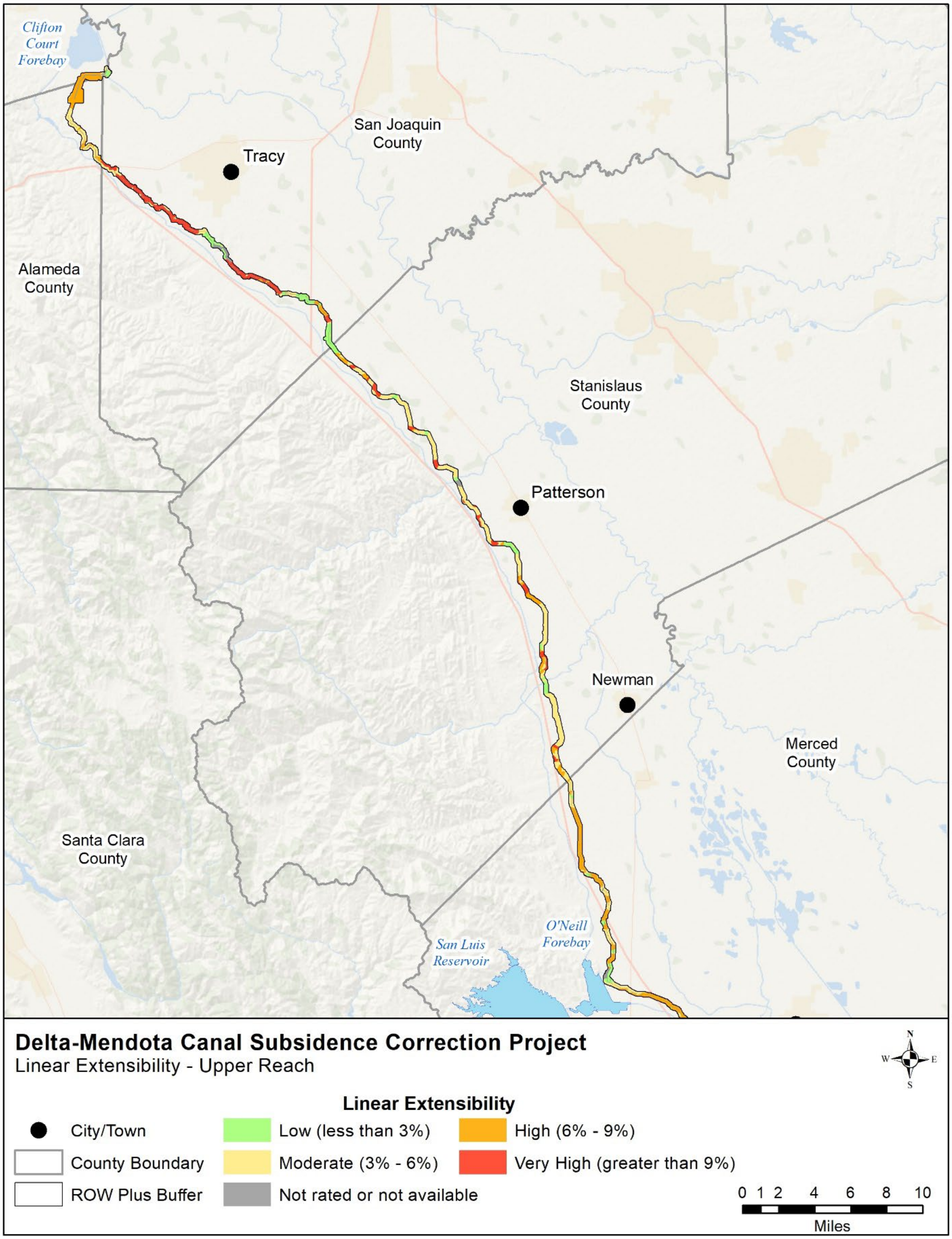
Table F-4. Predominant Soil Types of the Upper Delta-Mendota Canal Area

Map Unit Symbol	Description	Linear Extensibility (%)/Shrink-Swell Class	Wind Erodibility (tons per acre per year)
118	Capay clay	10.4 (Very High)	86 (Moderate)
282	Zacharias gravelly clay loam	4.5 (Moderate)	38 (Low)
120	Vernalis-Zacharias complex	4.5 (Moderate)	48 (Low)
253	Stanislaus clay loam	7.5 (High)	86 (Moderate)
277	Woo clay loam	4.5 (Moderate)	48 (Low)
301	Damluis clay loam	7.5 (High)	86 (Moderate)
130	Stomar clay loam	7.5 (High)	48 (Low)
125	Vernalis clay loam	4.5 (Moderate)	48 (Low)
156	El Solyo clay loam	5.0 (Moderate)	48 (Low)
161	Damluis clay loam	7.5 (High)	86 (Moderate)

Source: USDA NRCS 2022

Note: Organized in the order of greatest percentage within the Project area. Only the 10 most prevalent soil types are listed here, although many more exist in small amounts in this area.

Figure F-3 depicts the linear extensibility properties of soils in the upper DMC area.



Source: USDA NRCS 2022

Figure F-3. Upper Reach of the Delta-Mendota Canal: Soil Linear Extensibility

Lower Reach of the Delta-Mendota Canal: Merced and Fresno Counties

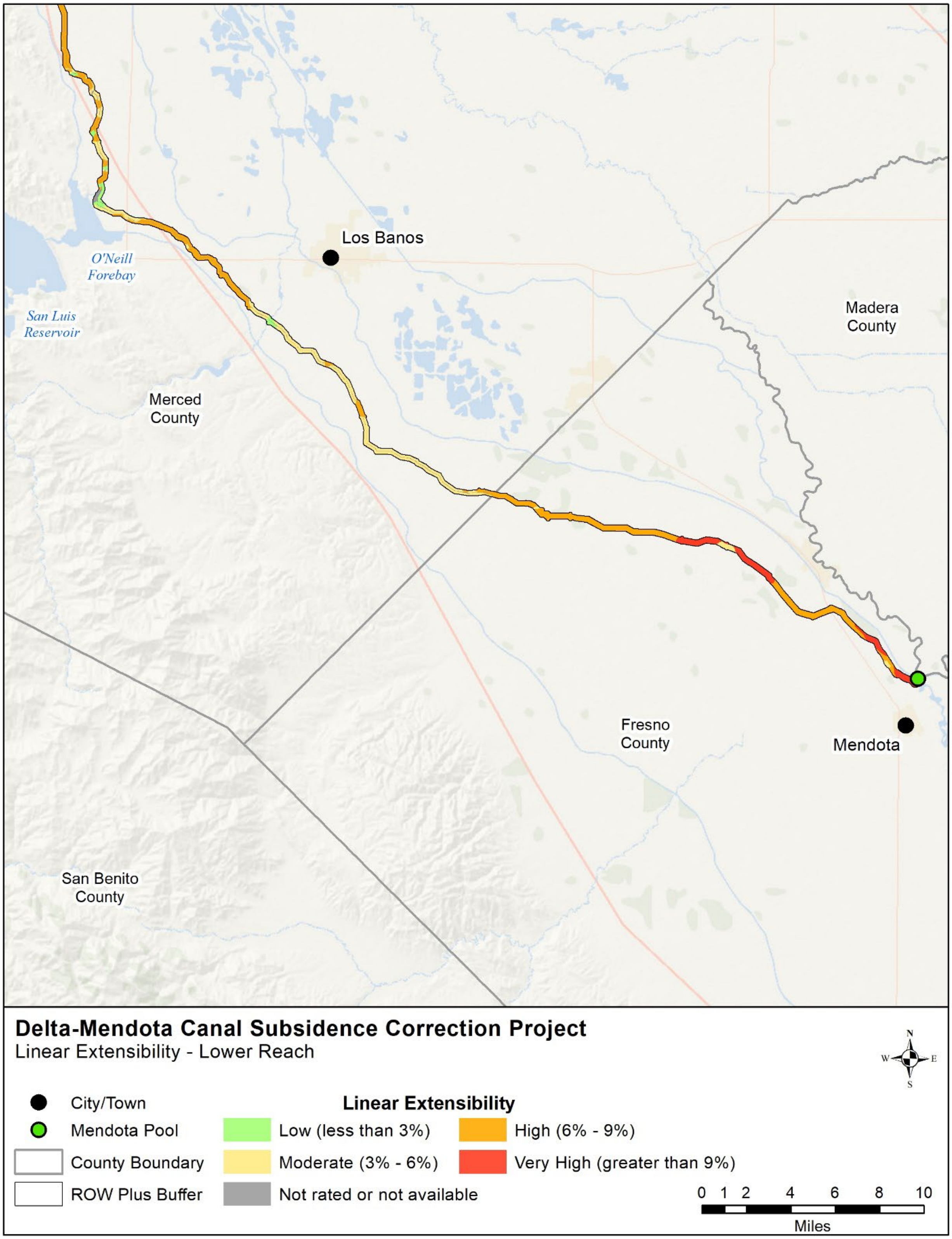
The lower reach of the DMC (the portion south of San Luis Reservoir) passes through central Merced County and the northwestern portion of Fresno County. Soils in this area are mostly saline-sodic soils (soils with excessive levels of soluble salt in the soil water), clay, and clay loam soils. These soils are characterized as being highly expansive, as the majority of the soils are in the high or very high shrink-swell classes with low to moderate wind erodibility indices. Table F-5 describes the predominant soil types that characterize the lower reach of the DMC. Figure F-4 depicts the linear extensibility properties of soils in the lower DMC area.

Table F-5. Predominant Soil Types of the Lower Delta-Mendota Canal Area

Map Unit Symbol	Description	Linear Extensibility (%)/Shrink-Swell Class	Wind Erodibility (tons per acre per year)
285	Tranquility-Tranquility, wet, complex, saline-sodic	11.0 (Very High)	86 (Moderate)
470	Chateau clay, partially drained	8.0 (High)	86 (Moderate)
167	Deldota clay, partially drained	7.5 (High)	86 (Moderate)
472	Wekoda clay, partially drained	12.0 (Very High)	86 (Moderate)
280	Woo clay	7.5 (High)	86 (Moderate)
277	Woo clay loam	4.5 (Moderate)	48 (Low)
468	Deldota clay, partially drained	8.0 (High)	86 (Moderate)
282	Tachi clay	15.1 (Very High)	86 (Moderate)
253	Stanislaus clay loam	7.5 (High)	86 (Moderate)
148	Carranza-Woo	4.5 (Moderate)	38 (Low)

Source: USDA NRCS 2022

Note: Organized in the order of greatest percentage within the Project area. Only the ten most prevalent soil types are listed here, although many more exist in small amounts in this area.



Source: USDA NRCS 2022

Figure F-4. Lower Reach of the Delta-Mendota Canal: Soil Linear Extensibility

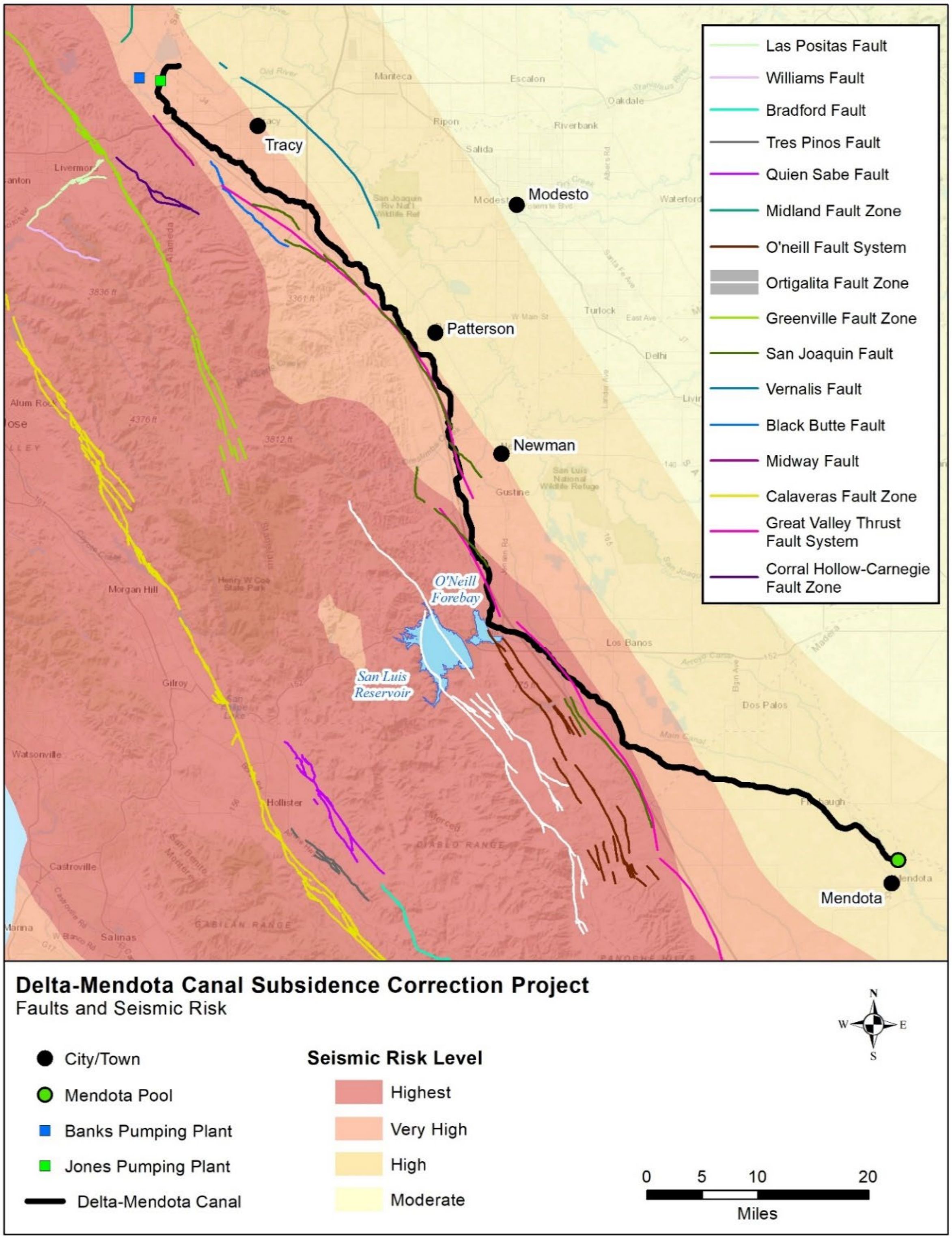
F.4.3 Seismicity

Seismic hazards are earthquake fault ground rupture and ground shaking (primary hazards) and liquefaction and earthquake-induced slope failure (secondary hazards).

F.4.3.1 Faults

The DMC, especially the upper reach, is located in one of the most seismically active regions of the United States. Major earthquakes have occurred in this vicinity of the Project area in the past and can be expected to occur again in the future. Although the faults closest to the Project area are not of the highest probability to experience a major earthquake, the region is susceptible to less severe impacts caused by more severe earthquakes likely to occur northwest of the Project area (USGS 2003).

The Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) was signed into California law in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. As defined under the Alquist-Priolo Act, an active fault is one that has had surface displacement within the Holocene time (about the last 11,000 years). An early Quaternary fault is one that has had surface displacement during the Quaternary time (the last 1.6 million years) (Hart and Bryant 2007). While none of the designated Alquist-Priolo Faults intersect the DMC, there are three that are within a 20-mile radius of it (Hart and Bryant 2007). Relevant faults, both designated by the Alquist-Priolo Act and not designated, are mapped in Figure F-5.



Source: USGS 2022a, Hart and Bryant 2007

Note: Fault zones that have been designated by the Alquist-Priolo Act are the Calaveras Fault Zone, Greenville Fault Zone, and Ortiga Fault Zone. All faults listed in the table are classified as Class A, meaning that there is geologic evidence that demonstrates the existence of each fault.

Figure F-5. Fault Lines in the Project Area

F.4.3.2 Seismic Hazards

The California Seismic Hazards Program delineates areas prone to ground failure and other earthquake-related hazards including soil liquefaction, earthquake-induced landslides, surface fault ruptures, and tsunami inundation. Earthquake fault zones identify areas in which buildings for human occupancy are not permitted to be constructed; liquefaction zones identify where the stability of foundation soils must be investigated, and require countermeasures to be undertaken in the design and construction of buildings for human occupancy; and landslide zones identify where the stability of hillslopes must be evaluated, and require countermeasures to be undertaken in the design and construction of buildings for human occupancy (California Department of Conservation [DOC] 2019).

Liquefaction

Liquefaction is a phenomenon in which the strength and stiffness of unconsolidated sediments are reduced by earthquake shaking or other rapid loading. Soils that are considered the most susceptible to liquefaction are poorly consolidated, water-saturated fine sands and silts having low plasticity and groundwater sources located within 50 feet of the ground surface. Along the upper reach of the DMC (within Contra Costa, Alameda, San Joaquin, and Stanislaus counties), nearby groundwater levels are mostly between 100 to 200 feet below the land's surface; however, in the lower reach of the DMC (within Merced and Fresno counties), nearby groundwater levels range from zero to 100 feet below the land's surface (California's Groundwater Live 2022). Although some groundwater sources surrounding the lower DMC are located within 50 feet of the ground's surface, the analysis of soil types in the Project area, as discussed in Section F.4.2.3, demonstrated that fine sands and silts are not present in significant amounts and, therefore, liquefaction susceptibility is expected to be low.

Landslides

A landslide is the movement of a mass of rock, debris, or earth down a slope. The term encompasses five modes of slope movement: falls, topples, slides, spreads, and flows. Most landslides occur as a result of multiple causes; causes include factors that increase the effects of down-slope forces and factors that contribute to low or reduced strength. Examples of these kinds of factors include rainfall, snowmelt, changes in water level, stream erosion, changes in groundwater, earthquakes, volcanic activity, disturbance by human activities, or any combination of these factors (USGS 2022b). Because the presence of a slope is necessary for a landslide to occur, the Project area is at low risk of experiencing the impacts of a landslide due to its location away from dramatic slopes. Additionally, the DOC has not identified any landslides that have occurred within 10 miles of the Project area (CGS 2015b).

F.5 Public Utilities

There are multiple facilities along the DMC that either use power to pump water, generate power by releasing water, or perform a combination of the two. These facilities include the C.W. "Bill" Jones Pumping Plant, O'Neill Pumping-Generating Plant, San Luis/W.R. Gianelli Pumping-Generating Plant, and the DMC / California Aqueduct Intertie Pumping Plant. Most residents of the areas immediately surrounding the DMC rely on water diverted from the DMC or water from private groundwater wells as their primary water supply.

There are 20 landfills located within a 40-mile radius of the DMC. Table F-6 presents the names, available capacity and/or dumping requirements, and distance from the DMC of the relevant landfills near the Project area.

Table F-6. Landfills in the Vicinity of the Project Area

County	Landfill Name	Available Capacity and/or Dumping Restrictions	Anticipated Ceased Operation Date	Distance to Nearest Point of DMC (miles)
Contra Costa	Brentwood Transfer Station	800 CY* per day	Not Available	20
Alameda	Altamont Landfill and Resource Recovery	65,400,000 CY available as of June 30, 2016. Limited to dumping 22,300 CY* per day	December 1, 2070	4
Alameda	Vasco Road Sanitary Landfill	7,379,000 CY as of October 31, 2016. Limited to dumping 5,036 CY* per day	December 31, 2022	8
Alameda	Pleasanton Garbage Service	1,440 CY* per day	Not Available	16
San Joaquin	Tracy Material Recovery & Transfer Station	Max Permit Capacity: 40,000 CY	Not Available	<1
San Joaquin	Lovelace Transfer Station	3,918 CY* per day	Not Available	17
Stanislaus	Fink Road Landfill	7,184,701 CY as of March 1, 2017. Limited to dumping 4,800 CY* per day	December 1, 2023	1
Stanislaus	Bertolotti Transfer and Recycling Center	2,500 CY* per day	Not Available	13
Merced	Billy Wright Landfill	11,370,000 CY as of September 30, 2010. Limited to dumping 3,000 CY* per day	December 31, 2054	2
San Benito	John Smith Road Landfill	1,921,000 CY as of April 30, 2021	August 1, 2025	29
Madera	Mammoth Recycling Facility and Transfer Station	1,000 CY* per day	Not Available	22

County	Landfill Name	Available Capacity and/or Dumping Restrictions	Anticipated Ceased Operation Date	Distance to Nearest Point of DMC (miles)
Fresno	Road Maintenance Area One, Firebaugh	3,900 CY per year	Not Available	<1
Fresno	Mid Valley Disposal	9,200 CY* per year	Not Available	18
Fresno	Road Maintenance Area Four, Biola	3,900 CY per year	Not Available	19
Fresno	Allan Company	2,500 CY* per day	Not Available	33
Fresno	Mid Valley Recycling (Elm Avenue)	4,000 CY* per day	Not Available	34
Fresno	Cedar Avenue Recycling and Transfer Center	6,200 CY* per day	Not Available	34
Fresno	Rice Road Recyclery and Transfer Station	1,200 CY* per day	Not Available	34
Fresno	Kroeker Inc. Recycling Facility	15,000 CY* per day	Not Available	36
Fresno	Green Valley Recycling	2,500 CY* per day	Not Available	36

Source: California Department of Resources Recycling and Recovery (CalRecycle) 2019

Note: Asterisk indicates that CY was calculated based on the number of tons permitted. The conversion factor between tons and CY was based on the Federal Emergency Management Act (FEMA) Debris Estimating Field Guide (Federal Emergency Management Act [FEMA] 2010), where 1 ton of construction and demolition debris is equal to 2 CY.

Key: CY = cubic yard, inc. = incorporated

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Appendix G
Water Supply Technical Appendix

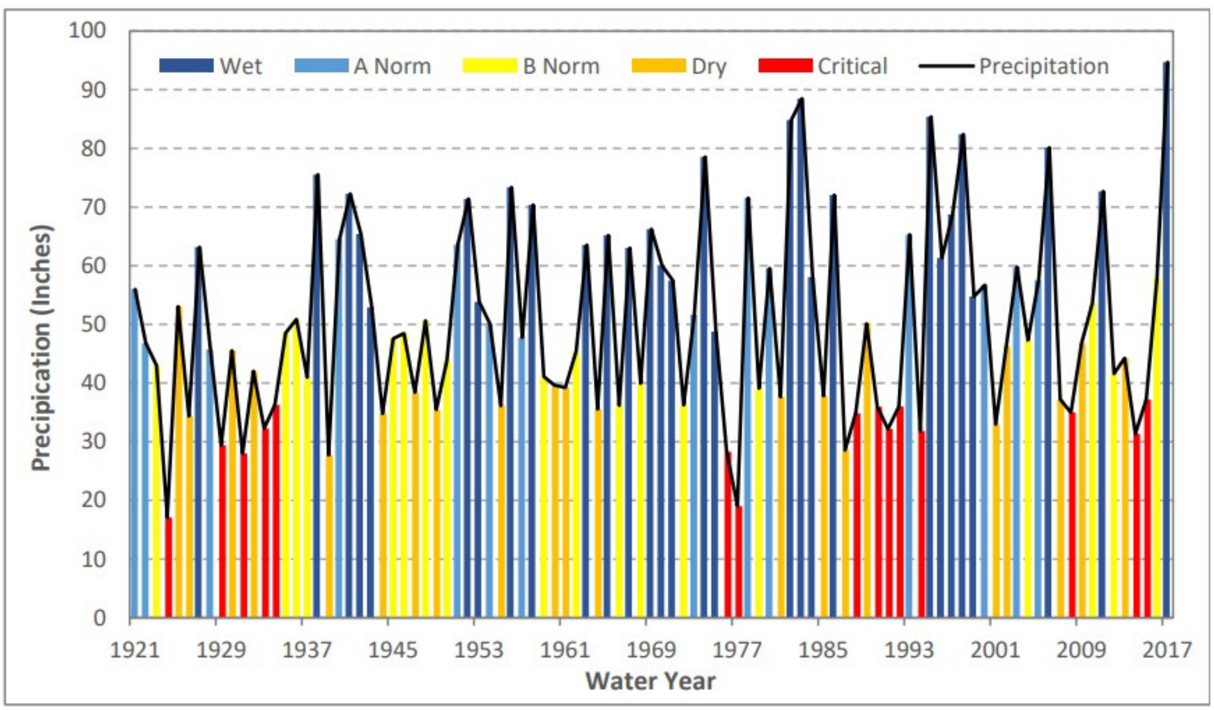
Appendix G Water Supply Technical Appendix

This appendix documents the water supply technical analysis to support the impact analysis in the Environmental Assessment/Initial Study (EA/IS) and describes the water supply resources that could be potentially affected by the implementation of the No Action/No Project Alternative (subsequently identified as the No Action Alternative) or the Proposed Action/Proposed Project (subsequently identified as the Proposed Action) considered by the EA/IS. Effects on water supply resulting from the construction and operation associated with the Proposed Action may occur in the federal and state water contractors' service areas.

G.1 Existing Conditions

G.1.1 Water in California

The total volume of water California receives from precipitation can vary dramatically between dry and wet years. The state may receive less than 100 million acre-feet (MAF) of water during a dry year and more than 300 MAF in a wet year (Department of Interior, Bureau of Reclamation [Reclamation] 2019). The majority of California's precipitation occurs between November and April, while most of the state's demand for water is in the summer months (Reclamation 2019). In addition, most precipitation falls in the northern portion of the state and much of the demand comes from central and southern portions of the state where major agricultural and population centers are located. Over time, annual precipitation trends have been changing and continue to change, as shown in Figure G-1.



Source: Reclamation 2019

Figure G-1. Sacramento River Hydrologic Region Precipitation Trends

The federal and state governments constructed the Central Valley Project (CVP) and State Water Project (SWP) in pursuit of maximizing use of the state's water supplies and providing flood control. The CVP has over 270 water contracts for delivery of CVP water (Reclamation 2019). The SWP currently has contracts to deliver supplies to 29 water suppliers across the state. Because C.W. "Bill" Jones Pumping Plant (Jones Pumping Plant) is operated as an integral component of the CVP, changes in pumping at Jones Pumping Plant due to restoration of Delta-Mendota Canal (DMC) capacity would affect operations of a majority of CVP and SWP facilities. Therefore, although the Project area is confined to the DMC right-of-way, the study area for this water supply analysis is broader. The study area captures the CVP and SWP contractors that may be impacted by changes to the operation of the DMC and evaluates the water supply impacts that the construction and operation of the DMC Subsidence Correction Project (Project) would have on deliveries to the entirety of the study area.

G.1.2 Central Valley Project and State Water Project Facilities and Operations

G.1.2.1 Trinity River Division

The CVP Trinity River Division includes facilities to store and regulate water in the Trinity River, as well as facilities to divert water to the Sacramento-San Joaquin River Delta. The Trinity River Division includes the Trinity River and Dam, Lewiston Dam, Whiskeytown Reservoir and Dam, Clear Creek, and Spring Creek and Debris Dam. All releases from Trinity Dam are re-regulated downstream at Lewiston Lake to meet downstream flow requirements, and supply exports through Clear Creek tunnel and the Carr power plant to Whiskeytown Lake. Spring Creek tunnel and power plant convey water from Whiskeytown Lake to Keswick Lake, located on the Sacramento River below Shasta Dam (Reclamation 2019).

Trinity Dam forms Trinity Lake, which has a maximum storage capacity of approximately 2.4 MAF. Based on the Trinity River Mainstem Fishery Restoration Record of Decision, 369 thousand acre-feet (TAF) to 815 TAF is allocated annually for Trinity River flows. There is some flood storage space reserved in the winter months, and the minimum storage in Trinity Reservoir generally is maintained above 1,000 TAF for recreation and water temperature considerations. The reservoir normally is filled to the highest storage level in April through June and then is drawn down slightly by the end of September (Reclamation 2019).

G.1.2.2 Shasta Division

The Shasta Division includes Shasta Dam, Lake, and Power Plant; Keswick Dam, Reservoir, and Power Plant; and the Shasta Temperature Control Device. Shasta Lake, a CVP facility on the Sacramento River formed by Shasta Dam, has a maximum storage capacity of 4.5 MAF. Water in Shasta Lake is released through or around the Shasta Power Plant to the Sacramento River, where it is re-regulated downstream by Keswick Dam. Maximum Shasta Reservoir storage occurs in April through June. A large portion of the maximum storage is reserved for flood control space between November and March. Storage usually increases from January through April and decreases from June through October (Reclamation 2019).

G.1.2.3 Lake Oroville

Lake Oroville is a major SWP storage reservoir, with a maximum capacity of about 3.5 MAF. The reservoir stores winter and spring runoff, which is released into the Feather River to meet the SWP's needs, Sacramento-San Joaquin River Delta (Delta) requirements, and fish and wildlife protection. The Oroville Complex also provides power generation (including pumpback operations) flood control storage, and recreation opportunities. California Department of Water Resources (DWR) maintains a minimum flow of 600 cubic feet per second (cfs) within the Feather River Low Flow Channel, as required by the 1983 California Department of Fish and Wildlife Agreement (Reclamation 2019).

G.1.2.4 Folsom Lake

Folsom Dam impounds a maximum of about 967 TAF and is a multipurpose reservoir that provides flood control and seasonal water storage for recreation, power, water supply, and minimum fish protection flows in the American River and to the Delta. About 400 TAF of storage is reserved for flood control space between December and March. Maximum Folsom Lake storage usually occurs in May through June (Reclamation 2019).

G.1.2.5 San Luis Reservoir

San Luis Reservoir is an off-stream storage reservoir in Merced County. Reclamation owns and jointly operates San Luis Reservoir with DWR to provide seasonal storage for the CVP and the SWP. San Luis Reservoir is capable of receiving water from both the DMC and the California Aqueduct, which enables the CVP and SWP to pump water into the reservoir during the wet season (October through March) and release water into the conveyance facilities during the dry season (April through September) when demands are higher. Deliveries from San Luis Reservoir also flow west through Pacheco Pumping Plant and Conduit to the San Felipe Division of the CVP (Reclamation 2019).

G.1.2.6 Other CVP Facilities

Reclamation operates the CVP, which uses the Jones Pumping Plant to pump water into the DMC. The DMC is a 116-mile-long canal that delivers water to contractors in the Central Valley and to and from San Luis Reservoir for storage. Water conveyed through the DMC to San Luis Reservoir is pumped from the canal to the O'Neill Forebay where it connects with the California Aqueduct and the San Luis Canal. The DMC continues east from the O'Neill Forebay to the Mendota Pool (Reclamation 2019). The Jones Pumping Plant, the DMC, and certain other CVP facilities are operated and maintained by the San Luis & Delta-Mendota Water Authority (SLDMWA) under a Transfer Agreement with Reclamation (Reclamation 2019).

The Jones Pumping Plant, about five miles north of Tracy, consists of six pumps with a maximum rated capacity of about 5,100 cfs. The Jones Pumping Plant is located at the end of an earth-lined intake channel about 2.5 miles long. At the head of the intake channel, "louver" screens that are part of the Tracy Fish Collection Facility intercept fish, which are then collected and transported by tanker truck to release sites away from the pumps. The water is pumped about 200 feet into the DMC, which has a maximum design capacity of about 4,600 cfs (Reclamation 2019).

G.1.2.7 Other SWP Facilities

DWR operates the SWP, which diverts water from the Delta through the Harvey O. Banks Pumping Plant (Banks Pumping Plant) into Bethany Reservoir. The California Aqueduct is 444 miles long and delivers water from Bethany Reservoir south to the Central Valley and Southern California. The California Aqueduct flows south 60 miles to O'Neill Forebay at San Luis Reservoir (DWR 2020). At O'Neill Forebay, the California Aqueduct becomes the San Luis Canal, which is managed jointly by Reclamation and DWR and serves both the CVP and SWP. The San Luis Canal is federally built and extends 103 miles from O'Neill Forebay southeast to just past Kettleman City (Reclamation 2019).

At this location the canal becomes the California Aqueduct again, an SWP facility that delivers water over the Tehachapi Mountains to southern California (Reclamation 2019).

The DMC/California Aqueduct Intertie (Intertie Pumping Plant) is a shared federal-state water system improvement, connecting the DMC and the California Aqueduct via two 108-inch-diameter pipes and pumping capacity of 700 cfs (900 cfs gravity flow from California Aqueduct to DMC). The Intertie Pumping Plant provides redundancy in the water distribution systems, allows for maintenance and repair activities that are less disruptive to water deliveries, and provides the flexibility to respond to CVP and SWP emergencies (Reclamation 2021).

G.1.3 CVP Contractors

The CVP has several different types of contracts, including Repayment Contracts, Exchange Contracts, Refuge Contracts, Settlement Contracts, Friant Division Contracts, and Water Service Contracts for delivery of CVP water (Reclamation 2021). These water contracts are subject to reductions, depending on the amount of water available each year. Water forecasting starts in the fall of the previous year when storage and hydrologic conditions are assessed. Annual water allocation for the CVP is generally announced early in the calendar year for the following growing season and updated monthly.

CVP water allocations for agricultural, municipal and industrial (M&I), and Refuge Contractors vary based on factors such as hydrology, runoff forecast, prior water right commitments, reservoir storage, required water quality releases, required environmental releases, and operational limitations. Each year Reclamation determines the amount of water that can be allocated to each CVP contractor based on contract types and entitlements and conditions for that year. In most cases, these allocations are expressed as a percentage of CVP contractors' contract total (for contracts that allow use of both agricultural and M&I water) or historical use (for M&I only contracts).

North of the Delta, there are 42 Water Service or Repayment Contractors across three CVP divisions that deliver water to agricultural contractors, M&I contractors, or both agricultural and M&I contractors. In the Delta and south of the Delta, there are 31 Water Service or Repayment Contractors across three CVP Divisions and one unit that deliver water to agricultural contractors, M&I contractors, or both agricultural and M&I contractors. South-of-Delta CVP Water Service and Repayment Contractors are located south of the Delta and consist of the Delta Division, San Felipe Division, and San Luis Unit. Other CVP contractors located south of the Delta include south-of-Delta Settlement Contractors, San Joaquin River Exchange Contractors, and Friant Division[1] / Cross Valley Canal contractors.

G.1.3.1 San Joaquin River Exchange Contract

The San Joaquin River Exchange Contractors (Exchange Contractors) hold some of the oldest water rights in the state, dating back to the late 1800s, for diversion of water from the San Joaquin and Kings rivers (Reclamation 2021). The operation of the CVP's Friant Division depended upon water being diverted from the San Joaquin River and conveyed to the east side of the valley via the Friant-Kern Canal and Madera Canal. To accomplish this, Reclamation and the Exchange Contractors entered into an agreement whereby the Exchange Contractors agreed to not exercise their rights to

[1] CVP Friant Division contractors receive deliveries from Friant Dam through the San Joaquin River, Madera Canal and the Friant Kern Canal. As such, they are separate from the CVP south of Delta Contractors that receive CVP deliveries from the Sacramento River and its tributaries or the Delta.

divert water from the San Joaquin River in exchange for Reclamation providing substitute water, generally coming from the Sacramento River and delivered via the DMC. During all calendar years, except critical, Reclamation is responsible for delivering an annual substitute water supply of up to 840,000 acre-feet. In critical years, the annual substitute water supply is reduced to 650,000 acre-feet (Reclamation 2021).

G.1.3.2 Friant Division Contractors

Friant Division contractors, located on the east side of the San Joaquin Valley, receive water stored behind Friant Dam and delivered through the Friant-Kern and Madera Canals. In years in which Reclamation is otherwise unable to make contracted deliveries to Exchange Contractors, Reclamation can make a call on water stored in Millerton Reservoir, thereby requiring releases from Friant Dam (U.S. Congressional Research Service [CRS] 2022).

G.1.3.3 South of Delta Settlement Contracts

After Reclamation started operating Friant Dam, contractors near Mendota Pool began experiencing difficulties in diversion since the San Joaquin River water was no longer reaching the Mendota Pool in quantities necessary to meet their irrigation demands. South of Delta Settlement Contractors receive a quantity of CVP water through the DMC (or Millerton if DMC supplies are not sufficient) at no charge in replacement of their water rights water, which is diverted and sold to the Friant Division contractors (Reclamation 2021).

G.1.3.4 Water Service and Repayment Contracts

Water Service contracts are used in instances, such as the CVP, where the project includes multiple individual multipurpose facilities benefiting different project functions and construction and a final cost allocation have not been completed. For such projects, costs are allocated to, and recovered from, appropriate beneficiaries based on the annual number of acre-feet of water diverted (Reclamation 2021). Repayment contracts are used when specific cost obligations can be readily assigned to beneficiaries, such as when a specific facility is constructed for the sole benefit of a single contractor. Repayment contracts generally provide for 40 fixed annual payments to repay a fixed repayment amount (Reclamation 2021).

G.1.3.5 Refuge Water Supply Program

The Central Valley Project Improvement Act (CVPIA), enacted in 1992, authorized a Refuge Water Supply Program to acquire approximately 555 TAF annually in water supplies for 19 Central Valley refuges (CRS 2022). Authorized refuge water supply under CVPIA is divided into two categories: Level 2 and Level 4 supplies. Level 2 supplies are the historical average of water deliveries to the refuges prior to enactment of CVPIA. Reclamation is obligated to acquire and deliver this water under CVPIA, and costs are 100 percent reimbursable by CVP contractors through a fund established by the act. Level 4 supplies are the additional increment of water beyond Level 2 supplies for optimal wetland habitat development. This water must be acquired by Reclamation through voluntary measures and is funded as a 75 percent federal cost and 25 percent state cost. In most cases, the Level 2 requirement is met; however, Level 4 supplies have not always been provided in full for a number of reasons, including a shortage of supplies and a lack of willing sellers (CRS 2022).

G.1.3.6 San Luis & Delta-Mendota Water Authority

SLDMWA was formed in 1992 to take over the operation and maintenance responsibilities of several CVP facilities and support the information and representative needs of its members (SLDMWA 2021). SLDMWA has 27 member agencies, 25 of which contract with Reclamation for CVP water (Table G-1). SLDMWA's members' service areas extend from the City of Tracy in San Joaquin County in the north to Kettleman City in Kings County in the south. The service areas cover approximately 3,300 square miles on the west side of the San Joaquin Valley.

Table G-1. SLDMWA Member Agencies

Upper Delta-Mendota Canal	San Luis Canal	Exchange Contractors and Refuges	San Felipe Division	Lower Delta-Mendota Canal and Mendota Pool
Banta-Carbona Irrigation District	Panoche Water District	Central California Irrigation District	San Benito County Water District	Broadview Water District
Byron-Bethany Irrigation District	San Luis Water District	Columbia Canal Company (a friend)	Santa Clara Valley Water District	Eagle Field Water District
City of Tracy	Westlands Water District	Firebaugh Canal Water District		Fresno Slough Water District
Del Puerto Water District		Grassland Water District		James Irrigation District
Patterson Water District		Henry Miller Reclamation District #2131		Laguna Water District
West Stanislaus Irrigation District				Mercy Springs Water District
				Oro Loma Water District
				Pacheco Water District
				Reclamation District 1606
				Tranquillity Irrigation District

Water supplies for SLDMWA member agencies include CVP and SWP water, groundwater, local surface water, recycled water, purified water, and transfer water. The DMC delivers an average of approximately 3.0 MAF of CVP water annually within the SLDMWA service area. Approximately 2.5 MAF of the water is used to irrigate 1.2 million acres of agricultural lands in the Central Valley and Santa Clara and San Benito Counties, while 150 to 250 TAF is used for M&I purposes, and 250 to 300 TAF is used for environmental purposes including wildlife habitat management in the San Joaquin Valley (SLDMWA 2021).

G.1.3.7 CVP Water Allocations

Hydrology and state-imposed conditions on Reclamation's water rights are the two primary drivers of CVP allocations. In the past, Reclamation has made significant cutbacks to water deliveries for many CVP contractors because of drought and regulatory restrictions, among other factors, as shown in Table G-2. In 2016, a dry water year, south-of-Delta CVP allocations were five percent for agricultural contractors and 55 percent for M&I contractors. In February 2020, south-of-Delta CVP agricultural Water Service Contractors received an initial allocation of 20 percent of contracted supplies, and south-of Delta M&I contractors initially received a 70 percent allocation. In May 2021, CVP M&I contract allocations were reduced to 25 percent of their historic water use. At a minimum, Reclamation works to deliver the amount of water needed to meet the public health and safety need, the amount of water determined to be necessary to sustain public health and safety, to CVP M&I contractors. In April 2022, because of critically dry hydrologic conditions, water supply allocations for all CVP M&I contractors were reduced to public health and safety levels (Reclamation 2022). In both 2021 and 2022, south-of-Delta CVP agricultural contractors received zero percent allocations.

Table G-2. Water Allocations for South-of-Delta CVP Contractors, 2016-2022 (Percentage of Maximum Contract Allocation)

	2016	2017	2018	2019	2020	2021	2022
Agricultural	5%	100%	50%	75%	20%	0%	0%
M&I	55%	100%	75%	100%	70%	25%[1]	PHS[2]
Exchange Contractors	100%	100%	100%	100%	100%	75%	75%
Refuges (Level 2)[3]	100%	100%	100%	100%	100%	75%	75%
Eastside Division	0%	100%	100%	100%	100%	100%	TBD

Source: Reclamation 2022

Notes:

[1] Percentage of historic use.

[2] The amount of water determined to be necessary to sustain public health and safety according to the CVP M&I Water Shortage Policy Guidelines and Procedures.

[3] Refuge water supplies are categorized into Level 2 and Incremental Level 4. Level 2 represents the historical average amount of water deliveries prior to the Central Valley Project Improvement Act enactment in 1992 and is the baseline water required for wildlife habitat management. Incremental Level 4 represents the additional increment of water required for optimal wetland habitat development.

Key: M&I- municipal and industrial, PHS – Public Health and Safety; TBD – To Be Determined

G.1.4 SWP Contractors

The SWP delivers water to 29 public water agencies in Northern, Central and Southern California that hold long-term contracts for surface water deliveries (see Table G-3 below for a list of south-of-Delta agencies with SWP contracts). The agencies deliver water for both urban and agricultural use, representing over 25 million municipal contractors and 750,000 acres of irrigated farmland. Five of the agencies use the SWP water primarily for agricultural uses and the remaining 24 use the SWP water primarily for municipal use. Water supplies for agencies include imported SWP water, groundwater, local surface water, and for some agencies other imported supplies. The agencies collectively have received deliveries ranging from approximately 1.4 MAF in dry water years to approximately 4.0 MAF in wet years.

Similar to CVP south-of-Delta deliveries, SWP exports from the Delta and the corresponding south-of-Delta deliveries have decreased over time. In the period between 2005 and 2013, average annual SWP exports have fallen by 12 percent (DWR 2020).

Table G-3. South-of-Delta SWP Contractors

Alameda County Flood Control & Water Conservation District - Zone 7	Metropolitan Water District of Southern California
Alameda County Water District	Mojave Water Agency
Antelope Valley-East Kern Water Agency	Oak Flat Water District
Castaic Lake Water Agency	Palmdale Water District
Coachella Valley Water District	San Bernardino Valley Municipal Water District
County of Kings	San Gabriel Valley Municipal Water District
Crestline-Lake Arrowhead Water Agency	San Gorgonio Pass Water Agency
Desert Water Agency	San Luis Obispo County Flood Control and Water Conservation District
Dudley Ridge Water District	Santa Barbara County Flood Control and Water Conservation District
Empire-West Side Irrigation District	Santa Clara Valley Water District
Kern County Water Agency	Tulare Lake Basin Water Storage District
Littlerock Creek Irrigation District	Ventura County Watershed Protection District

G.2 Assessment Methodology

Water operations modeling of the CVP/SWP system was performed using CalSim II. CalSim II is a planning model designed to simulate operations of CVP and SWP reservoirs and water delivery systems. CalSim II modeling was developed from a baseline model provided by Reclamation to the Project team. Effects of the Project are determined by comparing CalSim II model scenarios that assume full design capacity to a corresponding no action/no project model scenario, as detailed in Appendix D. As discussed in Chapter 2 of the EA/IS, under the California Environmental Quality Act (CEQA), existing conditions serve as the baseline to determine potential impacts of the Proposed Action. The existing condition CalSim II simulation was completed using historic hydrology from 1927 through 2003 and the current DMC capacity for existing conditions. This CEQA approach differs from that of the National Environmental Policy Act (NEPA), where the No Action Alternative reflects expected future conditions in the Project area if no action is taken. The future no action CalSim II simulation was completed using future projected 2035 hydrology with climate change and the projected 2035 reduced DMC capacity.

The CalSim II model monthly simulation of an actual daily (or even hourly) operation of CVP and SWP results in several limitations in use of model results. Model results must be used in a comparative manner to reduce effects of use of monthly and other assumptions that are indicative of real-time operations, but do not specifically match real-time observations. CalSim II model output is based upon a monthly time step. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches. Therefore, if quantitative changes between the Proposed Action and the No Action Alternative are five percent or less, conditions under the Proposed Action would be considered to be "similar" to conditions under the No Action Alternative.

Under extreme hydrologic and operational conditions where there is not enough water supply to meet all requirements, CalSim II uses a series of operating rules to reach a solution to allow for continuation of the simulation. It is recognized that these operating rules are a simplified version of very complex decision processes that CVP and SWP operators would use in actual extreme conditions. Therefore, model results and potential changes under these extreme conditions should be evaluated on a comparative basis between alternatives and are approximations of extreme operational conditions.

As previously stated in Section G.1.3, each year Reclamation determines the amount of water that can be allocated to each CVP contractor based on contract types and entitlements and conditions for that year. There would be no change to CVP contracts or maximum contract quantities under the Proposed Action and, therefore, changes in water supply deliveries modeled and analyzed in this assessment would be consistent with the existing CVP contracts and operations.

G.3 Significance Criteria

The significance criteria described below were developed with guidance from CEQA Guidelines to determine the significance of potential impacts on water supply that could result from implementation of the Project. Impacts on water supply would be considered potentially significant if the Proposed Action would reduce the annual supply of water available to the CVP, SWP, or other contractors. As previously discussed, CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches. Therefore, if quantitative changes between the Proposed Action and the No Action Alternative are a reduction of five percent or greater, deliveries would be substantially reduced and conditions under the Proposed Action would be considered significant.

The significance criteria described above apply to all water supplies that could be affected by the Project. Water supply has the potential to be impacted both during construction of the Proposed Action and during operation of the Proposed Action. Both periods are analyzed in the Project impacts section.

G.4 Project Impacts and Mitigation Measures

G.4.1 No Action Alternative

G.4.1.1 Impact WS-1: Would construction of the alternative change CVP and SWP deliveries to CVP and SWP contractors?

Under the No Action Alternative, no actions would be taken to restore, or otherwise offset, conveyance capacity lost in the DMC. No drawdown or partial outage of the DMC would be needed to repair the canal. **There would be no construction-generated impacts to CVP or SWP surface water supply under this alternative.**

G.4.1.2 Impact WS-2: Would operation of the alternative change CVP deliveries to CVP contractors?

Under the No Action Alternative, no actions would be taken to restore, or otherwise offset, conveyance capacity lost in the DMC. Under the No Action Alternative and consistent with the CVP M&I Water Shortage Policy, Reclamation would distribute Delta supplies to both south-of-Delta CVP contractors and north-of-Delta CVP contractors. However, because of the reduced capacity of the DMC, Reclamation would continue to deliver any south-of-Delta CVP supplies that are not able to be delivered via the DMC to north-of-Delta CVP contractors. The reduced capacity of the DMC under the No Action Alternative would also continue to limit the ability of the CVP to export their share of Delta excess, as defined under the 2018 Coordinated Operations Agreement Addendum. The reduced capacity of the DMC could limit the ability of Reclamation to meet CVP Exchange Contractor delivery requirements, which could result in a reduction in deliveries to other south-of-Delta CVP contractors to meet these senior water right deliveries.

Subsidence would further decrease the capacity of the DMC until full implementation of the Sustainable Groundwater Management Act (SGMA) in 2040, with residual elastic subsidence forecast to continue through the design life of the canal. Under future no action conditions, total average annual south-of-Delta CVP agricultural deliveries are expected to decrease up to 17 percent, or 280 TAF, under certain water year types compared to existing conditions. Table G-4 summarizes the change in delivery of south-of-Delta CVP agricultural water under the Proposed Action compared to existing conditions. Under future no action conditions, total average annual south-of-Delta CVP M&I deliveries are expected to decrease up to 10 percent, or 26 TAF, under certain water year types compared to existing conditions. Table G-5 summarizes the change in delivery of south-of-Delta CVP agricultural water under the Proposed Action compared to existing conditions. Therefore, CVP deliveries would be reduced compared to existing conditions. **Reduced capacity in the DMC has the potential to cause significant impacts on CVP water supply deliveries under the No Action Alternative.**

Table G-4. Averaged Modeled Difference in Total South-of-Delta CVP Agricultural Deliveries between Existing Conditions and Future No Action by Water Year Type (1,000 acre-feet)

Sacramento River Water Year Type	Total Average Existing Conditions	Future No Action	Difference from Existing Conditions	Percent Change
Wet	2,534	2,342	-192	-8%
Above Normal	2,204	1,878	-326	-15%
Below Normal	2,051	1,731	-320	-16%
Dry	1,625	1,345	-280	-17%
Critical	1,033	986	-47	-5%
All	1,984	1,756	-228	-11%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.

Table G-5. Averaged Modeled Difference in Total South-of-Delta CVP M&I Deliveries between Existing Conditions and Future No Action by Water Year Type (1,000 acre-feet)

Sacramento River Water Year Type	Total Average Existing Conditions	Future No Action	Difference from Existing Conditions	Percent Change
Wet	270	262	-8	-3%
Above Normal	254	233	-21	-8%
Below Normal	247	222	-26	-10%
Dry	212	201	-10	-5%
Critical	176	171	-4	-2%
All	237	225	-13	-5%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.

G.4.1.3 Impact WS-3: Would operation of the alternative change SWP deliveries to SWP contractors?

Under the No Action Alternative, SWP contractors could continue to export the CVP's share of Delta excess beyond the SWP share that is defined under the 2018 Coordinated Operations Agreement Addendum. **As such, there would be a beneficial effect to SWP surface water supply deliveries as a result of the decreased capacity of the DMC under the No Action Alternative.**

G.4.1.4 Impact WS-4: Would operation of the alternative change other water deliveries?

Under the No Action Alternative, the reduced capacity of the DMC would continue to limit the short-term conveyance of non-Project water and/or transferred water[2] to south-of-Delta CVP water contractors or other contractors reliant on the DMC for water conveyance. **Reduced capacity in the DMC has the potential to cause significant impacts on water supply deliveries to south of Delta CVP water contractors or other contractors under the No Action Alternative.**

G.4.2 Proposed Action

G.4.2.1 Impact WS-1: Would construction of the alternative change CVP deliveries to CVP contractors?

Construction of the Proposed Action is expected to last approximately seven and a half years. Some drawdowns of the canal water surface are needed to support construction activities, however no partial outages are required, thus providing flexibility in completing construction activities. During construction, the Intertie Pumping Plant could be used to maintain CVP deliveries consistent with existing operations, in coordination with DWR. It is anticipated that because no outages would be needed, impacts to water supply deliveries during construction of the Proposed Action would be

[2] Environmental compliance for the transfer actions including sellers making water available and the conveyance of transferred water to south-of-Delta CVP contractors is analyzed outside this EA/IS in separate environmental compliance documents, including but not limited to the Long-Term Water Transfers environmental document, available here: https://www.usbr.gov/mp/nepa/nepa_project_details.php?Project_ID=18361.

minimal. **Construction of the Proposed Action would have a less than significant impact on CVP deliveries.**

G.4.2.2 Impact WS-2: Would operation of the alternative change CVP deliveries to CVP contractors?

Deliveries to North-of-Delta CVP Contractors Restored conveyance capacity under the Proposed Action would allow Reclamation to distribute contract deliveries more evenly to all CVP contractors according to the CVP M&I Water Shortage Policy, which could result in an average annual decrease to north-of-Delta CVP contractors. Under operation of the Proposed Action, the average change in total annual north-of-Delta CVP deliveries is expected to minimal, decreasing less than one percent under all water year types compared to existing and future no action conditions. Compared to existing conditions, the average change in total annual north-of-Delta CVP deliveries would decrease up to five TAF under certain water year types. Table G-6 summarizes the change in delivery of north-of-Delta CVP agricultural water under the Proposed Action compared to existing conditions. Compared to future no action conditions, the average change in total annual north-of-Delta CVP deliveries would decrease up to four TAF under certain water year types. Table G-7 summarizes the change in delivery of north-of-Delta CVP agricultural water under the Proposed Action compared to future no action conditions. As was noted in Section G.3, CalSim II relies on assumptions and approaches that contribute to minor fluctuations of up to five percent, Project changes of less than five percent are not identified as an adverse or beneficial water supply effect. Changes to average annual north-of-Delta CVP deliveries would be a less than one percent total change on average and operation of the Proposed Action is not expected to have a significant impact on north-of-Delta CVP deliveries. In addition, all operations affecting Delta exports would be required to meet Delta water quality standards (e.g., D-1641) and meet the requirements of the 2019 U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) Biological Opinions and other current and future regulatory requirements for the long-term coordinated operations of the CVP and SWP. **Therefore, operating the Proposed Action would have a less than significant impact on north-of-Delta CVP contractors compared to existing and future no action conditions**.

Table G-6. Averaged Modeled Difference in Total North-of-Delta CVP Deliveries between Existing Conditions and the Proposed Action by Water Year Type (1,000 acre-feet)

Sacramento River Water Year Type	Total Average Existing Conditions	Proposed Action	Difference from Existing Conditions	Percent Change
Wet	2,294	2,294	0	0%
Above Normal	2,282	2,282	0	0%
Below Normal	2,309	2,305	-4	0%
Dry	2,183	2,178	-5	0%
Critical	1,794	1,789	-5	0%
All	2,197	2,195	-3	0%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
Modeling Period 1922-2003, Data results from CalSim II modeling. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.

Table G-7. Averaged Modeled Difference in Total North-of-Delta CVP Deliveries between Future No Action and the Proposed Action by Water Year Type (1,000 acre-feet)

Sacramento River Water Year Type	Total Average Future No Action	Proposed Action	Difference from Future No Action	Percent Change
Wet	2,273	2,272	0	0%
Above Normal	2,276	2,276	0	0%
Below Normal	2,282	2,279	-3	0%
Dry	2,147	2,144	-3	0%
Critical	1,798	1,794	-4	0%
All	2,178	2,176	-2	0%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.

Agricultural Deliveries to South-of-Delta CVP Contractors Under operation of the Proposed Action, average annual south-of-Delta CVP agricultural deliveries are expected to be restored up to 86 TAF, a four percent change, under certain water year types compared to existing conditions. Table G-8 summarizes the change in delivery of south-of-Delta CVP agricultural water under the Proposed Action compared to existing conditions. Average annual south-of-Delta CVP agricultural deliveries are expected to be restored up to 138 TAF, an eight percent change, under certain water year types compared to future no action conditions. Table G-9 summarizes the change in delivery of south-of-Delta CVP agricultural water under the Proposed Action compared to future no action conditions. In addition, consistent with the restoration of average annual total south-of-Delta CVP agricultural deliveries, Reclamation would most likely be able to meet CVP Exchange Contractor deliveries without impacting other south-of-Delta CVP contractors. **Therefore, operating the Proposed Action would have a beneficial effect on south-of-Delta CVP agricultural deliveries compared to existing and future no action conditions**.

Table G-8. Averaged Modeled Difference in Total South-of-Delta CVP Agricultural Deliveries between Existing Conditions and the Proposed Action by Water Year Type (1,000 acre-feet)

Sacramento River Water Year Type	Total Average Existing Conditions	Proposed Action	Difference from Existing Conditions	Percent Change
Wet	2,534	2,577	43	2%
Above Normal	2,204	2,275	71	3%
Below Normal	2,051	2,137	86	4%
Dry	1,625	1,699	74	5%
Critical	1,033	1,052	19	2%
All	1,984	2,042	58	3%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.

Table G-9. Averaged Modeled Difference in Total South-of-Delta CVP Agricultural Deliveries between Future No Action and the Proposed Action by Water Year Type (1,000 acre-feet)

Sacramento River Water Year Type	Total Average Future No Action	Proposed Action	Difference from Future No Action	Percent Change
Wet	2,342	2,422	80	3%
Above Normal	1,878	2,008	130	7%
Below Normal	1,731	1,871	138	8%
Dry	1,345	1,438	94	7%
Critical	986	1,016	30	3%
All	1,756	1,849	92	5%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.

Municipal and Industrial Deliveries to South-of-Delta CVP Contractors Under operation of the Proposed Action, average annual south-of-Delta CVP M&I deliveries are expected to be restored up to five TAF, a two percent change, under certain water year types compared to existing conditions. Table G-10 summarizes the change in delivery of CVP water under this option compared to existing conditions. Average annual south-of-Delta CVP M&I deliveries are expected to fluctuate up three TAF, a one percent change, under certain water year types compared to future no action conditions. Table G-11 summarizes the change in delivery of CVP water under this option compared to future no action conditions. Overall, average annual south-of-Delta CVP M&I deliveries would change by less than one percent, and as noted above in Section G.2, projected changes of less than five percent are not identifies as an adverse or beneficial water supply effect. **Therefore, operating the Proposed Action would have a less than significant impact on south-of-Delta CVP M&I contractors compared to existing and future no action conditions.**

Table G-10. Averaged Modeled Difference in Total South-of-Delta CVP M&I Deliveries between Existing Conditions and the Proposed Action by Water Year Type (1,000 acre-feet)

Sacramento River Water Year Type	Total Average Existing Conditions	Proposed Action	Difference from Existing Conditions	Percent Change
Wet	270	271	1	0%
Above Normal	254	259	5	2%
Below Normal	247	249	1	0%
Dry	212	214	2	1%
Critical	176	175	-1	0%
All	237	239	1	1%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.

Table G-11. Averaged Modeled Difference in Total South-of-Delta CVP M&I Deliveries between Future No Action and the Proposed Action by Water Year Type (1,000 acre-feet)

Sacramento River Water Year Type	Total Average Future No Action	Proposed Action	Difference from Future No Action	Percent Change
Wet	262	261	-2	-1%
Above Normal	233	235	2	1%
Below Normal	222	223	2	1%
Dry	201	198	-3	-1%
Critical	171	170	-2	-1%
All	225	224	-1	0%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.

Deliveries to South-of-Delta CVP Refuges Under operation of the Proposed Action, there would be no change to south-of-Delta CVP Level 2 refuge deliveries. Reclamation would continue its obligation to acquire and deliver this water under CVPIA. **Therefore, operating the Proposed Action would have a no impact on south-of-Delta CVP Level 2 refuge deliveries compared to existing and future no action conditions.**

G.4.2.3 Impact WS-3: Would construction of the alternative change SWP deliveries to SWP contractors?

Construction duration for the Proposed Action is expected to last approximately seven and a half years. Some drawdowns of the canal water surface are needed to support construction activities, however no partial outages are required, thus providing flexibility in completing construction activities. During construction, the Intertie Pumping Plant would continue to be used to maintain CVP deliveries consistent with existing operations. It is anticipated that because no outages would be needed, there would be no impact to SWP water supply deliveries during construction of the Proposed Action. Any adaptive management measures or restrictions imposed on SLDMWA, Reclamation, or the CVP through permits or other regulatory approvals issued for construction of the Proposed Action will be coordinated with DWR consistent with the rights and obligations of and between Reclamation and DWR agreed to in other independent agreements. **Construction of the Proposed Action would have no impact on SWP deliveries**.

G.4.2.4 Impact WS-4: Would operation of the alternative change SWP deliveries to SWP contractors?

Deliveries to SWP Contractors The CalSim II model tracks three categories of SWP deliveries – Table A contract allocations (i.e., firm), Article 21 (i.e., surplus or interruptible), and Article 56 (i.e., carryover). The water supply contracts set forth the maximum amount of SWP water a contractor may request, known as the Table A amount. Article 21 water is available to SWP contractors when SWP storage in San Luis Reservoir is full and there is excess water in the Delta. Article 56 water, referred to as carryover water, is Table A water allocated to a contractor in one year but held in San Luis Reservoir until it was delivered in the following calendar year.

Restored conveyance capacity under the Proposed Action would allow the CVP to export its share of excess, as defined under the 2018 Coordinated Operations Agreement Addendum, and therefore would reduce the SWP export of unused CVP share. Under operation of the Proposed Action, average annual south-of-Delta SWP Table A deliveries are expected to decrease up to 23 TAF, a one percent change, under certain water year types compared to existing conditions. Table G-12 summarizes the change in delivery of Table A SWP water under the Proposed Action compared to existing conditions. Table G-13 summarizes the change in delivery of Table A SWP water under the Proposed Action compared to future no action conditions. Average annual south-of-Delta SWP Table A deliveries are expected to decrease up to 42 TAF, a five percent change, under certain water year types compared to future no action conditions. As previously mentioned, under the Proposed Action the CVP would be able to export their share of Delta excess consistent with the 2018 Coordinated Operations Agreement Addendum. Therefore, the slight reduction in Table A SWP deliveries under the Proposed Action is not identified as an adverse water supply effect.

Table G-12. Averaged Modeled Difference in Total Table A SWP Deliveries between Existing Conditions and the Proposed Action by Water Year Type (1,000 acre-feet)

Sacramento River Water Year Type	Total Average Existing Conditions	Proposed Action	Difference from Existing Conditions	Percent Change
Wet	2,848	2,833	-16	-1%
Above Normal	2,610	2,592	-18	-1%
Below Normal	2,556	2,533	-23	-1%
Dry	1,533	1,518	-14	-1%
Critical	985	974	-11	-1%
All	2,202	2,186	-16	-1%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.

Table G-13. Averaged Modeled Difference in Total Table A SWP Deliveries between Future No Action and the Proposed Action by Water Year Type (1,000 acre-feet)

Sacramento River Water Year Type	Total Average Future No Action	Proposed Action	Difference from Future No Action	Percent Change
Wet	2,771	2,751	-20	-1%
Above Normal	2,474	2,458	-16	-1%
Below Normal	2,378	2,361	-17	-1%
Dry	1,354	1,328	-26	-2%
Critical	913	871	-42	-5%
All	2,080	2,056	-23	-1%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.

In addition, the Proposed Action could reduce potential surplus water supply (Article 21) and carryover water supply (Article 56) deliveries to SWP contractors as CVP deliveries are restored compared to existing conditions. The availability of this surplus and carryover water in any particular year is uncertain, and contractors do not base long-term water supply decisions based on the availability, or lack thereof, of this water. Both change in surplus and carryover water supply are presented in the context of total SWP deliveries, including Table A deliveries, because surplus and carryover water is delivered in addition to Table A deliveries. Table G-14 summarizes the change in delivery of Article 21 and Article 56 SWP water under the Proposed Action compared to existing conditions. Table G-15 summarizes the change in delivery of Article 21 and Article 56 SWP water under the Proposed Action compared to future no action conditions. Under operation of the Proposed Action, average annual south-of-Delta SWP deliveries with surplus and carryover water supply are expected to decrease up to 37 TAF, a one percent change, under certain water-year types compared to existing conditions and are expected to decrease up to 42 TAF, a four percent change, under certain water-year types compared to future no action conditions. All operations affecting Delta exports would be required to meet Delta water quality standards (e.g., D-1641) and meet the requirements of the 2019 USFWS and NMFS Biological Opinions and other current and future regulatory requirements for the long-term coordinated operations of the CVP and SWP. **Therefore, operating the Proposed Action would have a less than significant impact on south-of-Delta SWP contractors compared to existing and future no action conditions.**

Table G-14. Averaged Modeled Difference in Total Article 21 and Article 56 SWP Deliveries between Existing Conditions and the Proposed Action (1,000 acre-feet)

Sac Yr Type	Total Average Existing Conditions			Difference from Existing Conditions			Total Difference	Percent Change
	Table A	Article 21	Article 56	Table A	Article 21	Article 56		
W	2,833	230	338	-16	-5	-2	-22	-1%
AN	2,592	75	234	-18	-16	-2	-37	-1%
BN	2,533	77	218	-23	-1	3	-22	-1%
D	1,518	34	202	-14	3	3	-9	0%
C	974	38	96	-11	6	-11	-16	-1%
All	2,186	110	237	-16	-3	-1	-20	-1%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table G-15. Averaged Modeled Difference in Total Article 21 and Article 56 SWP Deliveries between Future No Action and the Proposed Action by Water Year Type (1,000 acre-feet)

Sac Yr Type	Total Average Future No Action			Difference from Future No Action			Total Difference	Percent Change
	Table A	Article 21	Article 56	Table A	Article 21	Article 56		
W	2,771	279	293	-20	-6	-14	-40	-1%
AN	2,474	76	156	-16	-6	-22	-43	-2%
BN	2,378	48	227	-17	-5	1	-20	-1%
D	1,354	21	135	-26	0	4	-22	-1%
C	913	13	106	-42	5	-5	-42	-4%
All	2,080	116	202	-23	-3	-7	-33	-1%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

G.4.2.5 Impact WS-5: Would operation of the alternative change other water deliveries?

The restored conveyance capacity of the DMC under the Proposed Action could improve the storage and conveyance of non-Project water and transferred water. The Warren Act authorizes Reclamation to negotiate agreements to store or convey non-CVP water when excess capacity is available in federal facilities. Implementing the Proposed Action could increase the availability of excess capacity in the DMC that would support the delivery of additional non-CVP water in the DMC to south-of-Delta CVP water contractors or other contractors reliant on the DMC for water conveyance when compared to the No Action Alternative. **Therefore, operating the Proposed Action would have a beneficial impact on south-of-Delta CVP water contractors or other contractors reliant on the DMC for non-CVP water deliveries compared to existing and future no action conditions.**

G.4.3 Mitigation Measures

No mitigation measures would be necessary to reduce impacts of the Proposed Action to the less than significant level.

G.5 References

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Appendix H
Water Quality Technical Appendix

Appendix H Water Quality Technical Appendix

This appendix documents the water quality technical analysis to support the impact analysis in the Environmental Assessment/Initial Study (EA/IS) and describes the water quality resources that could be potentially affected by the implementation of the No Action/No Project Alternative (subsequently identified as the No Action Alternative) and the Proposed Action/Proposed Project (subsequently identified as the Proposed Action) considered by the EA/IS. This appendix also discusses water quality in the San Joaquin-Sacramento Delta (Delta) and includes water quality monitoring and water quality modeling results.

H.1 Clean Water Act Section 303(d)-Listed Water Bodies

The 2018 Section 303(d) list approved by the United States Environmental Protection Agency (USEPA) under the Clean Water Act (CWA) identifies impaired water bodies for certain constituents of concern. CWA Section 303(d) requires states to identify water bodies that do not meet applicable water quality standards after the application of certain technology-based controls on point source discharges. As defined in the CWA and federal regulations, water quality standards include the designated beneficial uses of a water body, the adopted water quality criteria necessary to protect those uses, and an antidegradation policy. As defined in the Porter-Cologne Water Quality Control Act, water quality standards are associated with designated beneficial uses of a water body, the established water quality objectives (both narrative and numeric), and California's nondegradation policy (State Water Resources Control Board [SWRCB] Resolution No. 68-16). Appendix E contains a description of the CWA and the Section 303(d) listing process.

While the Delta-Mendota Canal (DMC) is not listed, the Delta, Mendota Pool, Newman Wasteway, O'Neill Forebay, San Luis Reservoir, and Westley Wasteway are listed as water quality limited (impaired) for several of the constituents of concern. Table H-1 presents the 2018 Section 303(d) listed constituents of concern for these water bodies. Some water quality constituents are also of concern with respect to drinking water. Section H.2 provides information on the constituents of concern listed in Table H-1.

Table H-1. Section 303(d) Listed Water Bodies Within the Area of Analysis and Associated Constituents of Concern

Name	Constituent	Estimated Area Affected[1]	Proposed TMDL Completion Year/ USEPA Approved Date	Region
Sacramento-San Joaquin River Delta	Chlordane DDT Dieldrin Dioxin compounds (including 2,3,7,8-TCDD) Furan Compounds Invasive Species Mercury PCBs PCBs (dioxin-like) Selenium	41,736 acres 41,736 acres 41,736 acres 41,736 acres 41,736 acres 41,736 acres 41,736 acres 41,736 acres 41,736 acres 41,736 acres	2029 2013 2013 2019 2019 2019 2/12/2008[2] 3/29/2010[2] 3/29/2010[2] 8/23/2016[2]	Contra Costa, Sacramento, San Joaquin, Solano, and Yolo Counties
Mendota Pool	Mercury Selenium	3,045 acres 3,045 acres	2027 2027	Fresno County
Newman Wasteway	Salinity Dissolved Oxygen Indicator Bacteria DDE	8 miles 8 miles 8 miles 8 miles	2021 2021 2021 2021	Merced County
O'Neill Forebay	Mercury PCBs	2,254 acres 2,254 acres	2012 2027	Merced County
San Luis Reservoir	Mercury PCBs Total DDT Chlordane	13,007 acres 13,007 acres 13,007 acres 13,007 acres	2027 2027 2027 2027	Merced County
Westley Wasteway	Indicator Bacteria Dimethoate Chlorpyrifos	4 miles 4 miles 4 miles	2027 2027 2026[2]	Stanislaus County

Source: SWRCB 2022

Notes:

[1] Estimated area affected is given as the surface area (acres) of lakes or estuaries or length (river miles) for river systems.

[2] Being addressed with USEPA approved TMDL.

Key: DDE = Dichlorodiphenyldichloroethylene, DDT – dichlorodiphenyltrichloroethane, PCB – polychlorinated biphenyl, TCDD – tetrachlorodibenzodioxin, TMDL – total maximum daily load, Total DDT = sum of 4,4'- and 2,4'- isomers of DDT, DDE, and DDD

H.2 Constituents of Concern

H.2.1 Chlordane

Chlordane is a manufactured chemical that was used as a pesticide in the United States until 1988 when USEPA banned all uses (Agency for Toxic Substances and Disease Registry [ATSDR] 2018). Chlordane sticks strongly to soil particles at the surface and is not likely to enter groundwater. Most chlordane leaves soil by evaporation to the air, where it breaks down slowly. Chlordane does not dissolve easily in water, and it builds up in the tissues of fish, birds, and mammals. The construction and operation of the DMC Subsidence Correction Project would not involve the use of chlordane and would not impact levels of chlordane in the Project area.

H.2.2 Chlorpyrifos

Chlorpyrifos is an organophosphate insecticide, acaricide, and miticide used to control foliage and soil-borne insect pests. It has been used as a pesticide since 1965 in both agricultural and non-agricultural areas. In 2021, USEPA released the Final Tolerance Rule for Chlorpyrifos, which revokes all tolerances for chlorpyrifos food-related uses (USEPA 2022). The construction and operation of the Project would not involve the use of chlorpyrifos and would not impact levels of chlorpyrifos in the Project area.

H.2.3 DDT and DDE

Dichlorodiphenyltrichloroethane (DDT) is a pesticide once widely used to control insects in agriculture and insects that carry diseases such as malaria, and dichlorodiphenyldichloroethylene (DDE) is a chemical similar to DDT that contaminate commercial DDT preparations. DDE has no commercial use (ATSDR 2021). The use of DDT in the United States was banned in 1972 because of damage to wildlife, but it is still used in some countries. DDT sticks strongly to soil. Only a small amount will go through the soil into groundwater, and it does not dissolve easily in water. DDT builds up in plants and in fatty tissues of fish, birds, and other animals. The construction and operation of the Project would not involve the use of DDT or DDE and would not impact levels of DDT or DDE in the Project area.

H.2.4 Dieldrin

From the 1950s until 1970, dieldrin was a widely used pesticide for crops like corn and cotton. Because of concerns about damage to the environment and potentially to human health, USEPA banned all uses of dieldrin in 1987 (ATSDR 2022a). Dieldrin binds tightly to soil and slowly evaporates to the air. Dieldrin in soil and water breaks down slowly. Plants take in and store dieldrin from the soil. The construction and operation of the Project would not involve the use of dieldrin and would not impact levels of dieldrin in the Project area.

H.2.5 Dimethoate

Dimethoate is an organophosphorus insecticide that was registered for use in the United States in 1962 and used on several field-grown agricultural crops (leafy greens, citrus, melons), tree crops, and ornamentals. Residential and non-agricultural uses were cancelled in 2000. Use on alfalfa, wheat, cotton, and corn crops accounts for more than 60 percent of the total dimethoate use in the United States. Dimethoate is nonvolatile, water soluble, and not mobile in soil (Center for Disease Control and Prevention [CDC] 2017). The construction and operation of the Project would not involve the use of dimethoate and would not impact levels of dimethoate in the Project area.

H.2.6 Dioxin and Furan Compounds

Dioxin and furan are the abbreviated or short names for a family of toxic substances that all share a similar chemical structure. The chlorinated dibenzo-p-dioxins (CDDs) are a class of compounds that are loosely referred to as dioxins. There are 75 possible dioxins. CDDs may be formed during the chlorine bleaching process at pulp and paper mills and during chlorination by waste and drinking water treatment plants. CDDs are released into the air in emissions from municipal solid waste and industrial incinerators (ATSDR 2011). When released in waste waters, some CDDs are broken down by sunlight and some evaporate to air, but most attach to soil and settle to the bottom sediment in water. CDD concentrations may build up in the food chain, resulting in measurable levels in animals. The construction and operation of the Project would not create dioxins and furans and would not impact levels of dioxins and furans in the Project area.

H.2.7 Dissolved Oxygen

Dissolved oxygen is a measure of how much oxygen is dissolved in the water that is available to living aquatic organisms. Rapidly moving water tends to contain a lot of dissolved oxygen, whereas stagnant water contains less. As the amount of dissolved oxygen in a waterbody decreases, the waterbody is less able to support aquatic life (United States Geological Survey (USGS) 2018). Low levels of dissolved oxygen in freshwater systems can be associated with biotoxin problems, or harmful algal blooms, which can reduce the quality of water for human use (USEPA 2012). The construction and operation of the Project would not create the potential to decrease the levels of dissolved oxygen in the Project area.

H.2.8 Indicator Bacteria

Indicator bacteria are surrogates used to measure the potential presence of fecal material and associated fecal pathogens in water. Common indicator bacteria include fecal coliform and enterococcus, which are part of the intestinal flora of warm-blooded animals. These bacteria can enter waterways from both man-made sources (such as sewer overflows, failing sewer lines, meat processing facilities, and more) and natural sources (such as wildlife). Serious illnesses are caused by swallowing water or food contaminated by indicator bacteria (USEPA 2012). The construction and operation of the Project would not create the potential for the introduction of indicator bacteria in the Project area.

H.2.9 Invasive Species

The introduction of invasive species is the leading cause of biodiversity loss in aquatic systems. There are several different ways invasive species are introduced into freshwater environments, including ballast water, hull fouling, aquaculture escapes, and accidental or intentional introductions, among others (USEPA 2016). Exotic species include plants, fishes, algae, mollusks, crustaceans, bacteria, and viruses. Many exotic species become invasive or otherwise cause harm to the economy, environment, or human health in their nonnative environment. The construction and operation of the Project would not create the potential for the introduction of invasive species in the Project area.

H.2.10 Mercury

Mercury is a naturally occurring metal that has several forms. Mercury is primarily used in the manufacturing of electronics, fluorescent lighting, and production of chlorine-caustic soda (ATSDR 2022b). Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and manufacturing plants. It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity. Methylmercury may be formed in water and soil by bacteria. It bioaccumulates and biomagnifies in food chains. The construction and operation of the Project would not generate or release mercury and would not impact levels of mercury in the Project area.

H.2.11 Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) are made up of up to 209 individual chlorinated compounds known as congeners. Manufacturing of PCBs was stopped in the United States because of links to harmful effects in 1977. During their manufacture, use and disposal, PCBs entered the air, water and soil caused from accidental spills and leaks during their transport, and from leaks or fires in products containing PCBs. Because PCBs do not break down easily, they may remain in the environment for long periods of time. Most PCBs in water stick to organic particles and bottom sediments, however, a few may remain dissolved. They will bind strongly with soil. PCBs accumulate in fish and marine mammals and may reach levels many thousands of times higher than in water (ATSDR 2014a). The construction and operation of the Project would not generate or release PCBs and would not impact levels of PCBs in the Project area.

H.2.12 Salinity

Salinity refers to the presence of minerals (salts) that dissolve in water. High levels of salinity can be toxic to freshwater plants and animals and make water unusable for drinking, irrigation, and livestock. Road de-icing, human and industrial wastewater, fertilizer applications, mining and drilling, and repeated use of irrigation water can contribute to high levels of salts in freshwater bodies (USEPA 2012). The construction and operation of the Project would not increase salinity levels in the Project area.

H.2.13 Selenium

Selenium is a metal commonly found in rocks and soil. Small selenium particles in the air settle to the ground or are taken out of the air in rain. Selenium dust can enter the air from burning coal and oil. Soluble selenium compounds in agricultural fields can leave the field in irrigation drainage water and can enter water from rocks, soil, and industrial waste. Some compounds dissolve in water and some will settle to the bottom as particles. Selenium can accumulate up the food chain (ATSDR 2014b). The construction and operation of the Project would not generate selenium and would not impact levels of selenium in the Project area.

H.3 Beneficial Uses

Application of water quality objectives (i.e., standards) to protect designated beneficial uses is critical to water quality management in California. State law defines beneficial uses to include "...domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Water Code Section 13050(f)). Protection and enhancement of existing and potential beneficial uses are primary goals of water quality planning. Significant points concerning the concept of beneficial uses are:

1. All water quality problems can generally be stated in terms of whether there is water of sufficient quantity or quality to protect or enhance beneficial uses (Central Valley Regional Water Quality Control Board [CVRWQCB] 2018).
2. Beneficial uses do not include all of the reasonable uses of water. For example, disposal of wastewaters is not included as a beneficial use. This is not to say that disposal of wastewaters is a prohibited use; it is merely a use that cannot be satisfied to the detriment of beneficial uses. Similarly, the use of water for the dilution of salts is not a beneficial use although it may, in some cases, be a reasonable and desirable use of water (CVRWQCB 2018).
3. The protection and enhancement of beneficial uses require that certain quality and quantity objectives be met for surface and ground waters (CVRWQCB 2018).
4. Fish, plants, and other wildlife and humans use water beneficially.

The Porter-Cologne Water Quality Control Act defines water quality objectives as, "…the limits or levels of water quality constituents or characteristics which are established for the reasonable protections of the beneficial uses of water or the preventions of nuisance within a specified area" (Water Code 13050(H)). The basin plans present water quality objectives in numerical or narrative format for specified water bodies or for protection of specified beneficial uses throughout a specific basin or region.

Beneficial use designation (and water quality objectives) must be reviewed at least once during each 3-year period for the purpose of modification as appropriate (40 Code of Federal Regulations [CFR] 131.20). The beneficial uses and abbreviations listed below are standard basin plan designations (CVRWQCB 2018).

Municipal and Domestic Supply (MUN) – Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

Agricultural Supply (AGR) – Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing.

Industrial Service Supply (IND) – Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization.

Industrial Process Supply (PRO) – Uses of water for industrial activities that depend primarily on water quality.

Groundwater Recharge (GWR) – Uses of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

Freshwater Replenishment (FRSH) – Uses of water for natural or artificial maintenance of surface water quantity or quality.

Navigation (NAV) – Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Hydropower Generation (POW) – Uses of water for hydropower generation.

Water Contact Recreation (REC-1) – Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, canoeing, white water activities, fishing, or use of natural hot springs.

Noncontact Water Recreation (REC-2) – Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Commercial and Sport Fishing (COMM) – Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Aquaculture (AQUA) – Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.

Warm Freshwater Habitat (WARM) – Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Cold Freshwater Habitat (COLD) – Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Estuarine Habitat (EST) – Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).

Wildlife Habitat (WILD) – Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

Preservation of Biological Habitats of Special Significance (BIOL) – Uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance, where the preservation or enhancement of natural resources requires special protection.

Rare, Threatened, or Endangered Species (RARE) – Uses of water that support aquatic habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.

Migration of Aquatic Organisms (MIGR) – Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

Spawning, Reproduction, and/or Early Development (SPWN) – Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Shellfish Harvesting (SHELL) – Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sports purposes.

The beneficial uses designated for the surface waters in the Project area are presented in Table H-2. The beneficial uses designated for any specifically identified water body generally also apply to its tributary streams. In some cases, a beneficial use may not be applicable to the entire body of water. In these cases, CVRWQCB judgment is applied. Water bodies within the basins that do not have beneficial uses designated are assigned municipal and domestic supply designations per the provisions of SWRCB Resolution No. 88-63. These municipal and domestic supply designations in no way affect the presence or absence of other beneficial uses in these water bodies.

Table H-2. Beneficial Uses of Water Bodies in the Project Area

Beneficial Use Designation	Delta-Mendota Canal	O'Neill Forebay	Sacramento-San Joaquin River Delta	San Luis Reservoir
Municipal and Domestic Supply (MUN)	X	X	X	X
Agricultural Supply – Irrigation (AGR)	X	X	X	X
Industrial Process Supply (PRO)			X	
Industrial Service Supply (IND)			X	X
Groundwater Recharge (GWR)			X	
Freshwater Replenishment (FRSH)				
Navigation (NAV)			X	
Hydropower Generation (POW)				X
Water Contact Recreation (REC-1)	X	X	X	X
Noncontact Water Recreation (REC-2)	X	X	X	X
Shellfish Harvesting (SHELL)			X	
Commercial and Sport Fishing (COMM)			X	
Aquaculture (AQUA)				
Warm Freshwater Habitat (WARM)	X	X	X	X
Cold Freshwater Habitat (COLD)			X	
Migration of aquatic organisms (MIGR)			X	
Spawning, Reproduction, and/or Early Development (SPWN)			X	
Estuarine Habitat (EST)			X	
Wildlife Habitat (WILD)	X		X	X
Rare, Threatened, or Endangered Species (RARE)			X	

Source: CVRWQCB 2018

H.4 Delta Region Water Quality

The Delta region forms the low-lying outlet of the Central Valley, which comprises the channels of the Sacramento and San Joaquin Rivers, including from about the I-Street Bridge in Sacramento on the Sacramento River and Vernalis on the San Joaquin River, west to Martinez, and includes Suisun Bay and the Suisun Marsh. West of Martinez is the Carquinez Strait and San Pablo and San Francisco Bays. Estuarine areas occur from the Delta to San Francisco Bay depending on season of the year and outflow conditions.

Water quality in the Delta region is governed in part by Delta hydrodynamics, which are highly complex. The principal factors affecting Delta hydrodynamic conditions are (1) river inflows from the San Joaquin and Sacramento River systems, (2) daily tidal inflows and outflows through the San Francisco Bay, and (3) pumping from the southern Delta through the Harvey O. Banks Pumping Plant, C.W. "Bill" Jones Pumping Plant (Jones Pumping Plant), and other smaller diversions throughout the Delta. These Delta hydrodynamic conditions are primarily measured using the parameters of Sacramento and San Joaquin River flows, Delta outflow, Delta inflow, location of the low salinity zone, Old and Middle River flows, and Delta exports.

The transition area between saline waters and fresh water, frequently referred to as the low salinity zone[1] (LSZ), is typically located within Suisun Bay and the western Delta. Changes in the location of the LSZ are commonly measured by the position of X2, which is controlled by parameters such as daily tidal flows, Delta inflow, and Delta exports. Aquatic organisms have different salinity tolerances and preferences, and as such, changes in the position of the LSZ and X2 are commonly used to characterize likely changes in species distribution and other ecological parameters. The location of X2 is an indicator of the extent of saltwater intrusion into the Delta and thus is used to indicate changes to salinity concentrations within the Delta.

The existing water quality constituents of concern in the Delta can be categorized broadly as metals, pesticides, nutrient enrichment and associated eutrophication, constituents associated with suspended sediments and turbidity, salinity, bromide, and organic carbon. The relative concentrations of these constituents over time are closely related to hydrodynamic conditions, including the position of X2, described above. Other physical parameters, including pH, temperature, and electrical conductivity can interact with water quality constituents of concern to increase or decrease their effects on aquatic organisms and other beneficial uses. Water quality is closely monitored in the Delta to better understand water quality issues and track the improvement or decline in water quality in the Delta region. Figure H-1 through Figure H-3 present historical data from 2017 through 2022 for pH, temperature, and EC in Clifton Court Forebay. Clifton Court Forebay is located south of the City of Stockton and collects Delta water to be pumped into the California Aqueduct.

The Jones Pumping Plant diverts water from the Delta into the DMC that conveys Central Valley Project (CVP) water to users in the Central Valley and includes San Luis Reservoir as a storage feature. Similar to the Delta region, water quality constituents of concern in the DMC can be categorized broadly as metals, pesticides, constituents associated with suspended sediments and turbidity, salinity, bromide, and organic carbon.

The Banks Pumping Plant diverts water from the Delta into Bethany Reservoir and then the California Aqueduct. Water diverted to the California Aqueduct is conveyed south to State Water Project (SWP) water contractors via the O'Neill Forebay and San Luis Reservoir. Water quality constituents of concern in the south-of-Delta SWP, similar to the Delta region and DMC, include metals, pesticides, constituents associated with suspended sediments and turbidity, salinity, bromide, and organic carbon.

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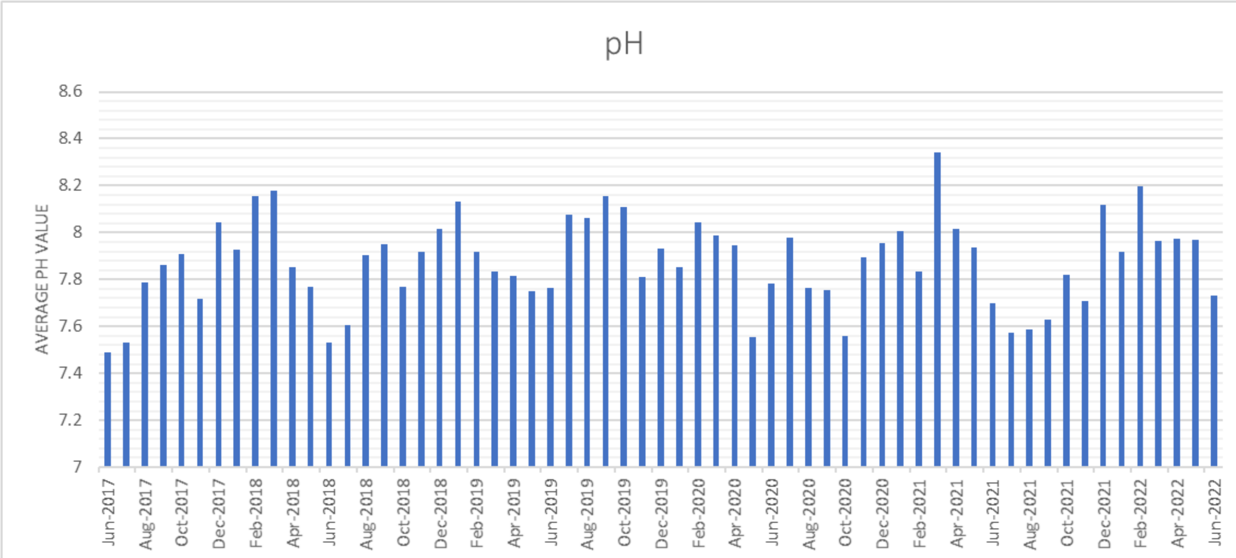
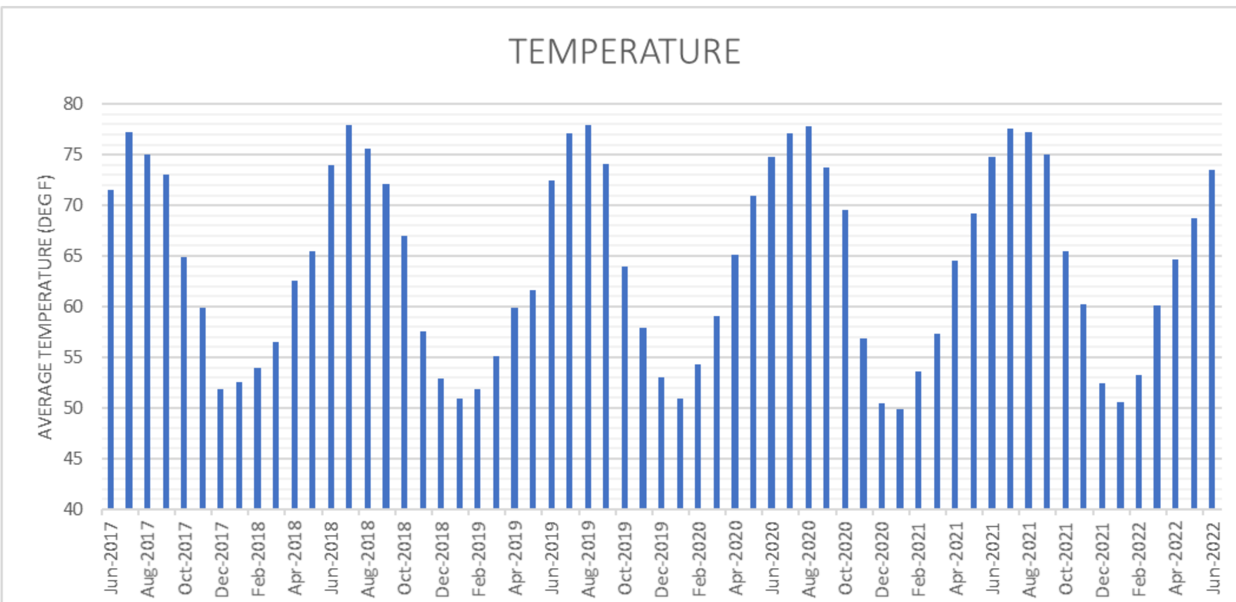
[1] The low salinity zone is often referenced by X2, which is the distance upstream, in kilometers, from the Golden Gate Bridge where tidally averaged salinity is equal to two parts per thousand (ppt). X2 is largely determined by Delta outflow (Kimmerer 2004).



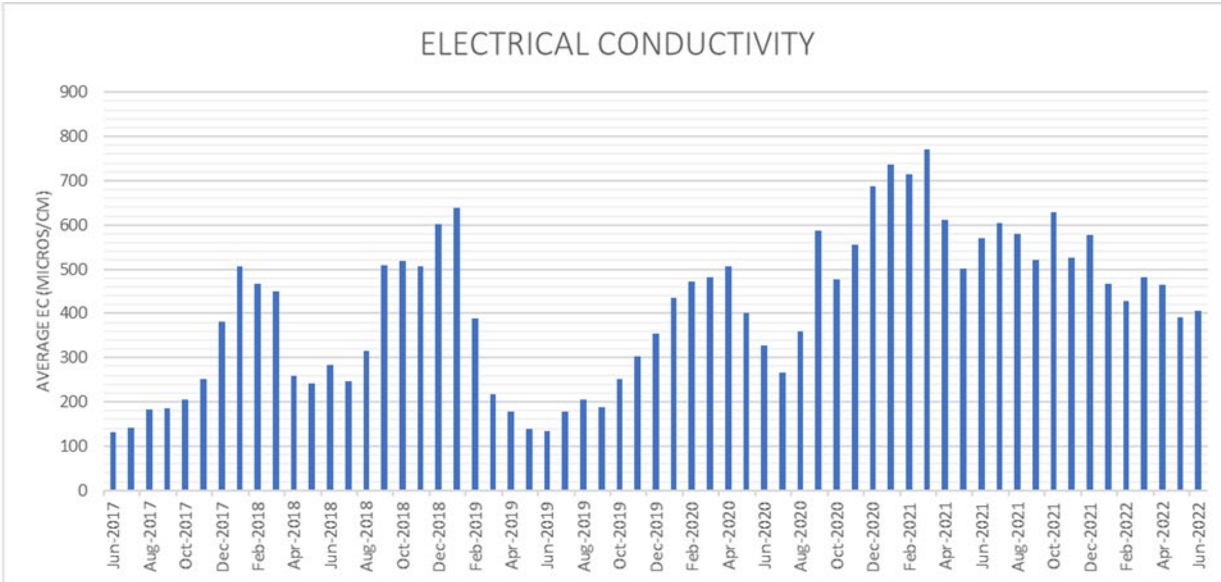
Source: DWR California Data Exchange Center (CDEC) 2022

Figure H-1. pH in Clifton Court Forebay



Source: DWR CDEC 2022

Figure H-2. Water Temperature in Clifton Court Forebay



Source: DWR CDEC 2022

Figure H-3. Electrical Conductivity in Clifton Court Forebay

H.5 Assessment Methodology

Water quality monitoring data and CalSim II modeling were used to aid in evaluating potential impacts within the Delta, San Luis Reservoir, and the DMC. Temporary construction-related effects and long-term operational effects to water quality were considered as part of this evaluation. Effects to the DMC are primarily expected to occur during construction. Temporary construction-related impacts were evaluated qualitatively based on anticipated construction practices, materials, locations, and duration of construction and related activities. Impacts outside the Delta, San Luis Reservoir, and the DMC were not considered since CalSim II modeling showed little to no changes in reservoir and stream flow levels. Effects to the Delta water quality from potential changes to CVP and SWP exports are discussed below. Because water from the Delta is pumped into the DMC, water quality within the Delta is a good indicator of water quality within the DMC. As noted previously, the Proposed Action would restore conveyance capacity in the DMC back to its original design capacity. Operation of the Proposed Action would conform to the existing operating rules identified in the 2019 USFWS and NMFS Biological Opinions (USFWS 2019; NMFS 2019).

As discussed in Chapter 2 of the EA/IS, under the California Environmental Quality Act (CEQA), existing conditions serve as the baseline to determine potential impacts of the Proposed Action. The existing condition CalSim II simulation was completed using historic hydrology from 1927 through 2003 and the current reduced DMC capacity. This CEQA approach differs from that of the National Environmental Policy Act (NEPA), where the No Action Alternative reflects expected future conditions in the Project area if no action is taken. The future no action CalSim II simulation was completed using future projected 2035 hydrology with climate change and the projected 2035 reduced DMC capacity.

The CalSim II model's monthly simulation of an actual daily (or even hourly) operation of CVP and SWP results in several limitations in use of model results. Model results must be used in a comparative manner to reduce effects of use of monthly data and other assumptions that are indicative of real-time operations but do not specifically match real-time observations. CalSim II model output is based upon a monthly time step. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches. Therefore, if quantitative changes between the Proposed Action and the No Action Alternative are five percent or less, conditions under the Proposed Action would be considered "similar" to conditions under the No Action Alternative.

Under extreme hydrologic and operational conditions where there is not enough water supply to meet all requirements, CalSim II utilizes a series of operating rules to reach a solution to allow for continuation of the simulation. It is recognized that these operating rules are a simplified version of complex decision processes that CVP and SWP operators would use in actual extreme conditions. Therefore, model results and potential changes under these extreme conditions should be evaluated on a comparative basis between alternatives and approximate extreme operational conditions.

H.5.1 X2 Results

X2 calculations were completed to provide an indication of changes to salinity throughout the Delta. The X2 water quality parameter represents the distance from the Golden Gate to the location of two parts per thousand (ppt) salinity concentration in the Delta. Larger values indicate that the salinity concentrations are increasing in the Delta because of reductions in outflow and the movement of the salinity zone further into the Delta, and smaller values indicate lower salinity concentrations as the salinity zone is pushed further out of the Delta.

H.5.2 South-of-Delta Export and Outflow Results

As noted above, water quality in the Delta and the south-of-Delta CVP and SWP is closely related to changes in hydrodynamics. Changes in south-of-Delta exports are directly linked to hydrodynamic conditions and can impact water quality conditions (e.g., salinity and total dissolved solids [TDS] levels) in the central and southern Delta and in south-of-Delta CVP and SWP water supplies. Greater exports during winter and spring, particularly during storm events, could draw turbidity and TDS from the Sacramento and San Joaquin Rivers into the central and southern Delta. Greater exports during the summer and spring, lower Delta inflow months, could draw salinity further into the central and southern Delta. Like the X2 analysis above, Delta outflow can be used as an indicator of potential changes to salinity concentrations resulting from the Proposed Action.

H.6 Significance Criteria

The significance criteria described below were developed with guidance from California Environmental Quality Act (CEQA) Guidelines to determine the significance of potential impacts on water quality that could result from implementation of the Project. Impacts would be significant if they resulted in one or more of the following conditions or situations:

1. Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality.

2. 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 that would: (a) result in substantial erosion or siltation on- or off-site or (b) create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
3. Conflict with or obstruct implementation of a water quality control plan.

The DMC is not located within a flood hazard, tsunami, or seiche zone. Therefore, risk of pollutants due to Project inundation within a flood hazard, tsunami, or seiche zone does not exist and has not been evaluated under the Proposed Action.

H.7 Project Impacts and Mitigation Measures

H.7.1 No Action Alternative

As discussed in Section 2.1 of the EA/IS, the No Action Alternative presents conditions in the absence of the Proposed Action. Under NEPA, the No Action Alternative reflects expected future conditions in the Project area if no action is taken. This EA/IS uses future projected CalSim II hydrology and the estimated reduced DMC capacity as a result of future subsidence for the future no action. This differs under CEQA, where existing conditions serve as the baseline to determine potential impacts of the alternatives. This EA/IS uses historic CalSim II hydrology and the current reduced DMC capacity for existing conditions.

H.7.1.1 Impact WQ-1: Would the alternative violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality?

Under the No Action Alternative, no actions would be taken to restore, or otherwise offset, conveyance capacity lost in the DMC. No physical modifications, operational or institutional changes would occur under this alternative that would degrade existing water quality conditions. Water quality conditions within the area of analysis would remain similar to existing and future no action conditions. **This alternative would have no impact on water quality.**

H.7.1.2 Impact WQ-2: Would the alternative 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?

Under the No Action Alternative, no actions would be taken to restore, or otherwise offset, conveyance capacity lost in the DMC. No physical modifications, operational or institutional changes would occur under this alternative that would alter existing drainage patterns or create or contribute runoff water. Water quality conditions within the area of analysis would remain similar to existing and future no action conditions. **This alternative would have no impact on water quality.**

H.7.1.3 Impact WQ-3: Would the alternative conflict with or obstruct implementation of a water quality control plan?

Under the No Action Alternative, no actions would be taken to restore, or otherwise offset, conveyance capacity lost in the DMC. As discussed in Section H.7.1.1, water quality conditions within the area of analysis would remain similar to existing and future no action conditions. Therefore, this alternative would not conflict with or obstruct implementation of a water quality control plan. **This alternative would have no impact on water quality.**

H.7.2 Proposed Action

H.7.2.1 Impact WQ-1: Would the alternative violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality?

During construction, the exposure of bare soils, soil and material stockpiles, and the presence of fuels, lubricants, and solid and liquid wastes could cause short-term surface or groundwater water quality impacts to the DMC and adjacent water bodies if not managed properly. The proposed modification of the DMC under the Proposed Action would include adding fill material along the canal right-of-way and excavation of the earthen materials from the sides of the canal. Filling and dredging activities could degrade water quality during construction. **This impact would be significant.**

Implementation of Mitigation Measure (MM) WQ-1, as described in Section H.7.3, would require the preparation of a Stormwater Pollution Prevention Plan (SWPPP). Additionally, CVRWQCB would require Best Management Practices (BMPs), monitoring and other construction controls to protect water quality. **With the implementation of MM WQ-1, this impact would be less than significant.**

As noted under Section H.4, water quality in the Delta and the south-of-Delta CVP and SWP is closely related to changes in hydrodynamics. Changes in south-of-Delta exports are directly linked to changes in Delta outflow, which can impact water quality conditions (e.g., salinity and TDS levels) in the southern Delta and south-of-Delta CVP and SWP service areas.

X2 calculations were completed to determine the movement of salinity throughout the Delta under the Proposed Action. Table H-3 and Table H-4 summarize X2 results which modeled potential changes in salinity in comparison to the existing conditions. Table H-5 and Table H-6 summarize X2 results in comparison to the future no action. Positive values indicate movement of the salinity zone into the Delta while negative values indicate the zones movement out of the Delta. Under the Proposed Action there would be limited changes, less than one kilometer on average, in the position of the X2. Considering X2 moves several kilometers every few hours twice per day (Water Education Foundation 2014), this change would not be significant. Under the operation of the Proposed Action, X2 results indicate that there would be no changes to Delta salinity levels resulting from changes in Delta outflows.

Table H-3. Modeled Difference in Delta X2 between Existing Conditions and the Proposed Action (km change[1])

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.1	-0.3	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0
D	0.0	0.0	0.1	0.3	0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0
C	0.0	-0.1	0.1	0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
All	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes: Modeling Period 1922-2003, Data results from CalSim modeling.
[1] Positive values indicate movement of the salinity zone into the Delta while negative values indicate the zones movement out of the Delta.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table H-4. Modeled Difference in Delta X2 between Existing Conditions and the Proposed Action (percent change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.0%	0.0%	0.2%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
AN	0.0%	0.0%	0.1%	0.0%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.1%
BN	0.0%	0.2%	-0.3%	0.1%	0.2%	0.1%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
D	0.0%	0.0%	0.1%	0.3%	0.2%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%
C	0.0%	-0.1%	0.1%	0.1%	-0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
All	0.0%	0.0%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table H-5. Modeled Difference in Delta X2 between Future No Action and the Proposed Action (km change[1])

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.0	0.0	0.3	0.1	0.2	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
AN	0.0	0.0	0.1	0.4	0.3	0.0	0.0	0.0	0.0	0.1	-0.2	-0.1
BN	-0.1	-0.5	0.7	0.5	0.3	0.4	0.1	0.1	0.0	0.0	0.0	-0.1
D	0.0	0.0	-0.4	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0
C	-0.1	0.0	-0.3	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
All	0.0	-0.1	0.1	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
[1] Positive values indicate movement of the salinity zone into the Delta while negative values indicate the zones movement out of the Delta.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table H-6. Modeled Difference in Delta X2 between Future No Action and the Proposed Action (percent change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.0%	0.0%	0.4%	0.2%	0.3%	0.1%	0.0%	0.0%	0.1%	0.0%	-0.1%	-0.1%
AN	0.0%	0.0%	0.1%	0.5%	0.5%	0.0%	0.0%	0.0%	0.0%	0.1%	-0.3%	-0.2%
BN	-0.1%	-0.6%	0.8%	0.7%	0.4%	0.6%	0.2%	0.1%	0.0%	0.0%	-0.1%	-0.1%
D	0.0%	0.0%	-0.4%	0.2%	0.3%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
C	-0.1%	0.0%	-0.3%	-0.1%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.1%	0.0%
All	0.0%	-0.1%	0.1%	0.3%	0.3%	0.2%	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Under the Proposed Action, south-of-Delta exports are expected to increase, as operation of the DMC at design capacity would allow for the full use of Jones Pumping Plant. As shown in Table H-7 through Table H-10, this would be an approximately one percent total change on average compared to existing and future no action conditions and is not expected to have a measurable impact on water quality conditions in the Delta. In addition, the Proposed Action would be operated consistent with all environmental requirements pertaining to Delta operations, including the 2019 USFWS and NMFS Biological Opinions for CVP and SWP operations and any future biological opinions or requirements.

Table H-7. Modeled Difference in Total South-of-Delta Exports between Existing Conditions and the Proposed Action (1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	3	16	7	3	6	-6	-4	-1	0	7	7	4	44
AN	-3	13	11	0	-8	-1	1	0	-1	5	32	14	63
BN	2	-30	8	0	3	0	2	2	-1	19	20	0	24
D	3	-5	3	-1	-3	0	-1	-2	4	30	9	4	42
C	4	12	-1	-5	-1	-5	0	0	2	5	8	0	20
All	2	3	6	0	1	-3	-1	0	1	14	14	4	39

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table H-8. Modeled Difference in Total South-of-Delta Exports between Existing Conditions and the Proposed Action (percent change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	1%	3%	1%	1%	1%	-1%	-1%	0%	0%	1%	1%	1%	1%
AN	-1%	2%	2%	0%	-2%	0%	0%	0%	0%	1%	6%	2%	1%
BN	0%	-6%	2%	0%	1%	0%	1%	1%	0%	3%	3%	0%	0%
D	1%	-1%	1%	0%	-1%	0%	0%	-1%	2%	6%	3%	1%	1%
C	2%	5%	0%	-1%	0%	-2%	0%	0%	2%	4%	4%	0%	1%
All	0%	1%	1%	0%	0%	-1%	0%	0%	0%	3%	3%	1%	1%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table H-9. Modeled Difference in Total South-of-Delta Exports between Future No Action and the Proposed Action (1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-2	21	7	11	4	-3	-3	-1	0	14	11	13	72
AN	-3	13	-16	1	-4	-3	0	1	-9	23	29	20	54
BN	-34	47	1	0	20	0	0	2	1	13	27	8	86
D	3	-30	-15	5	-2	-2	0	0	13	52	3	4	30
C	-5	-13	13	9	2	2	0	0	30	1	-5	6	38
All	-7	9	-1	6	4	-1	-1	0	6	22	12	10	58

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table H-10. Modeled Difference in Total South-of-Delta Exports between No Future Action and the Proposed Action (percent change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0%	4%	1%	2%	1%	-1%	-1%	0%	0%	3%	2%	2%	1%
AN	-1%	3%	-3%	0%	-1%	-1%	0%	0%	-3%	5%	5%	4%	1%
BN	-7%	12%	0%	0%	4%	0%	0%	1%	0%	2%	5%	1%	2%
D	1%	-8%	-4%	1%	-1%	-1%	0%	0%	5%	16%	2%	1%	1%
C	-3%	-9%	4%	3%	0%	1%	0%	0%	26%	1%	-4%	3%	2%
All	-2%	2%	0%	1%	1%	0%	0%	0%	2%	5%	3%	2%	1%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Under operation of the Proposed Action, Delta outflows are expected to decrease during winter months as the change in operations increase exports with the DMC operation at design capacity. Like the X2 analysis above, Delta outflow can be used as an indicator of potential changes to salinity concentrations as a result of the Proposed Action. Table H-11 through Table H-14 show the change in Delta outflow under the Proposed Action compared to existing and future no action conditions. As shown in Table H-12 and Table H-14, operation of the Proposed Action would result in a less than one percent change on average compared to existing and future no action conditions and is not expected to have a measurable impact on water quality conditions in the Delta.

Table H-11. Modeled Difference in Total Delta Outflow between Existing Conditions and the Proposed Action (cubic feet per second)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
-2	-10	-11	-5	-9	3	3	-1	0	0	-1	0	-2
1	-8	-14	-3	-12	0	-2	1	-2	0	-3	1	1
-10	19	-15	-4	-13	0	-10	-6	1	0	1	1	-10
-1	-6	-28	0	-3	-2	0	1	-1	0	1	0	-1
5	-8	0	6	-1	-1	0	0	-1	0	-2	0	5
-2	-4	-14	-2	-7	0	-1	-1	0	0	0	0	-2

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table H-12. Modeled Difference in Total Delta Outflow between Existing Conditions and the Proposed Action (percent change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0%	-2%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
AN	0%	-2%	-1%	0%	0%	0%	0%	0%	0%	0%	-1%	0%
BN	-3%	3%	-1%	0%	-1%	0%	-1%	-1%	0%	0%	0%	1%
D	0%	-1%	-2%	0%	0%	0%	0%	0%	0%	0%	1%	0%
C	2%	-4%	0%	1%	0%	0%	0%	0%	0%	0%	-1%	0%
All	0%	-1%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table H-13. Modeled Difference in Total Delta Outflow between Future No Action and the Proposed Action (cubic feet per second)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-2	-20	-15	-29	-2	5	3	-1	0	4	0	-1
AN	2	-15	2	-31	-7	14	-1	0	-5	19	-1	-3
BN	28	-65	-25	-4	-42	2	-5	2	-2	4	1	5
D	0	21	-23	-11	1	-13	2	-1	0	0	1	1
C	-3	17	-26	-10	4	0	0	0	1	-8	6	0
All	4	-13	-18	-18	-8	1	0	0	-1	3	1	0

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table H-14. Modeled Difference in Total Delta Outflow No Future Action and the Proposed Action (percent change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0%	-3%	-1%	0%	0%	0%	0%	0%	0%	1%	0%	0%
AN	0%	-3%	0%	-1%	0%	0%	0%	0%	-1%	3%	0%	0%
BN	8%	-10%	-1%	0%	-2%	0%	0%	0%	0%	1%	0%	3%
D	0%	5%	-1%	-1%	0%	-1%	0%	0%	0%	0%	0%	0%
C	-1%	4%	-4%	-1%	0%	0%	0%	0%	0%	-3%	3%	0%
All	1%	-2%	-1%	-1%	0%	0%	0%	0%	0%	1%	0%	0%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

While there would be changes to Delta exports and outflows, changes in Delta water quality would not be measurably impacted. **Therefore, operation of the Proposed Action would not substantially degrade Delta water quality and would have a less than significant impact on water quality standards.**

The DMC is not an impaired water body listed on the Section 303(d) list and currently meets CWA water quality standards. Reclamation monitors and evaluates the quality of water in the DMC to ensure water is suitable for downstream agricultural and wetland use. The Proposed Action would restore conveyance capacity in the DMC back to its original design capacity. The DMC's operations after construction are expected to continue as they were executed following the original construction of the canal. **Therefore, no impact on water quality in the DMC is expected from the long-term operation the Proposed Action.**

San Luis Reservoir is capable of receiving water from the DMC, which enables the CVP to pump water into the reservoir during the wet season (October through March) and release water into the conveyance facilities during the dry season (April through September) when demands are higher. Operation of the Proposed Action would result in minor fluctuations of storage levels within San Luis Reservoir. Based on CalSim II modeling results, operation of the Proposed Action would lead to an average maximum change in elevation of four feet, or a less than one percent change, compared to existing conditions. Operation of the Proposed Action would lead to an average maximum change in elevation of five feet, or a one percent change, compared to future no action conditions. Table H-15 through Table H-18 summarize the monthly change in total San Luis Reservoir elevation under the Proposed Action compared to existing and future no action conditions. As shown in Table H-16 and Table H-18, operation of the Proposed Action would result in a less than one percent change on average compared to existing and future no action conditions and is not expected to have a measurable impact on water quality conditions in San Luis Reservoir. **Therefore, there would be no impact on water quality in San Luis Reservoir from the long-term operation the Proposed Action.**

Table H-15. Modeled Difference in San Luis Reservoir Elevation between Existing Conditions and the Proposed Action (feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-1	0	1	-1	0	0	-1	0	-2	-4	-3	-2
AN	-1	0	1	-1	0	0	0	-1	-4	-9	-3	-1
BN	-3	-5	-4	0	1	1	0	0	-2	-5	-4	-4
D	-1	-1	-1	1	1	1	1	1	-1	-1	-3	-1
C	1	3	2	-1	-1	-1	-1	-1	-1	-1	0	0
All	-1	-1	0	0	0	0	0	0	-2	-4	-3	-2

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table H-16. Modeled Difference in San Luis Reservoir Elevation between Existing Conditions and the Proposed Action (percent change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	0%
AN	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-2%	-1%	0%
BN	-1%	-1%	-1%	0%	0%	0%	0%	0%	-1%	-1%	-1%	-1%
D	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%
C	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	0%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table H-17. Modeled Difference in San Luis Reservoir Elevation between Future No Action and the Proposed Action (1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-4	-1	0	-2	-1	-1	-1	-1	-2	-5	-6	-4
AN	-2	-1	-3	2	2	3	2	2	-3	-7	-4	-1
BN	-10	-4	-4	0	2	2	2	1	-2	-7	-8	-6
D	0	-4	-4	0	0	-1	-1	-1	-2	-1	-3	-2
C	-3	-5	-2	-6	-5	-5	-5	-5	-3	-4	-5	-4
All	-4	-3	-2	-1	0	0	0	-1	-2	-5	-5	-3

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table H-18. Modeled Difference in San Luis Reservoir Elevation between Future No Action and the Proposed Action (percent change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-1%	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	-1%	-1%
AN	0%	0%	-1%	0%	1%	1%	0%	0%	-1%	-2%	-1%	0%
BN	-2%	-1%	-1%	0%	0%	0%	0%	0%	0%	-2%	-2%	-2%
D	0%	-1%	-1%	0%	0%	0%	0%	0%	-1%	0%	-1%	0%
C	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%
All	-1%	-1%	0%	0%	0%	0%	0%	0%	-1%	-1%	-1%	-1%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

H.7.2.2 Impact WQ-2: Would the alternative 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?

The proposed modification of the DMC under the Proposed Action would include adding fill material along the canal right-of-way and excavation of the earthen materials from the sides of the canal. Soil disturbance could result in localized surface erosion, minor changes in drainage patterns, and changes in erosion rates. Therefore, construction-related activities have the potential to degrade water quality and create additional sources of polluted runoff. **This impact would be significant.**

Implementation of MM WQ-1, as described in Section H.7.3, would require the preparation of a SWPPP. Additionally, CVRWQCB would require BMPs, monitoring and other construction controls to protect water quality. **With implementation of MM WQ-1, this impact would be less than significant.**

H.7.2.3 Impact WQ-3: Would the alternative conflict with or obstruct implementation of a water quality control plan?

Several different regional water quality control plans govern water bodies within the Project area (See Section E.2.22 in Appendix E). These plans establish water quality standards and requirements for parameters such as toxic chemicals, bacterial contamination, and other factors which have the potential to adversely affect beneficial uses or cause nuisance conditions (SWRCB 2018). Construction-related activities have the potential to degrade water quality under the Proposed Action, which could affect the ability to meet objectives in a water quality control plan. **This impact would be significant.**

Implementation of MM WQ-1, as described in Section H.7.3, would require the preparation of a SWPPP. Additionally, CVRWQCB would require BMPs, monitoring and other construction controls to protect water quality. **With implementation of MM WQ-1, this impact would be less than significant.**

As previously discussed in Section H.7.2.1, changes to Delta water quality as a result of the operation of the Proposed Action would be minimal and would not cause nuisance conditions or adversely affect beneficial use of the Delta. **Therefore, operation of the Proposed Action would not conflict with or obstruct implementation of a water quality control plan and would have a less than significant impact on water quality.**

H.7.3 Mitigation Measures

MM WQ-1: Prepare site-specific Stormwater Pollution Prevention Plan (SWPPP). The objectives of the SWPPP would be to: (1) identify pollutant sources that may affect the quality of stormwater associated with construction activity; and (2) identify, construct, and implement stormwater pollution prevention measures to reduce pollutants in stormwater discharges during and after construction. The SWPPP would also include details of how the sediment and erosion control practices, referred to as BMPs would be implemented. The implementation of the SWPPP would comply with state and federal water quality regulations.

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Appendix I1
Air Quality Technical Appendix

Appendix I1 Air Quality Technical Appendix

This appendix documents the air quality technical analysis to support the impact analysis in the Environmental Assessment/Initial Study (EA/IS) and describes the potential air quality effects that could result from the implementation of the No Action/No Project Alternative (subsequently identified as the No Action Alternative) and the Proposed Action/Proposed Project (subsequently identified as the Proposed Action) considered by the EA/IS. Effects on air quality resulting from the construction and operation associated with the Proposed Action may occur in the San Joaquin Valley region alongside the Delta-Mendota Canal (DMC).

Air quality is affected by a combination of meteorological conditions that affect the dispersal of pollutants within a region and of the rate, quantity, and location of pollutant emissions throughout a region. Atmospheric conditions including wind speed and direction, and air temperatures, and local surface topography (i.e., the geographic features of a region) all play a role in the effect of air pollutant emissions on regional air quality.

I1.1 Existing Conditions

Although the Project area is confined to the DMC right-of-way (ROW), the study area for air quality is broader. The study area follows the route of the DMC, originating in Contra Costa County and passing through Alameda, San Joaquin, Stanislaus, and Merced Counties before terminating in Fresno County. No construction activities are planned to be undertaken within Contra Costa County under the Proposed Action; thus, Contra Costa County is excluded from the air quality study area. Alameda County is within the San Francisco Bay Area Air Basin (SFBAAB) where air pollution is regulated by the Bay Area Air Quality Management District (BAAQMD), while San Joaquin, Stanislaus, Merced, and Fresno counties are within the San Joaquin Valley Air Basin (SJVAB), regulated by the San Joaquin Valley Air Pollution Control District (SJVAPCD).

The SFBAAB is bordered on the west by the Coast Range and Pacific Ocean, and on the south and east by warmer inland valleys, including the SJVAB. The SJVAB is bordered on the west by the Coast Range, on the east by the Sierra Nevada Mountains, and on the south by the Tehachapi Mountains. The study area is highly susceptible to air pollutant accumulation because of the topographical boundaries of the mountain ranges to low atmospheric air currents.

The study area's low average wind speeds in winter months contribute to higher pollutant concentrations in the region. During summer months, winds driven by marine air currents typically flow in a south/southeasterly direction through the SFBAAB and SJVAB, originating through gaps in the Coast Range at the Golden Gate Strait and Carquinez Strait. These conditions contribute to persistent summer inversions, the trapping of cool marine air under a mass of warmer air in the atmosphere, that stymie the vertical dispersion of air pollutants.

The federal Clean Air Act requires the classification of all, or portions, of air basins based on the ambient pollutant concentrations relative to the National Ambient Air Quality Standards (NAAQS). Areas for which the NAAQS have been achieved are designated as attainment. For areas for which the NAAQS have not been achieved, states must prepare a State Implementation Plan detailing strategies to reduce air pollutant concentrations in the area and achieve the NAAQS. California, through the California Clean Air Act has adopted additional California Ambient Air Quality

Standards (CAAQS), applicable only to California, for which attainment must be classified in addition to the NAAQS. Table I1-1 presents the attainment status of the SFBAAB and SJVAB.

Table I1-1. Attainment Status for the SFBAAB and SJVAB

Pollutant	National Standards[1,2,3]	California Standards[1,2]
Ozone (O_3)	SFBAAB – Nonattainment (Marginal) SJVAB – Nonattainment (Extreme)	SFBAAB – Nonattainment SJVAB – Nonattainment
Carbon monoxide (CO)	SFBAAB – Attainment SJVAB - Attainment	SFBAAB – Unclassified SJVAB – Unclassified
Nitrogen dioxide (NO_2)	SFBAAB – Attainment SJVAB - Attainment	SFBAAB – Attainment SJVAB - Attainment
Sulfur dioxide (SO_2)	SFBAAB – Attainment SJVAB - Attainment	SFBAAB – Attainment SJVAB - Attainment
Inhalable particulate matter (PM_{10})	SFBAAB – Attainment SJVAB – Maintenance	SFBAAB – Nonattainment SJVAB – Nonattainment
Fine particulate matter ($PM_{2.5}$)	SFBAAB – Nonattainment (Moderate) SJVAB – Nonattainment (Serious)	SFBAAB – Nonattainment SJVAB – Nonattainment
Lead (Pb)	SFBAAB – Attainment SJVAB - Attainment	SFBAAB – Attainment SJVAB - Attainment

Source: California Air Resources Board (CARB) 2022a; United States Environmental Protection Agency (USEPA) 2022a

Notes:

1 Nonattainment means that the area does not meet the ambient air quality standard for the given pollutant.

2 Attainment means that the area meets the ambient air quality standards for the given pollutant.

3 Maintenance means that the area has recently met the ambient air quality standard for the given pollutant and must provide the U.S. Environmental Protection Agency (USEPA) with information demonstrating that it is maintaining the standard before the area can be redesignated as attainment.

Key: SFBAAB = San Francisco Bay Area Air Basin; SJVAB = San Joaquin Valley Air Basin

Sensitive receptors are locations where individuals susceptible to poor air quality, such as children, elderly, and people with preexisting health problems, may reside or spend significant amounts of time. Examples of sensitive receptors include residences, schools, parks, daycare centers, convalescent homes, and medical facilities. Numerous sensitive receptors exist throughout the study area which would be affected by regional air pollution emitted by the Proposed Action activities. Table I1-2 summarizes the potential health effects of prolonged exposure to high concentrations of criteria air pollutants. Exposure to concentrations below the NAAQS and CAAQS would reduce these health effects to levels appropriate to protect the health of the most sensitive groups in populations.

Table I1-2. Criteria Pollutants and their Health Effects

Pollutant	Characteristics	Health Effects	Major Sources
O_3	Highly reactive photochemical pollutant created by the action of sunshine on O_3 precursors	• Cough and chest tightness pain upon taking a deep breath • Worsening of wheezing and other asthma symptoms • Reduced lung function • Increased hospitalizations for respiratory causes	Pollutants emitted from vehicles, factories, and other industrial sources; fossil fuels combustion; consumer products; and evaporation of paints
CO	Highly toxic odorless, colorless gas; formed by the incomplete combustion of fuels	• Impairment of oxygen transport in the bloodstream • Aggravation of cardiovascular disease • Fatigue, headache, and dizziness	Carbon-containing fuels like gasoline or wood
NO_2	Reactive, oxidizing gas formed during combustion	• Respiratory symptoms • Episodes of respiratory illness • Impaired lung function	High-temperature combustion processes, such as those occurring in trucks, cars, and power plants
SO_2	Colorless gas with pungent odor	• Wheezing, shortness of breath, and chest tightness • Pulmonary symptoms and disease • Decreased pulmonary function • Increased risk of mortality	Sulfur-containing fuel burned by locomotives, ships, and off-road diesel equipment, or industrial sources like petroleum refining and metal processing
PM_{10} and $PM_{2.5}$	Small particles measuring 10 microns or less are termed PM10 (fine particles less than 2.5 microns are termed PM2.5); solid and liquid particles of dust, soot, aerosols, smoke, ash, and pollen and other matter that is small enough to remain suspended in the air for a long period	• Increased risk of hospitalization for lung and heart-related respiratory illness • Increased risk of premature deaths • Reduced lung function • Increased respiratory symptoms and illness	Burning fuels like gasoline, oil, and diesel or wood ($PM_{2.5}$) and windblown dust (PM_{10})

Pollutant	Characteristics	Health Effects	Major Sources
Pb	Soft resilient metal	• Impaired blood formation and nerve conduction • Fatigue, anxiety, short-term memory loss, depression, weakness in extremities, and learning disabilities in children • Cancer	Various industrial activities

Source: USEPA 2022b

Key: O_3 = ozone; CO = carbon monoxide; NO_2 = nitrogen dioxide; SO_2 = sulfur dioxide; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; Pb = lead

I1.2 Assessment Methodology

This section describes the general assessment methods used to analyze the potential air quality effects of the Proposed Action described in the EA/IS.

I1.2.1 Construction

Emissions from construction-related equipment engine exhaust were estimated using emission factors derived from emissions and activity data from the California Air Resources Board (CARB) EMFAC2017 on-road component of the CARB's web-based emissions model and the OFFROAD2021 off-road component of the CARB's web-based emissions model (CARB 2022b, 2022c). Although a more recent version of the on-road component (EMFAC2021) has been developed by CARB, that model has not yet been approved by the United States Environmental Protection Agency (USEPA) for use in regulatory purposes. In the estimation of construction equipment emission factors, only equipment of model year 2015 or newer, representative of USEPA Tier 4 final engine standard equipment, were considered. Hauling and delivery vehicles were also assumed to be of model year 2015 or newer.

Task-specific construction equipment, personnel, haul and excavation quantities, and scheduling information was derived from the Bureau of Reclamation's (Reclamation's) 2021 *Delta-Mendota Canal Subsidence Project: Feasibility Study of the Structural Alternatives*. It was assumed that 50 percent of necessary backfill material would be reused from materials excavated on-site. Haul trucks were assumed to be at least 10 cubic yards in capacity for all construction. Vendor delivery trip counts, if not provided in Reclamation's 2021 *Delta-Mendota Canal Subsidence Project: Feasibility Study of the Structural Alternatives* for a given element of action construction, were estimated based on the estimated typical square-footage of the construction element and default vendor delivery rates from the California Air Pollution Control Officers Association (CAPCOA) California Emissions Estimator Model (CalEEMod) version 2022.1. Haul route, worker commute, and vendor delivery distances were based on default regional values from the CAPCOA California Emissions Estimator Model (CalEEMod) version 2022.1 (California Air Pollution Control Officers Association [CAPCOA] 2022).

All equipment was assumed to operate over single, 10-hour shifts throughout the construction durations. Nonexhaust air pollutant emission from construction, such as those which would result from bulldozing, grading, earthen material handling, or the re-entrainment of paved or unpaved road dust by construction vehicles, were estimated using emission factors from the USEPA's Compilation of Air Pollutant Emissions Factors (AP-42) resource and the equipment activities and material quantities discussed previously (USEPA 2022c).

I1.2.2 Operation

While the Proposed Action would modify the structure of the existing canal, these modifications would not be expected to result in an operational change to air pollutants emissions relative to the existing, or future no action, conditions. Therefore, emissions of air pollutants potentially attributable to canal operation were not quantified.

I1.3 Significance Criteria

The thresholds of significance for impacts address the environmental checklist items from Appendix G of the State California Environmental Quality Act Guidelines as well as federal air quality requirements. The Proposed Action would result in a significant impact to air quality if it would:

1. Result in emissions of air pollutants exceeding the General Conformity *de minimis* emission levels or the quantitative criteria promulgated by the applicable local air pollution control agency.
2. Expose sensitive receptors to substantial pollutant concentrations.
3. Result in other emissions, such as those leading to objectionable odors, adversely affecting a substantial number of people.

The environmental checklist from Appendix G of the State California Environmental Quality Act (CEQA) Guidelines indicates that a project would result in a significant impact on air quality if it would (1) would conflict with or obstruct implementation of the applicable air quality plan; (2) would result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard; (3) would expose sensitive receptors to substantial pollutant concentrations; or (4) would result in other emissions, such as those leading to objectionable odors, adversely affecting a substantial number of people. Quantitative significance criteria have been developed by the BAAQMD and SJVAPCD. These criteria were developed such that a project consistent with the criteria would not be expected to exceed the CAAQS or NAAQS and would not conflict with or obstruct implementation of the respective applicable regional air quality plans. The USEPA's quantitative General Conformity *de minimis* emission levels were developed to ensure that federal projects in nonattainment areas would not conflict with a region's attainment or progress toward attainment of the NAAQS. Although not nonattainment pollutants, volatile organic compounds (VOC)/reactive organic gases (ROG) and oxides of nitrogen (NO_X) are precursor compounds to O_3, which develops in the atmosphere and is not directly emitted by combustion sources. Therefore, significance criteria have been developed by the applicable agencies and USEPA for ROG and NO_X for the control of regional O_3 concentrations. Table I1-3 lists the General Conformity *de minimis* emission levels applicable to the SJVAB and SFBAAB. Table I1-4 lists the applicable emissions criteria of the BAAQMD and SJVAPCD. Criteria are presented in tons per year (tpy) or average pounds per day (lb./day). These quantitative criteria address the Proposed Action's consistency with items (1) and (2) of the CEQA checklist.

Table I1-3. General Conformity *de minimis* Emission Levels

Air Basin	VOC	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
SFBAAB	100 tpy	n/a	100 tpy	n/a	n/a	100 tpy
SJVAB	10 tpy	n/a	10 tpy	n/a	100 tpy	70 tpy

Source: USEPA 2022d

Key: SFBAAB = San Francisco Bay Area Air Basin; CO = carbon monoxide; n/a = not applicable; NO_x = nitrous oxide; $PM_{2.5}$ = fine particulate matter PM_{10} = inhalable particulate matter; San Francisco Bay Area Air Basin; SJVAB = San Joaquin Valley Air Basin; SO_x = sulfur oxide; tpy = tons per year; VOC = volatile organic compound

Table I1-4. Quantitative Air Quality Significance Criteria for Construction

Air Agency	ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
BAAQMD	54 lb./day	n/a	54 lb./day	n/a	82 lb./day	54 lb./day
SJVAPCD	10 tpy	100 tpy	10 tpy	27 tpy	15 tpy	15 tpy

Source: Bay Area Air Quality Management District (BAAQMD) 2017; San Joaquin Valley Air Pollution Control District (SJVAPCD) 2015

Key: BAAQMD = Bay Area Air Quality Management District; CO = carbon monoxide; lb./day = pounds per day; n/a = not applicable; NO_x = nitrous oxide; $PM_{2.5}$ = fine particulate matter; PM_{10} = inhalable particulate matter; ROG = reactive organic gases; SJVAPCD = San Joaquin Valley Air Pollution Control District; SO_x = sulfur oxide; tpy = tons per year

I1.4 Project Impacts and Mitigation Measures

I1.4.1 No Action Alternative

I1.4.1.1 Impact AQ-1: Would the alternative result in emissions of air pollutants exceeding the General Conformity de minimis *emission levels or a quantitative threshold promulgated by the applicable local air pollution control agency?*

Under the No Action Alternative, no actions would be taken to restore, or otherwise offset, conveyance capacity lost in the DMC. Operational changes would occur to compensate for the effects of future land subsidence on the capacity of the DMC, but these changes would be minor and would not result in an appreciable change to regional air pollutant emissions. **Therefore, impacts to air quality relative to air pollutant emissions from the No Action Alternative would be less than significant**.

I1.4.1.2 Impact AQ-2: Would the alternative expose sensitive receptors to substantial pollutant concentrations?

Under the No Action Alternative, no action would be taken to restore, or otherwise offset, conveyance capacity lost in the DMC; therefore, there would be no short-term exposure of sensitive receptors to construction-related emissions of toxic air contaminants (TAC). Operational changes would occur to compensate for the effects of future land subsidence on the capacity of the DMC, but these changes would be minor and would not result in an appreciable change to localized concentrations of TAC. **Therefore, impacts to air quality relative to the exposure of sensitive receptors to substantial pollutant concentrations would be less than significant.**

I1.4.1.3 Impact AQ-3: Would the alternative result in other emissions, such as those leading to objectionable odors, adversely affecting a substantial number of people?

Under the No Action Alternative, no action would be taken to restore, or otherwise offset, conveyance capacity lost in the DMC; therefore, there would be no short-term dust or odors from construction activities. Operational changes would occur to compensate for the effects of future land subsidence on the capacity of the DMC, but these changes would be minor and would not result in an appreciable change to odors or dust associated with operation of the DMC. **Therefore, impacts to air quality relative to other emissions adversely affecting a substantial number of people would be less than significant.**

I1.4.2 Proposed Action

I1.4.2.1 Impact AQ-1: Would the alternative result in emissions of air pollutants exceeding the General Conformity de minimis emission levels or a quantitative threshold promulgated by the applicable local air pollution control agency?

Under the Proposed Action, construction would last for approximately seven and a half years, with the time spent at various locations along the canal. As shown in Table I1-5, construction activities along the canal would generate air pollutant emissions which would be less than the USEPA General Conformity *de minimis* levels and would be less than the BAAQMD and SVJAPCD quantitative thresholds. Operation of the DMC under the Proposed Action would not be expected to result in an appreciable change to regional air pollutant emissions relative to the existing, or future no action, conditions. **Therefore, impacts to air quality relative to air pollutant emissions from the Proposed Action would be less than significant**.

Table I1-5. Proposed Action Construction Emissions Compared to Local Air Pollution Control Agencies Criteria

Construction	ROG/VOCs	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
BAAQMD						
Emissions (lb./day)	2.1	18.6	37.9	0.1	12.5	2.7
BAAQMD Significance Thresholds (lb./day)	54	54	n/a	n/a	82	54
Exceeds Thresholds?	No	No	n/a	n/a	No	No
Emissions (tpy)	0.3	2.4	5.0	<0.1	1.6	0.4
General Conformity *de minimis* (tpy)	100	100	n/a	n/a	n/a	100
Exceeds General Conformity?	No	No	n/a	n/a	n/a	No
SJVAPCD						
Emissions (tpy)	0.6	5.3	9.3	<0.1	3.6	0.8
SJVAPCD Significance Thresholds (tpy)	10	10	100	27	15	15
Exceeds Thresholds?	No	No	No	No	No	No
General Conformity *de minimis* (tpy)	10	10	n/a	n/a	100	70
Exceeds General Conformity?	No	No	n/a	n/a	No	No

Source: BAAQMD 2017; SJVAPCD 2015

Key: BAAQMD = Bay Area Air Quality Management District; CO = carbon monoxide; lb./day = pounds per day; n/a = not applicable; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; ROG = reactive organic gases; SJVAPCD = San Joaquin Valley Air Pollution Control District; SO_2 = sulfur dioxide; tpy = tons per year; VOCs = volatile organic compounds

I1.4.2.2 Impact AQ-2: Would the alternative expose sensitive receptors to substantial pollutant concentrations?

Under the Proposed Action, construction would last for approximately seven and a half years, with the time spent at various locations along the canal. Construction activities along the canal have the potential to emit TAC in the form of construction equipment engine exhaust, including diesel particulate matter (DPM);[1] however, construction impacts from construction of the Proposed Action would be temporary and highly mobile, occurring for short periods along various points of the 116-mile DMC. In addition to the short-term, highly mobile nature of construction under the Proposed Action, pollutant concentrations have been shown to drop up to 70 percent at a distance of 500 feet from a vehicle exhaust source and up to 80 percent by 1,000 feet (CARB 2005). Operation of the DMC under the Proposed Action would not be expected to result in an appreciable change to local TAC concentrations relative to the existing, or future no action, conditions. Therefore, the exposure of sensitive receptors to DPM or other potential TAC would be minimal. **Impacts to air quality relative to the exposure of sensitive receptors to substantial pollutant concentrations would be less than significant.**

I1.4.2.3 Impact AQ-3: Would the alternative result in other emissions, such as those leading to objectionable odors, adversely affecting a substantial number of people?

Under the Proposed Action, construction of the Project would last for approximately seven and a half years, with the time spent at various locations along the canal. Construction of the canal would result in the emission of diesel engine exhaust, which may generate near-field odors that certain individuals may find objectionable. Earthmoving activities and operation of construction vehicles on paved and unpaved roadways would also result in the generation of fugitive dust. Construction impacts from the Proposed Action would be temporary and highly mobile, occurring for short periods along various points of the 116-mile DMC. In addition to the short-term, highly mobile nature of construction, the watering of construction areas during earthmoving activities would reduce emissions of fugitive dust up to 61 percent (CAPCOA 2022). The DMC ROW also passes through predominantly rural, sparsely populated countryside with most individuals who might experience construction activities being passersby in motor vehicles. Operation of the DMC under the Proposed Action would not be expected to result in an appreciable change to change to odors or dust associated with operation of the DMC relative to the existing, or future no action, conditions. Therefore, relatively few individuals would have the potential to experience odors or dust related to construction activities, exposure to construction-related odors or dust for individuals near construction would minimal. **Impacts to air quality relative to other emissions adversely affecting a substantial number of people would be less than significant.**

I1.4.2.4 Mitigation Measures

No mitigation measures would be necessary to reduce impacts of the Proposed Action to the less than significant level.

[1] DPM is listed by California Office of Environmental Health Hazard Assessment (OEHHA) as a carcinogen and contributes to noncancer chronic health effects. OEHHA has not established a hazard index attributable to DPM for acute (short-term) health effects.

I1.5 Cumulative Impacts

Table I1-6 and Table I1-7 summarize the maximum annual cumulative construction emissions anticipated to result from the identified cumulative projects within the SFBAAB and SJVAB respectively. These emissions were obtained from publicly available environmental documents and represent the maximum annual construction emissions for each pollutant from each cumulative project after the application of applicable mitigations outlined in the respective environmental documents.

Table I1-6. San Francisco Bay Area Air Basin Cumulative Construction Emissions

Cumulative Development Projects	ROG / VOC	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
Delta Conveyance Project (tpy)	3	122	27	<1	93	14
Los Vaqueros Reservoir Expansion Project (tpy)	10	74	86	--[1]	39	--[1]
Total Cumulative Development Projects (tpy)	>13	>196	>113	>1	>132	>14
BAAQMD's project-level quantitative criteria	54 lb./day (10 tpy)	n/a	54 lb./day (10 tpy)	n/a	82 lb./day (15 tpy)	54 lb./day (10 tpy)
Total greater than BAAQMD project-level quantitative criteria?	yes	n/a	yes	n/a	yes	yes

Source: Reclamation 2009, 2015

Note: Values in bold indicate that the BAAQMD significance threshold was exceeded.

Key: BAAQMD = Bay Area Air Quality Management District; CO = carbon monoxide; lb./day = pounds per day; n/a = not applicable; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; ROG = reactive organic gases; SJVAPCD = San Joaquin Valley Air Pollution Control District; SO_2 = sulfur dioxide; tpy = tons per year; VOCs = volatile organic compounds

Table I1-7. San Joaquin Valley Air Basin Cumulative Construction Emissions

Cumulative Development Projects	ROG / VOC	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
Delta Conveyance Project (tpy)	2	34	34	<1	18	3
Mendota Pool Bypass and Reach 2B Improvements Project (tpy)	0[1]	>100	0[1]	1	0[1]	0[1]
San Luis Low Point Improvement Project (tpy)	6	49	9	<1	41	6
Del Puerto Canyon Reservoir Project (tpy)	3	93	17	<1	10	4
Total Cumulative Development Projects (tpy)	>21	>276	>70	>1	>84	>28
SJVAPCD's project-level quantitative criteria (tpy)	10	100	10	27	15	15
Total greater than SJVAPCD project-level quantitative criteria?	yes	yes	yes	no	yes	yes

Source: Del Puerto Water District (DPWD) 2019; Reclamation 2015, 2019

Notes:

[1] Zero values are based on the execution of the Voluntary Emissions Reduction Agreement on January 17, 2019, between Reclamation and SJVAPCD.

Values in **bold** indicate that the SJVAPCD significance threshold was exceeded.

Key: CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; ROG = reactive organic gases; SJVAPD = San Joaquin Valley Air Pollution Control District; SO_2 = sulfur dioxide; tpy = tons per year; VOCs = volatile organic compounds

I1.6 References

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Appendix I2
Air Quality and Greenhouse Gas Emissions Calculations

Key assumptions:
> Model year 2015+ construction equipment.
> Model year 2015+ haul trucks.
> Assumed 50% reuse of excavated material / topsoil on site for project elements where backfill is necessary.
> **Modification of the Earthen Lined Segment** under ADJUST CANAL INVERT AND RAISE DEFICIENT STRUCTURES ALTERNATIVE would occur at half the intensity described in Appendix G of the Delta-Mendota Canal Feasibility Study (i.e., only 18 sites of the canal would be worked concurrently instead of 36 sites and construction would take place over six years instead of three).

> Haul trucks would be assumed to be at least 10 cubic yards for all construction elements other than the **Modification of the Earthen-Lined Segment**, which would use 20 cubic yard hauling trucks.

> A single, 10-hour shift would be assumed daily for all construction elements other than the **Modification of the Earthen-Lined Segment,** which would have two, 10-hour shifts daily.

RAISE DEFICIENT STRUCTURES ALTERNATIVE (SJVAB)			POLLUTANT [TONS PER YEAR; METRIC TONS FOR CO2e]							
Construction Phase	**Start**	**End**	**ROG**	**TOG**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**	**CO2e**
Bridge Replacement	04/07/2025	07/30/2032	0.1	0.1	2.2	0.8	<0.1	0.6	0.1	584
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	0.1	0.1	1.4	1.0	<0.1	0.7	0.2	621
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	0.1	0.1	1.0	0.7	<0.1	0.7	0.1	384
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	0.3	0.4	5.8	3.8	<0.1	2.6	0.6	2,321
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	0.6	0.3	<0.1	0.1	<0.1	170
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	<0.1	<0.1	0.2	0.1	<0.1	<0.1	<0.1	60
Turnout Modifications (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	0.2	0.1	<0.1	<0.1	<0.1	74
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	<0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.1	29
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**0.5**	**0.6**	**9.3**	**5.3**	**<0.1**	**3.6**	**0.8**	**3,408**
SJVAPCD CEQA Threshold:			10	n/a	100	10	27	15	15	n/a
Exceeds Threshold?			no	no	no	no	no	no	no	no
General Conformity De Minimis Emission Level:			10	n/a	n/a	10	n/a	100	70	n/a
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

Key assumptions:
> Model year 2015+ construction equipment.
> Model year 2015+ haul trucks.
> Assumed 50% reuse of excavated material / topsoil on site for project elements where backfill is necessary.
> **Modification of the Earthen Lined Segment** under ADJUST CANAL INVERT AND RAISE DEFICIENT STRUCTURES ALTERNATIVE would occur at half the intensity described in Appendix G of the Delta-Mendota Canal Feasibility Study (i.e., only 18 sites of the canal would be worked concurrently instead of 36 sites and construction would take place over six years instead of three).

> Haul trucks would be assumed to be at least 10 cubic yards for all construction elements other than the **Modification of the Earthen-Lined Segment**, which would use 20 cubic yard hauling trucks.

> A single, 10-hour shift would be assumed daily for all construction elements other than the **Modification of the Earthen-Lined Segment,** which would have two, 10-hour shifts daily.

RAISE DEFICIENT STRUCTURES ALTERNATIVE (SJVAB)			ROG [TONS PER YEAR]							
Construction Phase	**Start**	**End**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Bridge Replacement	04/07/2025	07/30/2032	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	<0.1	0.1	0.1	0.1	0.1	0.0	0.0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	<0.1	<0.1	<0.1	<0.1	0.0	0.0	0.0	0
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**0.2**	**0.5**	**0.2**	**0.2**	**0.2**	**0.1**	**0.1**	**0**
SJVAPCD CEQA Threshold:			10	10	10	10	10	10	10	10
Exceeds Threshold?			no	no	no	no	no	no	no	no
General Conformity De Minimis Emission Level:			10	10	10	10	10	10	10	10
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

Key assumptions:
> Model year 2015+ construction equipment.
> Model year 2015+ haul trucks.
> Assumed 50% reuse of excavated material / topsoil on site for project elements where backfill is necessary.
> **Modification of the Earthen Lined Segment** under ADJUST CANAL INVERT AND RAISE DEFICIENT STRUCTURES ALTERNATIVE would occur at half the intensity described in Appendix G of the Delta-Mendota Canal Feasibility Study (i.e., only 18 sites of the canal would be worked concurrently instead of 36 sites and construction would take place over six years instead of three).

> Haul trucks would be assumed to be at least 10 cubic yards for all construction elements other than the **Modification of the Earthen-Lined Segment**, which would use 20 cubic yard hauling trucks.

> A single, 10-hour shift would be assumed daily for all construction elements other than the **Modification of the Earthen-Lined Segment,** which would have two, 10-hour shifts daily.

RAISE DEFICIENT STRUCTURES ALTERNATIVE (SJVAB) — TOG [TONS PER YEAR]

Construction Phase	Start	End	2025	2026	2027	2028	2029	2030	2031	2032
Bridge Replacement	04/07/2025	07/30/2032	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	<0.1	0.1	0.1	0.1	0.1	0.0	0.0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	<0.1	<0.1	<0.1	<0.1	0.0	0.0	0.0	0
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**0.3**	**0.6**	**0.3**	**0.2**	**0.2**	**0.1**	**0.1**	**0**
SJVAPCD CEQA Threshold:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds Threshold?			no	no	no	no	no	no	no	no
General Conformity De Minimis Emission Level:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

Key assumptions:

> Model year 2015+ construction equipment.
> Model year 2015+ haul trucks.
> Assumed 50% reuse of excavated material / topsoil on site for project elements where backfill is necessary.
> **Modification of the Earthen Lined Segment** under ADJUST CANAL INVERT AND RAISE DEFICIENT STRUCTURES ALTERNATIVE would occur at half the intensity described in Appendix G of the Delta-Mendota Canal Feasibility Study (i.e., only 18 sites of the canal would be worked concurrently instead of 36 sites and construction would take place over six years instead of three).

> Haul trucks would be assumed to be at least 10 cubic yards for all construction elements other than the **Modification of the Earthen-Lined Segment**, which would use 20 cubic yard hauling trucks.

> A single, 10-hour shift would be assumed daily for all construction elements other than the **Modification of the Earthen-Lined Segment,** which would have two, 10-hour shifts daily.

RAISE DEFICIENT STRUCTURES ALTERNATIVE (SJVAB)			CO [TONS PER YEAR]							
Construction Phase	**Start**	**End**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Bridge Replacement	04/07/2025	07/30/2032	1.6	2.2	2.2	2.2	2.2	2.2	2.2	1
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	0.4	1.4	1.4	1.4	1.1	0.0	0.0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	1.5	4.4	0.0	0.0	0.0	0.0	0.0	0
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	0.4	0.6	0.2	0.0	0.0	0.0	0.0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	<0.1	0.2	0.2	0.2	0.2	0.1	0.0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	0.1	0.1	0.1	<0.1	0.0	0.0	0.0	0
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**4.5**	**9.3**	**4.1**	**3.8**	**3.5**	**2.3**	**2.2**	**1**
SJVAPCD CEQA Threshold:			100	100	100	100	100	100	100	100
Exceeds Threshold?			no	no	no	no	no	no	no	no
General Conformity De Minimis Emission Level:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

Key assumptions:
> Model year 2015+ construction equipment.
> Model year 2015+ haul trucks.
> Assumed 50% reuse of excavated material / topsoil on site for project elements where backfill is necessary.
> **Modification of the Earthen Lined Segment** under ADJUST CANAL INVERT AND RAISE DEFICIENT STRUCTURES ALTERNATIVE would occur at half the intensity described in Appendix G of the Delta-Mendota Canal Feasibility Study (i.e., only 18 sites of the canal would be worked concurrently instead of 36 sites and construction would take place over six years instead of three).

> Haul trucks would be assumed to be at least 10 cubic yards for all construction elements other than the **Modification of the Earthen-Lined Segment**, which would use 20 cubic yard hauling trucks.

> A single, 10-hour shift would be assumed daily for all construction elements other than the **Modification of the Earthen-Lined Segment,** which would have two, 10-hour shifts daily.

RAISE DEFICIENT STRUCTURES ALTERNATIVE (SJVAB)			NOx [TONS PER YEAR]							
Construction Phase	**Start**	**End**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Bridge Replacement	04/07/2025	07/30/2032	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	0.2	1.0	1.0	1.0	0.7	0.0	0.0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	1.0	2.9	0.0	0.0	0.0	0.0	0.0	0
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	<0.1	0.1	0.1	0.1	0.1	<0.1	0.0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	0.1	0.1	<0.1	0.0	0.0	0.0	0.0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	<0.1	0.1	0.1	<0.1	0.0	0.0	0.0	0
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**2.3**	**5.3**	**2.0**	**1.9**	**1.6**	**0.9**	**0.8**	**0**
SJVAPCD CEQA Threshold:			10	10	10	10	10	10	10	10
Exceeds Threshold?			no	no	no	no	no	no	no	no
General Conformity De Minimis Emission Level:			10	10	10	10	10	10	10	10
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

Key assumptions:
> Model year 2015+ construction equipment.
> Model year 2015+ haul trucks.
> Assumed 50% reuse of excavated material / topsoil on site for project elements where backfill is necessary.
> **Modification of the Earthen Lined Segment** under ADJUST CANAL INVERT AND RAISE DEFICIENT STRUCTURES ALTERNATIVE would occur at half the intensity described in Appendix G of the Delta-Mendota Canal Feasibility Study (i.e., only 18 sites of the canal would be worked concurrently instead of 36 sites and construction would take place over six years instead of three).

> Haul trucks would be assumed to be at least 10 cubic yards for all construction elements other than the **Modification of the Earthen-Lined Segment**, which would use 20 cubic yard hauling trucks.

> A single, 10-hour shift would be assumed daily for all construction elements other than the **Modification of the Earthen-Lined Segment,** which would have two, 10-hour shifts daily.

RAISE DEFICIENT STRUCTURES ALTERNATIVE (SJVAB)			SOx [TONS PER YEAR]							
Construction Phase	**Start**	**End**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Bridge Replacement	04/07/2025	07/30/2032	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0.0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	<0.1	<0.1	<0.1	<0.1	0.0	0.0	0.0	0
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**
SJVAPCD CEQA Threshold:			27	27	27	27	27	27	27	27
Exceeds Threshold?			no	no	no	no	no	no	no	no
General Conformity De Minimis Emission Level:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

Key assumptions:
> Model year 2015+ construction equipment.
> Model year 2015+ haul trucks.
> Assumed 50% reuse of excavated material / topsoil on site for project elements where backfill is necessary.
> **Modification of the Earthen Lined Segment** under ADJUST CANAL INVERT AND RAISE DEFICIENT STRUCTURES ALTERNATIVE would occur at half the intensity described in Appendix G of the Delta-Mendota Canal Feasibility Study (i.e., only 18 sites of the canal would be worked concurrently instead of 36 sites and construction would take place over six years instead of three).

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> A single, 10-hour shift would be assumed daily for all construction elements other than the **Modification of the Earthen-Lined Segment,** which would have two, 10-hour shifts daily.

RAISE DEFICIENT STRUCTURES ALTERNATIVE (SJVAB)			PM10 [TONS PER YEAR]							
Construction Phase	**Start**	**End**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Bridge Replacement	04/07/2025	07/30/2032	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	0.2	0.7	0.7	0.7	0.6	0.0	0.0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	0.7	2.0	0.0	0.0	0.0	0.0	0.0	0
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	0.1	0.1	<0.1	0.0	0.0	0.0	0.0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	<0.1	<0.1	<0.1	<0.1	0.0	0.0	0.0	0
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**1.6**	**3.6**	**1.3**	**1.3**	**1.1**	**0.6**	**0.6**	**0**
SJVAPCD CEQA Threshold:			15	15	15	15	15	15	15	15
Exceeds Threshold?			no	no	no	no	no	no	no	no
General Conformity De Minimis Emission Level:			100	100	100	100	100	100	100	100
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

Key assumptions:
> Model year 2015+ construction equipment.
> Model year 2015+ haul trucks.
> Assumed 50% reuse of excavated material / topsoil on site for project elements where backfill is necessary.
> **Modification of the Earthen Lined Segment** under ADJUST CANAL INVERT AND RAISE DEFICIENT STRUCTURES ALTERNATIVE would occur at half the intensity described in Appendix G of the Delta-Mendota Canal Feasibility Study (i.e., only 18 sites of the canal would be worked concurrently instead of 36 sites and construction would take place over six years instead of three).

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> A single, 10-hour shift would be assumed daily for all construction elements other than the **Modification of the Earthen-Lined Segment,** which would have two, 10-hour shifts daily.

RAISE DEFICIENT STRUCTURES ALTERNATIVE (SJVAB)			PM2.5 [TONS PER YEAR]							
Construction Phase	**Start**	**End**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Bridge Replacement	04/07/2025	07/30/2032	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	<0.1	0.2	0.2	0.2	0.2	0.0	0.0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	<0.1	<0.1	<0.1	<0.1	0.0	0.0	0.0	0
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**0.3**	**0.8**	**0.3**	**0.3**	**0.3**	**0.1**	**0.1**	**0**
SJVAPCD CEQA Threshold:			15	15	15	15	15	15	15	15
Exceeds Threshold?			no	no	no	no	no	no	no	no
General Conformity De Minimis Emission Level:			70	70	70	70	70	70	70	70
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

Key assumptions:
> Model year 2015+ construction equipment.
> Model year 2015+ haul trucks.
> Assumed 50% reuse of excavated material / topsoil on site for project elements where backfill is necessary.
> **Modification of the Earthen Lined Segment** under ADJUST CANAL INVERT AND RAISE DEFICIENT STRUCTURES ALTERNATIVE would occur at half the intensity described in Appendix G of the Delta-Mendota Canal Feasibility Study (i.e., only 18 sites of the canal would be worked concurrently instead of 36 sites and construction would take place over six years instead of three).

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> A single, 10-hour shift would be assumed daily for all construction elements other than the **Modification of the Earthen-Lined Segment,** which would have two, 10-hour shifts daily.

RAISE DEFICIENT STRUCTURES ALTERNATIVE (SJVAB)			CO2e [TONS PER YEAR]							
Construction Phase	**Start**	**End**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Bridge Replacement	04/07/2025	07/30/2032	433	584	582	582	584	584	584	339
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	159	621	619	619	481	0	0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	98	105	0	0	0	0	0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	594	1,763	0	0	0	0	0	0
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	126	170	48	0	0	0	0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	15	60	60	60	60	20	0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	55	74	21	0	0	0	0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	22	29	29	6	0	0	0	0
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**1,501**	**3,408**	**1,359**	**1,267**	**1,126**	**604**	**584**	**339**
SJVAPCD CEQA Threshold:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds Threshold?			no	no	no	no	no	no	no	no
General Conformity De Minimis Emission Level:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

Key assumptions:
> Model year 2015+ construction equipment.
> Model year 2015+ haul trucks.
> Assumed 50% reuse of excavated material / topsoil on site for project elements where backfill is necessary.
> **Modification of the Earthen Lined Segment** under ADJUST CANAL INVERT AND RAISE DEFICIENT STRUCTURES ALTERNATIVE would occur at half the intensity described in Appendix G of the Delta-Mendota Canal Feasibility Study (i.e., only 18 sites of the canal would be worked concurrently instead of 36 sites and construction would take place over six years instead of three).

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> A single, 10-hour shift would be assumed daily for all construction elements other than the **Modification of the Earthen-Lined Segment,** which would have two, 10-hour shifts daily.

RAISE DEFICIENT STRUCTURES ALTERNATIVE (SFBAAB)			POLLUTANT [AVERAGE POUNDS PER DAY]							
Construction Phase	**Start**	**End**	**ROG**	**TOG**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**	**CO2e**
Bridge Replacement	04/07/2025	07/30/2032	0.8	1.0	17.0	6.4	<0.1	4.3	0.9	4,461
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	0.7	0.8	10.5	7.3	<0.1	5.5	1.5	4,742
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	0.5	0.6	7.8	5.0	<0.1	5.6	0.7	2,930
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	0.2	0.3	4.4	1.9	<0.1	1.1	0.1	1,297
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	0.1	0.1	1.3	0.5	<0.1	<0.1	<0.1	462
Turnout Modifications (all season work)	04/07/2025	04/14/2027	0.1	0.1	1.7	0.6	<0.1	<0.1	<0.1	566
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	<0.1	<0.1	0.9	0.4	<0.1	0.1	<0.1	222
AVERAGE DAILY TOTAL PROJECT EMISSIONS [POUNDS PER DAY]			**2.1**	**2.5**	**37.9**	**18.6**	**0.1**	**12.5**	**2.7**	**12,555**
BAAQMD CEQA Threshold:			54	n/a	n/a	54	n/a	82	54	n/a
Exceeds Threshold?			no	no	no	no	no	no	no	no
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**0.3**	**0.3**	**5.0**	**2.4**	**<0.1**	**1.6**	**0.4**	**1,645**
General Conformity De Minimis Emission Level:			100	n/a	n/a	100	n/a	n/a	100	n/a
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

[1] construction element would not occur in SFBAAB

Key assumptions:

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> Model year 2015+ haul trucks.
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> A single, 10-hour shift would be assumed daily for all construction elements other than the **Modification of the Earthen-Lined Segment,** which would have two, 10-hour shifts daily.

RAISE DEFICIENT STRUCTURES ALTERNATIVE (SFBAAB) — ROG [AVERAGE POUNDS PER DAY]

Construction Phase	**Start**	**End**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Bridge Replacement	04/07/2025	07/30/2032	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	0.2	0.7	0.7	0.7	0.5	0.0	0.0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	<0.1	0.1	0.1	0.1	0.1	<0.1	0.0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	0.1	0.1	<0.1	0.0	0.0	0.0	0.0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	<0.1	<0.1	<0.1	<0.1	0.0	0.0	0.0	0
AVERAGE DAILY TOTAL PROJECT EMISSIONS [POUNDS PER DAY]			**1.2**	**2.1**	**1.7**	**1.6**	**1.4**	**0.9**	**0.8**	**0**
BAAQMD CEQA Threshold:			54	54	54	54	54	54	54	54
Exceeds Threshold?			no	no	no	no	no	no	no	no
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**0.2**	**0.3**	**0.2**	**0.2**	**0.2**	**0.1**	**0.1**	**0**
General Conformity De Minimis Emission Level:			100	100	100	100	100	100	100	100
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

[1] construction element would not occur in SFBAAB

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> Model year 2015+ haul trucks.
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RAISE DEFICIENT STRUCTURES ALTERNATIVE (SFBAAB)			TOG [AVERAGE POUNDS PER DAY]							
Construction Phase	**Start**	**End**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Bridge Replacement	04/07/2025	07/30/2032	0.7	1.0	1.0	1.0	1.0	1.0	1.0	1
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	0.2	0.8	0.8	0.8	0.6	0.0	0.0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	<0.1	0.1	0.1	0.1	0.1	<0.1	0.0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	0.1	0.1	<0.1	0.0	0.0	0.0	0.0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	<0.1	<0.1	<0.1	<0.1	0.0	0.0	0.0	0
AVERAGE DAILY TOTAL PROJECT EMISSIONS [POUNDS PER DAY]			**1.4**	**2.5**	**2.0**	**1.9**	**1.7**	**1.0**	**1.0**	**1**
BAAQMD CEQA Threshold:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds Threshold?			no	no	no	no	no	no	no	no
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**0.2**	**0.3**	**0.3**	**0.2**	**0.2**	**0.1**	**0.1**	**0**
General Conformity De Minimis Emission Level:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

[1] construction element would not occur in SFBAAB

Key assumptions:
> Model year 2015+ construction equipment.
> Model year 2015+ haul trucks.
> Assumed 50% reuse of excavated material / topsoil on site for project elements where backfill is necessary.
> **Modification of the Earthen Lined Segment** under ADJUST CANAL INVERT AND RAISE DEFICIENT STRUCTURES ALTERNATIVE would occur at half the intensity described in Appendix G of the Delta-Mendota Canal Feasibility Study (i.e., only 18 sites of the canal would be worked concurrently instead of 36 sites and construction would take place over six years instead of three).

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RAISE DEFICIENT STRUCTURES ALTERNATIVE (SFBAAB) — CO [AVERAGE POUNDS PER DAY]

Construction Phase	**Start**	**End**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Bridge Replacement	04/07/2025	07/30/2032	12.6	17.0	16.9	16.9	17.0	17.0	17.0	10
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	2.7	10.5	10.4	10.4	8.1	0.0	0.0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	2.0	2.1	0.0	0.0	0.0	0.0	0.0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	3.3	4.4	1.2	0.0	0.0	0.0	0.0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	0.3	1.3	1.3	1.3	1.3	0.4	0.0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	1.3	1.7	0.5	0.0	0.0	0.0	0.0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	0.7	0.9	0.9	0.2	0.0	0.0	0.0	0
AVERAGE DAILY TOTAL PROJECT EMISSIONS [POUNDS PER DAY]			**22.8**	**37.9**	**31.3**	**28.8**	**26.4**	**17.4**	**17.0**	**10**
BAAQMD CEQA Threshold:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds Threshold?			no	no	no	no	no	no	no	no
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**3.0**	**5.0**	**4.1**	**3.8**	**3.5**	**2.3**	**2.2**	**1**
General Conformity De Minimis Emission Level:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

[1] construction element would not occur in SFBAAB

Key assumptions:

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> Model year 2015+ haul trucks.
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RAISE DEFICIENT STRUCTURES ALTERNATIVE (SFBAAB) — NOx [AVERAGE POUNDS PER DAY]

Construction Phase	Start	End	2025	2026	2027	2028	2029	2030	2031	2032
Bridge Replacement	04/07/2025	07/30/2032	4.8	6.4	6.4	6.4	6.4	6.4	6.4	4
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	1.9	7.3	7.3	7.3	5.7	0.0	0.0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	1.3	1.4	0.0	0.0	0.0	0.0	0.0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	1.4	1.9	0.5	0.0	0.0	0.0	0.0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	0.1	0.5	0.5	0.5	0.5	0.1	0.0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	0.5	0.6	0.2	0.0	0.0	0.0	0.0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	0.3	0.4	0.4	0.1	0.0	0.0	0.0	0
AVERAGE DAILY TOTAL PROJECT EMISSIONS [POUNDS PER DAY]			**10.2**	**18.6**	**15.3**	**14.2**	**12.6**	**6.6**	**6.4**	**4**
BAAQMD CEQA Threshold:			54	54	54	54	54	54	54	54
Exceeds Threshold?			no	no	no	no	no	no	no	no
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**1.3**	**2.4**	**2.0**	**1.9**	**1.6**	**0.9**	**0.8**	**0**
General Conformity De Minimis Emission Level:			100	100	100	100	100	100	100	100
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

[1] construction element would not occur in SFBAAB

Key assumptions:
> Model year 2015+ construction equipment.
> Model year 2015+ haul trucks.
> Assumed 50% reuse of excavated material / topsoil on site for project elements where backfill is necessary.
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RAISE DEFICIENT STRUCTURES ALTERNATIVE (SFBAAB) — SOx [AVERAGE POUNDS PER DAY]

Construction Phase	Start	End	2025	2026	2027	2028	2029	2030	2031	2032
Bridge Replacement	04/07/2025	07/30/2032	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0.0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	<0.1	<0.1	<0.1	<0.1	0.0	0.0	0.0	0
AVERAGE DAILY TOTAL PROJECT EMISSIONS [POUNDS PER DAY]			**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**<0.1**	**<0.1**	**<0.1**
BAAQMD CEQA Threshold:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds Threshold?			no	no	no	no	no	no	no	no
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**
General Conformity De Minimis Emission Level:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

[1] construction element would not occur in SFBAAB

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RAISE DEFICIENT STRUCTURES ALTERNATIVE (SFBAAB) — PM10 [AVERAGE POUNDS PER DAY]

Construction Phase	Start	End	2025	2026	2027	2028	2029	2030	2031	2032
Bridge Replacement	04/07/2025	07/30/2032	3.2	4.3	4.3	4.3	4.3	4.3	4.3	2
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	1.4	5.5	5.4	5.4	4.2	0.0	0.0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	1.4	1.5	0.0	0.0	0.0	0.0	0.0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	0.8	1.1	0.3	0.0	0.0	0.0	0.0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	0.1	0.1	0.1	<0.1	0.0	0.0	0.0	0
AVERAGE DAILY TOTAL PROJECT EMISSIONS [POUNDS PER DAY]			**6.9**	**12.5**	**10.1**	**9.8**	**8.5**	**4.3**	**4.3**	**2**
BAAQMD CEQA Threshold:			82	82	82	82	82	82	82	82
Exceeds Threshold?			no	no	no	no	no	no	no	no
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**0.9**	**1.6**	**1.3**	**1.3**	**1.1**	**0.6**	**0.6**	**0**
General Conformity De Minimis Emission Level:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

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RAISE DEFICIENT STRUCTURES ALTERNATIVE (SFBAAB)			PM2.5 [AVERAGE POUNDS PER DAY]							
Construction Phase	**Start**	**End**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Bridge Replacement	04/07/2025	07/30/2032	0.6	0.9	0.8	0.8	0.9	0.9	0.9	0
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	0.4	1.5	1.5	1.5	1.2	0.0	0.0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	0.1	0.1	<0.1	0.0	0.0	0.0	0.0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	<0.1	<0.1	<0.1	<0.1	0.0	0.0	0.0	0
AVERAGE DAILY TOTAL PROJECT EMISSIONS [POUNDS PER DAY]			**1.3**	**2.7**	**2.4**	**2.3**	**2.0**	**0.9**	**0.9**	**0**
BAAQMD CEQA Threshold:			54	54	54	54	54	54	54	54
Exceeds Threshold?			no	no	no	no	no	no	no	no
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**0.2**	**0.4**	**0.3**	**0.3**	**0.3**	**0.1**	**0.1**	**0**
General Conformity De Minimis Emission Level:			100	100	100	100	100	100	100	100
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

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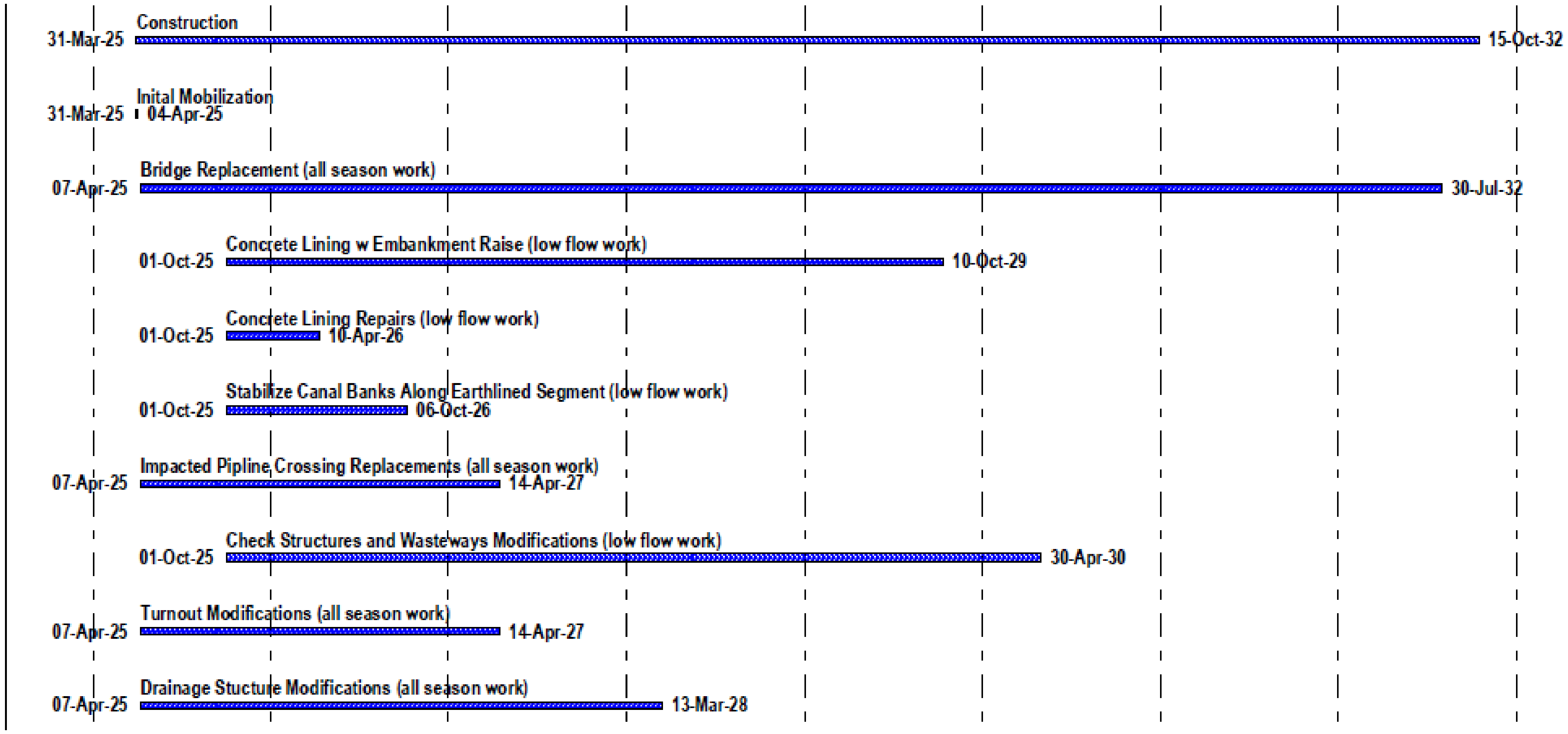
RAISE DEFICIENT STRUCTURES ALTERNATIVE (SFBAAB)			CO2e [AVERAGE POUNDS PER DAY]							
Construction Phase	**Start**	**End**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Bridge Replacement	04/07/2025	07/30/2032	3,303	4,461	4,444	4,444	4,461	4,461	4,461	2,588
Concrete Lining w Associated Embankment Raise (low flow work)	10/01/2025	10/10/2029	1,213	4,742	4,723	4,723	3,674	0	0	0
Concrete Lining Repairs (low season work)	10/01/2025	04/10/2026	749	805	0	0	0	0	0	0
Stabilize Canal Banks Along Earthlined Segment (low flow work)	10/01/2025	10/06/2026	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]	--[1]
Impacted Pipline Crossing Replacements (all season work)	04/07/2025	04/14/2027	961	1,297	366	0	0	0	0	0
Check Structures and Wasteways Modifications (low flow work)	10/01/2025	04/30/2030	118	462	460	460	462	152	0	0
Turnout Modifications (all season work)	04/07/2025	04/14/2027	419	566	160	0	0	0	0	0
Drainage Stucture Modifications (all season work)	04/07/2025	03/13/2028	164	222	221	43	0	0	0	0
AVERAGE DAILY TOTAL PROJECT EMISSIONS [POUNDS PER DAY]			**6,927**	**12,555**	**10,374**	**9,670**	**8,596**	**4,613**	**4,461**	**2,588**
BAAQMD CEQA Threshold:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds Threshold?			no	no	no	no	no	no	no	no
MAXIMUM ANNUAL TOTAL PROJECT EMISSIONS [TONS PER YEAR; METRIC TONS FOR CO2e]			**907**	**1,645**	**1,359**	**1,267**	**1,126**	**604**	**584**	**339**
General Conformity De Minimis Emission Level:			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exceeds De Minimis Emission Level?			no	no	no	no	no	no	no	no

[1] construction element would not occur in SFBAAB

Raise Deficient Structures Alternative - Proposed Action (presented schedule not final - assumes the maximum possible construction overlap)

Task	Duration	Start	Finish
Construction	1921.0d	31-Mar-25	15-Oct-32
Inital Mobilization	5.0d	31-Mar-25	04-Apr-25
Bridge Replacement (all season work)	1861.0d	07-Apr-25	30-Jul-32
Concrete Lining w Embankment Raise (low flow work)	1023.0d	01-Oct-25	10-Oct-29
Concrete Lining Repairs (low flow work)	134.0d	01-Oct-25	10-Apr-26
Stabilize Canal Banks Along Earthlined Segment (low flow work)	258.0d	01-Oct-25	06-Oct-26
Impacted Pipline Crossing Replacements (all season work)	514.0d	07-Apr-25	14-Apr-27
Check Structures and Wasteways Modifications (low flow work)	1163.0d	01-Oct-25	30-Apr-30
Turnout Modifications (all season work)	514.0d	07-Apr-25	14-Apr-27
Drainage Stucture Modifications (all season work)	745.0d	07-Apr-25	13-Mar-28



Phase #	BRIDGE REPLACEMENT Construction Phase	(workdays per area) Duration	Shifts	Equipment	Count	Assumptions	Factor Type
1	temporary utility relocation	10	1	service truck with crane	1	a,	offroad
1	temporary utility relocation	10	1	personnel	3	a,f,	onroad
2	demolishion of existing bridge	20	1	crane	2	a,	offroad
2	demolishion of existing bridge	20	1	sawcut	1	a,	offroad
2	demolishion of existing bridge	20	1	personnel	7	a,f,	onroad
2	demolishion of existing bridge	20	1	hauling trips (demolished material)	2	a,b,c,d,f,	onroad
3	earthwork to rasie abutments (1-3 foot raise)	10	1	dozer	1	a,	offroad
3	earthwork to rasie abutments (1-3 foot raise)	10	1	end dump truck	6	a,h	offroad
3	earthwork to rasie abutments (1-3 foot raise)	10	1	compactor	1	a,	offroad
3	earthwork to rasie abutments (1-3 foot raise)	10	1	excavator	1	a,	offroad
3	earthwork to rasie abutments (1-3 foot raise)	10	1	tractor	1	a,	offroad
3	earthwork to rasie abutments (1-3 foot raise)	10	1	personnel	12	a,f,	onroad
3	earthwork to rasie abutments (1-3 foot raise)	10	1	hauling trips (material import)	12	a,b,c,f,	onroad
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	drill rig	1	a,	offroad
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	crane	1	a,	offroad
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	skid steer	1	a,	offroad
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	excavator	1	a,	offroad
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	personnel	11	a,f,	onroad
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	hauling trips (vendor delivery)	1	a,b,c,e,f,	onroad
5	form and place wing walls	10	1	excavator	1	a,	offroad
5	form and place wing walls	10	1	personnel	5	a,f,	onroad
5	form and place wing walls	10	1	hauling trips (vendor delivery)	1	a,b,c,e,f,	onroad
6	set bridge girders	15	1	crane	1	a,	offroad
6	set bridge girders	15	1	skid steer	1	a,	offroad
6	set bridge girders	15	1	personnel	5	a,f,	onroad
6	set bridge girders	15	1	hauling trips (vendor delivery)	3	a,b,c,e,f,	onroad
7	form and place deck	30	1	truck	2	a,g,	onroad
7	form and place deck	30	1	skid steer	1	a,	offroad
7	form and place deck	30	1	personnel	6	a,f,	onroad
7	form and place deck	30	1	hauling trips (vendor delivery)	3	a,b,c,e,f,	onroad
8	utility replacement	10	1	snooper truck	1	a,	offroad
8	utility replacement	10	1	personnel	3	a,f,	onroad
9	final grading and paving	10	1	skid steer	1	a,	offroad
9	final grading and paving	10	1	paver	1	a,	offroad
9	final grading and paving	10	1	truck	4	a,g,	onroad
9	final grading and paving	10	1	personnel	10	a,f,	onroad
9	final grading and paving	10	1	hauling trips (vendor delivery)	1	a,b,c,e,f,	onroad

Phase #	BRIDGE REPLACEMENT Construction Phase	(workdays per area) Duration	Shifts	Equipment	Vehicle Category	Usage Factor	Trip Distance
1	temporary utility relocation	10	1	service truck with crane	Construction and Mining - Cranes	0.85	--
1	temporary utility relocation	10	1	personnel	Workers	1.00	22
2	demolishion of existing bridge	20	1	crane	Construction and Mining - Cranes	0.85	--
2	demolishion of existing bridge	20	1	sawcut	Construction and Mining - Misc - Concrete/Industrial Sav	0.85	--
2	demolishion of existing bridge	20	1	personnel	Workers	1.00	22
2	demolishion of existing bridge	20	1	hauling trips (demolished material)	Hauling/Delivery	1.00	40
3	earthwork to rasie abutments (1-3 foot raise)	10	1	dozer	Construction and Mining - Rubber Tired Dozers	0.85	--
3	earthwork to rasie abutments (1-3 foot raise)	10	1	end dump truck	Construction and Mining - Off-Highway Trucks	0.25	--
3	earthwork to rasie abutments (1-3 foot raise)	10	1	compactor	Construction and Mining - Misc - Plate Compactors	0.85	--
3	earthwork to rasie abutments (1-3 foot raise)	10	1	excavator	Construction and Mining - Excavators	0.85	--
3	earthwork to rasie abutments (1-3 foot raise)	10	1	tractor	Construction and Mining - Tractors/Loaders/Backhoes	0.85	--
3	earthwork to rasie abutments (1-3 foot raise)	10	1	personnel	Workers	1.00	22
3	earthwork to rasie abutments (1-3 foot raise)	10	1	hauling trips (material import)	Hauling/Delivery	1.00	40
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	drill rig	Construction and Mining - Bore/Drill Rigs	0.85	--
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	crane	Construction and Mining - Cranes	0.85	--
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	skid steer	Construction and Mining - Skid Steer Loaders	0.85	--
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	excavator	Construction and Mining - Excavators	0.85	--
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	personnel	Workers	1.00	22
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17
5	form and place wing walls	10	1	excavator	Construction and Mining - Excavators	0.85	--
5	form and place wing walls	10	1	personnel	Workers	1.00	22
5	form and place wing walls	10	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17
6	set bridge girders	15	1	crane	Construction and Mining - Cranes	0.85	--
6	set bridge girders	15	1	skid steer	Construction and Mining - Skid Steer Loaders	0.85	--
6	set bridge girders	15	1	personnel	Workers	1.00	22
6	set bridge girders	15	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17
7	form and place deck	30	1	truck	LDT1	0.25	300
7	form and place deck	30	1	skid steer	Construction and Mining - Skid Steer Loaders	0.85	--
7	form and place deck	30	1	personnel	Workers	1.00	22
7	form and place deck	30	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17
8	utility replacement	10	1	snooper truck	Construction and Mining - Cranes	0.85	--
8	utility replacement	10	1	personnel	Workers	1.00	22
9	final grading and paving	10	1	skid steer	Construction and Mining - Skid Steer Loaders	0.85	--
9	final grading and paving	10	1	paver	Construction and Mining - Pavers	0.85	--
9	final grading and paving	10	1	truck	LDT1	0.25	300
9	final grading and paving	10	1	personnel	Workers	1.00	22
9	final grading and paving	10	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17

	BRIDGE REPLACEMENT	(workdays per area)			Emission Factors (g/hr for offroad; g/mi for onroad)							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	temporary utility relocation	10	1	service truck with crane	5.03E+00	5.98E+00	9.58E+01	2.54E+01	3.72E+04	6.69E-01	6.15E-01	3.35E-01
1	temporary utility relocation	10	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
2	demolishion of existing bridge	20	1	crane	5.03E+00	5.98E+00	9.58E+01	2.54E+01	3.72E+04	6.69E-01	6.15E-01	3.35E-01
2	demolishion of existing bridge	20	1	sawcut	5.30E+00	6.41E+00	8.56E+01	7.02E+01	1.40E+04	2.80E-01	2.57E-01	1.77E-01
2	demolishion of existing bridge	20	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
2	demolishion of existing bridge	20	1	hauling trips (demolished material)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
3	earthwork to rasie abutments (1-3 foot raise)	10	1	dozer	1.07E+01	1.27E+01	1.31E+02	4.02E+01	4.73E+04	1.34E+02	7.41E+01	4.25E-01
3	earthwork to rasie abutments (1-3 foot raise)	10	1	end dump truck	1.92E+01	2.28E+01	1.85E+02	1.42E+02	8.46E+04	4.21E+02	4.40E+01	7.60E-01
3	earthwork to rasie abutments (1-3 foot raise)	10	1	compactor	2.15E+01	2.57E+01	7.49E+02	1.62E+01	1.54E+03	7.89E+00	5.96E+00	4.41E-02
3	earthwork to rasie abutments (1-3 foot raise)	10	1	excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
3	earthwork to rasie abutments (1-3 foot raise)	10	1	tractor	3.99E+00	4.74E+00	1.04E+02	4.20E+01	1.96E+04	4.17E-01	3.83E-01	1.76E-01
3	earthwork to rasie abutments (1-3 foot raise)	10	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
3	earthwork to rasie abutments (1-3 foot raise)	10	1	hauling trips (material import)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	drill rig	7.69E+00	9.15E+00	1.63E+02	5.15E+01	5.83E+04	1.04E+00	9.60E-01	5.24E-01
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	crane	5.03E+00	5.98E+00	9.58E+01	2.54E+01	3.72E+04	6.69E-01	6.15E-01	3.35E-01
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	skid steer	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
5	form and place wing walls	10	1	excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
5	form and place wing walls	10	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
5	form and place wing walls	10	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
6	set bridge girders	15	1	crane	5.03E+00	5.98E+00	9.58E+01	2.54E+01	3.72E+04	6.69E-01	6.15E-01	3.35E-01
6	set bridge girders	15	1	skid steer	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
6	set bridge girders	15	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
6	set bridge girders	15	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
7	form and place deck	30	1	truck	4.28E-02	4.56E-02	6.35E-01	3.16E-02	2.70E+02	1.35E-01	4.15E-02	2.65E-03
7	form and place deck	30	1	skid steer	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
7	form and place deck	30	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
7	form and place deck	30	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
8	utility replacement	10	1	snooper truck	5.03E+00	5.98E+00	9.58E+01	2.54E+01	3.72E+04	6.69E-01	6.15E-01	3.35E-01
8	utility replacement	10	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
9	final grading and paving	10	1	skid steer	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
9	final grading and paving	10	1	paver	4.23E+00	5.03E+00	1.26E+02	3.27E+01	3.08E+04	5.46E-01	5.02E-01	2.77E-01
9	final grading and paving	10	1	truck	4.28E-02	4.56E-02	6.35E-01	3.16E-02	2.70E+02	1.35E-01	4.15E-02	2.65E-03
9	final grading and paving	10	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
9	final grading and paving	10	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02

	BRIDGE REPLACEMENT	(workdays per area)			Emissions (tons per bridge)							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	temporary utility relocation	10	1	service truck with crane	4.71E-04	5.60E-04	8.98E-03	2.38E-03	3.49E+00	6.26E-05	5.76E-05	3.14E-05
1	temporary utility relocation	10	1	personnel	2.81E-05	3.02E-05	4.55E-04	2.20E-05	1.74E-01	9.71E-05	2.97E-05	1.71E-06
2	demolishion of existing bridge	20	1	crane	1.88E-03	2.24E-03	3.59E-02	9.54E-03	1.40E+01	2.51E-04	2.31E-04	1.26E-04
2	demolishion of existing bridge	20	1	sawcut	9.93E-04	1.20E-03	1.60E-02	1.32E-02	2.63E+00	5.24E-05	4.82E-05	3.31E-05
2	demolishion of existing bridge	20	1	personnel	1.31E-04	1.41E-04	2.12E-03	1.03E-04	8.11E-01	4.53E-04	1.39E-04	7.96E-06
2	demolishion of existing bridge	20	1	hauling trips (demolished material)	2.65E-05	3.01E-05	3.74E-04	3.84E-03	2.07E+00	4.22E-04	1.56E-04	1.87E-05
3	earthwork to rasie abutments (1-3 foot raise)	10	1	dozer	9.99E-04	1.19E-03	1.23E-02	3.76E-03	4.43E+00	1.26E-02	6.94E-03	3.98E-05
3	earthwork to rasie abutments (1-3 foot raise)	10	1	end dump truck	3.17E-03	3.78E-03	3.06E-02	2.34E-02	1.40E+01	6.97E-02	7.28E-03	1.26E-04
3	earthwork to rasie abutments (1-3 foot raise)	10	1	compactor	2.01E-03	2.41E-03	7.02E-02	1.52E-03	1.44E-01	7.40E-04	5.59E-04	4.13E-06
3	earthwork to rasie abutments (1-3 foot raise)	10	1	excavator	5.16E-04	6.14E-04	9.67E-03	3.18E-03	3.08E+00	5.76E-05	5.30E-05	2.77E-05
3	earthwork to rasie abutments (1-3 foot raise)	10	1	tractor	3.73E-04	4.44E-04	9.75E-03	3.94E-03	1.84E+00	3.90E-05	3.59E-05	1.65E-05
3	earthwork to rasie abutments (1-3 foot raise)	10	1	personnel	1.13E-04	1.21E-04	1.82E-03	8.80E-05	6.95E-01	3.89E-04	1.19E-04	6.83E-06
3	earthwork to rasie abutments (1-3 foot raise)	10	1	hauling trips (material import)	7.94E-05	9.04E-05	1.12E-03	1.15E-02	6.20E+00	1.27E-03	4.69E-04	5.60E-05
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	drill rig	1.08E-03	1.29E-03	2.29E-02	7.24E-03	8.19E+00	1.47E-04	1.35E-04	7.36E-05
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	crane	7.06E-04	8.41E-04	1.35E-02	3.58E-03	5.23E+00	9.40E-05	8.65E-05	4.71E-05
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	skid steer	3.21E-04	3.82E-04	1.09E-02	5.27E-03	1.89E+00	3.44E-05	3.16E-05	1.70E-05
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	excavator	7.74E-04	9.21E-04	1.45E-02	4.77E-03	4.62E+00	8.64E-05	7.95E-05	4.15E-05
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	personnel	1.55E-04	1.66E-04	2.50E-03	1.21E-04	9.56E-01	5.34E-04	1.64E-04	9.39E-06
4	shaft foundation, rebar cage, and concrete placement at abutments	15	1	hauling trips (vendor delivery)	4.10E-06	4.67E-06	5.80E-05	5.96E-04	3.21E-01	6.54E-05	2.42E-05	2.89E-06
5	form and place wing walls	10	1	excavator	5.16E-04	6.14E-04	9.67E-03	3.18E-03	3.08E+00	5.76E-05	5.30E-05	2.77E-05
5	form and place wing walls	10	1	personnel	4.69E-05	5.03E-05	7.58E-04	3.67E-05	2.90E-01	1.62E-04	4.95E-05	2.84E-06
5	form and place wing walls	10	1	hauling trips (vendor delivery)	2.74E-06	3.12E-06	3.86E-05	3.97E-04	2.14E-01	4.36E-05	1.62E-05	1.93E-06
6	set bridge girders	15	1	crane	7.06E-04	8.41E-04	1.35E-02	3.58E-03	5.23E+00	9.40E-05	8.65E-05	4.71E-05
6	set bridge girders	15	1	skid steer	3.21E-04	3.82E-04	1.09E-02	5.27E-03	1.89E+00	3.44E-05	3.16E-05	1.70E-05
6	set bridge girders	15	1	personnel	7.04E-05	7.54E-05	1.14E-03	5.50E-05	4.34E-01	2.43E-04	7.43E-05	4.27E-06
6	set bridge girders	15	1	hauling trips (vendor delivery)	1.23E-05	1.40E-05	1.74E-04	1.79E-03	9.62E-01	1.96E-04	7.27E-05	8.68E-06
7	form and place deck	30	1	truck	2.12E-04	2.26E-04	3.15E-03	1.57E-04	1.34E+00	6.72E-04	2.06E-04	1.32E-05
7	form and place deck	30	1	skid steer	6.42E-04	7.64E-04	2.17E-02	1.05E-02	3.77E+00	6.87E-05	6.32E-05	3.39E-05
7	form and place deck	30	1	personnel	1.69E-04	1.81E-04	2.73E-03	1.32E-04	1.04E+00	5.83E-04	1.78E-04	1.02E-05
7	form and place deck	30	1	hauling trips (vendor delivery)	2.46E-05	2.80E-05	3.48E-04	3.58E-03	1.92E+00	3.93E-04	1.45E-04	1.74E-05
8	utility replacement	10	1	snooper truck	4.71E-04	5.60E-04	8.98E-03	2.38E-03	3.49E+00	6.26E-05	5.76E-05	3.14E-05
8	utility replacement	10	1	personnel	2.81E-05	3.02E-05	4.55E-04	2.20E-05	1.74E-01	9.71E-05	2.97E-05	1.71E-06
9	final grading and paving	10	1	skid steer	2.14E-04	2.55E-04	7.25E-03	3.51E-03	1.26E+00	2.29E-05	2.11E-05	1.13E-05
9	final grading and paving	10	1	paver	3.96E-04	4.71E-04	1.18E-02	3.07E-03	2.89E+00	5.11E-05	4.71E-05	2.60E-05
9	final grading and paving	10	1	truck	1.42E-04	1.51E-04	2.10E-03	1.04E-04	8.92E-01	4.48E-04	1.37E-04	8.77E-06
9	final grading and paving	10	1	personnel	9.38E-05	1.01E-04	1.52E-03	7.34E-05	5.79E-01	3.24E-04	9.91E-05	5.69E-06
9	final grading and paving	10	1	hauling trips (vendor delivery)	2.74E-06	3.12E-06	3.86E-05	3.97E-04	2.14E-01	4.36E-05	1.62E-05	1.93E-06

NOTE: Bridge replacement phasing assumed to be performed in series (i.e. does not overlap) [Appendix G of the Delta-Mendota Canal Feasibility Study]. Therefore, peak bridge replacement phase assumed to represent bridge construction on all counts (equipment emissions, trips, personnel, etc.)

Emissions (tons per bridge)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.02	0.02	0.36	0.14	104.36	0.09	0.02	0.00

Total Bridge Construction Duration

04/07/2025	07/30/2032
1,910	total workdays
262	workdays per year
45	impacted bridges
0.0236	bridges per workday
6.17	average bridges per year

Emissions (tons per year)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.11	0.13	2.22	0.84	644.18	0.56	0.11	0.01

Phase #	CONCRETE LINING AND ASSOCIATED EMBANKMENT RAISE Construction Phase	Duration	Shifts	Equipment	Count	Assumptions	Factor Type
1	stripping	1,063	1	small dozer	1	a,	offroad
1	stripping	1,063	1	personnel	1	a,d,	onroad
2	topsoil moving	1,063	1	small dozer	0	a,c,	offroad
2	topsoil moving	1,063	1	front end loader	1	a,	offroad
2	topsoil moving	1,063	1	personnel	2	a,d,	onroad
2	topsoil moving	1,063	1	hauling trips (topsoil export)	1	a,b,d,	onroad
3	excavation	1,063	1	small excavator	1	a,	offroad
3	excavation	1,063	1	end dump truck	2	a,f	offroad
3	excavation	1,063	1	personnel	3	a,d,	onroad
3	excavation	1,063	1	hauling trips (material export)	10	a,b,d,	onroad
4	compacted backfill	1,063	1	front end loader	1	a,	offroad
4	compacted backfill	1,063	1	roller compactor (4-foot) with blade	1	a,	offroad
4	compacted backfill	1,063	1	personnel	2	a,d,	onroad
4	compacted backfill	1,063	1	hauling trips (material import)	15	a,b,d,	onroad
5	concrete lining	1,063	1	pickup truck	3	a,e,	onroad
5	concrete lining	1,063	1	skid steer	1	a,	offroad
5	concrete lining	1,063	1	personnel	15	a,d,	onroad
5	concrete lining	1,063	1	hauling trips (vendor delivery)	6	a,b,d,	onroad

CONCRETE LINING AND ASSOCIATED EMBANKMENT RAISE

Phase #	Construction Phase	Duration	Shifts	Equipment	Vehicle Category	Usage Factor	Trip Distance
1	stripping	1,063	1	small dozer	Construction and Mining - Rubber Tired Dozers	0.85	--
1	stripping	1,063	1	personnel	Workers	1.00	22
2	topsoil moving	1,063	1	small dozer	Construction and Mining - Rubber Tired Dozers	0.85	--
2	topsoil moving	1,063	1	front end loader	Construction and Mining - Rubber Tired Loaders	0.85	--
2	topsoil moving	1,063	1	personnel	Workers	1.00	22
2	topsoil moving	1,063	1	hauling trips (topsoil export)	Hauling/Delivery	1.00	40
3	excavation	1,063	1	small excavator	Construction and Mining - Excavators	0.85	--
3	excavation	1,063	1	end dump truck	Construction and Mining - Off-Highway Trucks	0.25	--
3	excavation	1,063	1	personnel	Workers	1.00	22
3	excavation	1,063	1	hauling trips (material export)	Hauling/Delivery	1.00	40
4	compacted backfill	1,063	1	front end loader	Construction and Mining - Rubber Tired Loaders	0.85	--
4	compacted backfill	1,063	1	roller compactor (4-foot) with blade	Construction and Mining - Rollers	0.85	--
4	compacted backfill	1,063	1	personnel	Workers	1.00	22
4	compacted backfill	1,063	1	hauling trips (material import)	Hauling/Delivery	1.00	40
5	concrete lining	1,063	1	pickup truck	LDT1	0.25	300
5	concrete lining	1,063	1	skid steer	Construction and Mining - Skid Steer Loaders	0.85	--
5	concrete lining	1,063	1	personnel	Workers	1.00	22
5	concrete lining	1,063	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17

	CONCRETE LINING AND ASSOCIATED EMBANKMENT RAISE				Emission Factors (g/hr for offroad; g/mi for onroad)							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	stripping	1,063	1	small dozer	1.07E+01	1.27E+01	1.31E+02	4.02E+01	4.73E+04	1.34E+02	7.41E+01	4.25E-01
1	stripping	1,063	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
2	topsoil moving	1,063	1	small dozer	1.07E+01	1.27E+01	1.31E+02	4.02E+01	4.73E+04	1.34E+02	7.41E+01	4.25E-01
2	topsoil moving	1,063	1	front end loader	8.11E+00	9.66E+00	1.22E+02	3.15E+01	3.99E+04	8.24E-01	7.58E-01	3.59E-01
2	topsoil moving	1,063	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
2	topsoil moving	1,063	1	hauling trips (topsoil export)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
3	excavation	1,063	1	small excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
3	excavation	1,063	1	end dump truck	1.92E+01	2.28E+01	1.85E+02	1.42E+02	8.46E+04	4.21E+02	4.40E+01	7.60E-01
3	excavation	1,063	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
3	excavation	1,063	1	hauling trips (material export)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
4	compacted backfill	1,063	1	front end loader	8.11E+00	9.66E+00	1.22E+02	3.15E+01	3.99E+04	8.24E-01	7.58E-01	3.59E-01
4	compacted backfill	1,063	1	roller compactor (4-foot) with blade	2.71E+00	3.23E+00	8.87E+01	3.48E+01	1.69E+04	2.99E-01	2.75E-01	1.52E-01
4	compacted backfill	1,063	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
4	compacted backfill	1,063	1	hauling trips (material import)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
5	concrete lining	1,063	1	pickup truck	4.28E-02	4.56E-02	6.35E-01	3.16E-02	2.70E+02	1.35E-01	4.15E-02	2.65E-03
5	concrete lining	1,063	1	skid steer	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
5	concrete lining	1,063	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
5	concrete lining	1,063	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02

	CONCRETE LINING AND ASSOCIATED EMBANKMENT RAISE				Emissions (total tons)							
Phase #	Construction Phase	Duration	Shifts	Equipment	ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
1	stripping	1,063	1	small dozer	1.06E-01	1.26E-01	1.31E+00	4.00E-01	4.71E+02	1.34E+00	7.38E-01	4.23E-03
1	stripping	1,063	1	personnel	9.97E-04	1.07E-03	1.61E-02	7.80E-04	6.16E+00	3.44E-03	1.05E-03	6.05E-05
2	topsoil moving	1,063	1	small dozer	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	topsoil moving	1,063	1	front end loader	8.08E-02	9.62E-02	1.22E+00	3.14E-01	3.97E+02	8.21E-03	7.55E-03	3.57E-03
2	topsoil moving	1,063	1	personnel	1.99E-03	2.14E-03	3.22E-02	1.56E-03	1.23E+01	6.88E-03	2.11E-03	1.21E-04
2	topsoil moving	1,063	1	hauling trips (topsoil export)	7.03E-04	8.01E-04	9.93E-03	1.02E-01	5.49E+01	1.12E-02	4.15E-03	4.96E-04
3	excavation	1,063	1	small excavator	5.48E-02	6.52E-02	1.03E+00	3.38E-01	3.27E+02	6.12E-03	5.63E-03	2.94E-03
3	excavation	1,063	1	end dump truck	1.12E-01	1.34E-01	1.08E+00	8.30E-01	4.95E+02	2.47E+00	2.58E-01	4.45E-03
3	excavation	1,063	1	personnel	2.99E-03	3.21E-03	4.84E-02	2.34E-03	1.85E+01	1.03E-02	3.16E-03	1.81E-04
3	excavation	1,063	1	hauling trips (material export)	7.03E-03	8.01E-03	9.93E-02	1.02E+00	5.49E+02	1.12E-01	4.15E-02	4.96E-03
4	compacted backfill	1,063	1	front end loader	8.08E-02	9.62E-02	1.22E+00	3.14E-01	3.97E+02	8.21E-03	7.55E-03	3.57E-03
4	compacted backfill	1,063	1	roller compactor (4-foot) with blade	2.70E-02	3.22E-02	8.84E-01	3.47E-01	1.68E+02	2.98E-03	2.74E-03	1.51E-03
4	compacted backfill	1,063	1	personnel	1.99E-03	2.14E-03	3.22E-02	1.56E-03	1.23E+01	6.88E-03	2.11E-03	1.21E-04
4	compacted backfill	1,063	1	hauling trips (material import)	1.06E-02	1.20E-02	1.49E-01	1.53E+00	8.24E+02	1.68E-01	6.23E-02	7.44E-03
5	concrete lining	1,063	1	pickup truck	1.13E-02	1.20E-02	1.67E-01	8.32E-03	7.11E+01	3.57E-02	1.09E-02	6.99E-04
5	concrete lining	1,063	1	skid steer	2.28E-02	2.71E-02	7.70E-01	3.73E-01	1.34E+02	2.44E-03	2.24E-03	1.20E-03
5	concrete lining	1,063	1	personnel	1.50E-02	1.60E-02	2.42E-01	1.17E-02	9.24E+01	5.16E-02	1.58E-02	9.07E-04
5	concrete lining	1,063	1	hauling trips (vendor delivery)	1.75E-03	1.99E-03	2.46E-02	2.53E-01	1.36E+02	2.78E-02	1.03E-02	1.23E-03

NOTE: Concrete lining and associated embankment raise phasing assumed to be performed concurrently (i.e. overlapping) [Appendix G of the Delta-Mendota Canal Feasibility Study]

Emissions (total tons)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.54	0.64	8.33	5.85	4,166.95	4.27	1.17	0.04

Concrete Lining w Associated Embankment Raise (low flow work)

10/01/2025	10/10/2029
1,063	total workdays
175	workdays per year

Emissions (tons per year)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.09	0.10	1.37	0.96	684.69	0.70	0.19	0.01

	CONCRETE LINING REPAIRS	(workdays per area)					
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**Count**	**Assumptions**	**Factor Type**
1	remove damaged concrete	10	1	excavator	1	a,	offroad
1	remove damaged concrete	10	1	dump truck	2	a,d	offroad
1	remove damaged concrete	10	1	skid steer	1	a,	offroad
1	remove damaged concrete	10	1	personnel	6	a,c,	onroad
1	remove damaged concrete	10	1	hauling trips (damaged concrete)	6	a,b,c,	onroad
2	place gravel bedding	10	1	excavator	1	a,	offroad
2	place gravel bedding	10	1	dump truck	2	a,d	offroad
2	place gravel bedding	10	1	skid steer	1	a,	offroad
2	place gravel bedding	10	1	personnel	6	a,c,	onroad
2	place gravel bedding	10	1	hauling trips (vendor delivery)	8	a,b,c,	onroad
3	install concrete	10	1	excavator	1	a,	offroad
3	install concrete	10	1	personnel	6	a,	onroad
3	install concrete	10	1	hauling trips (vendor delivery)	6	a,b,c,	onroad

	CONCRETE LINING REPAIRS	(workdays per area)					
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**Vehicle Category**	**Usage Factor**	**Trip Distance**
1	remove damaged concrete	10	1	excavator	Construction and Mining - Excavators	0.85	--
1	remove damaged concrete	10	1	dump truck	Construction and Mining - Off-Highway Trucks	0.25	--
1	remove damaged concrete	10	1	skid steer	Construction and Mining - Skid Steer Loaders	0.85	--
1	remove damaged concrete	10	1	personnel	Workers	1.00	22
1	remove damaged concrete	10	1	hauling trips (damaged concrete)	Hauling/Delivery	1.00	40
2	place gravel bedding	10	1	excavator	Construction and Mining - Excavators	0.85	--
2	place gravel bedding	10	1	dump truck	Construction and Mining - Off-Highway Trucks	0.25	--
2	place gravel bedding	10	1	skid steer	Construction and Mining - Skid Steer Loaders	0.85	--
2	place gravel bedding	10	1	personnel	Workers	1.00	22
2	place gravel bedding	10	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17
3	install concrete	10	1	excavator	Construction and Mining - Excavators	0.85	--
3	install concrete	10	1	personnel	Workers	1.00	22
3	install concrete	10	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17

	CONCRETE LINING REPAIRS	(workdays per area)			**Emission Factors (g/hr for offroad; g/mi for onroad)**							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	remove damaged concrete	10	1	excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
1	remove damaged concrete	10	1	dump truck	1.92E+01	2.28E+01	1.85E+02	1.42E+02	8.46E+04	4.21E+02	4.40E+01	7.60E-01
1	remove damaged concrete	10	1	skid steer	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
1	remove damaged concrete	10	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
1	remove damaged concrete	10	1	hauling trips (damaged concrete)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
2	place gravel bedding	10	1	excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
2	place gravel bedding	10	1	dump truck	1.92E+01	2.28E+01	1.85E+02	1.42E+02	8.46E+04	4.21E+02	4.40E+01	7.60E-01
2	place gravel bedding	10	1	skid steer	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
2	place gravel bedding	10	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
2	place gravel bedding	10	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
3	install concrete	10	1	excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
3	install concrete	10	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
3	install concrete	10	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02

	CONCRETE LINING REPAIRS	(workdays per area)			Emissions (tons per area)							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	remove damaged concrete	10	1	excavator	5.16E-04	6.14E-04	9.67E-03	3.18E-03	3.08E+00	5.76E-05	5.30E-05	2.77E-05
1	remove damaged concrete	10	1	dump truck	1.06E-03	1.26E-03	1.02E-02	7.81E-03	4.66E+00	2.32E-02	2.43E-03	4.19E-05
1	remove damaged concrete	10	1	skid steer	2.14E-04	2.55E-04	7.25E-03	3.51E-03	1.26E+00	2.29E-05	2.11E-05	1.13E-05
1	remove damaged concrete	10	1	personnel	5.63E-05	6.03E-05	9.10E-04	4.40E-05	3.48E-01	1.94E-04	5.95E-05	3.41E-06
1	remove damaged concrete	10	1	hauling trips (damaged concrete)	3.97E-05	4.52E-05	5.61E-04	5.76E-03	3.10E+00	6.33E-04	2.34E-04	2.80E-05
2	place gravel bedding	10	1	excavator	5.16E-04	6.14E-04	9.67E-03	3.18E-03	3.08E+00	5.76E-05	5.30E-05	2.77E-05
2	place gravel bedding	10	1	dump truck	1.06E-03	1.26E-03	1.02E-02	7.81E-03	4.66E+00	2.32E-02	2.43E-03	4.19E-05
2	place gravel bedding	10	1	skid steer	2.14E-04	2.55E-04	7.25E-03	3.51E-03	1.26E+00	2.29E-05	2.11E-05	1.13E-05
2	place gravel bedding	10	1	personnel	5.63E-05	6.03E-05	9.10E-04	4.40E-05	3.48E-01	1.94E-04	5.95E-05	3.41E-06
2	place gravel bedding	10	1	hauling trips (vendor delivery)	2.19E-05	2.49E-05	3.09E-04	3.18E-03	1.71E+00	3.49E-04	1.29E-04	1.54E-05
3	install concrete	10	1	excavator	5.16E-04	6.14E-04	9.67E-03	3.18E-03	3.08E+00	5.76E-05	5.30E-05	2.77E-05
3	install concrete	10	1	personnel	5.63E-05	6.03E-05	9.10E-04	4.40E-05	3.48E-01	1.94E-04	5.95E-05	3.41E-06
3	install concrete	10	1	hauling trips (vendor delivery)	1.64E-05	1.87E-05	2.32E-04	2.38E-03	1.28E+00	2.62E-04	9.69E-05	1.16E-05

NOTE: Concrete lining repairs phasing assumed to be performed in series (i.e. does not overlap) [Appendix G of the Delta-Mendota Canal Feasibility Study]. Therefore, peak concrete lining repairs phase assumed to represent concrete lining repairs on all counts (equipment emissions, trips, personnel, etc.)

Emissions (tons per area)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.00	0.01	0.07	0.04	28.20	0.05	0.01	0.00

Concrete Lining Repairs

10/01/2025	04/10/2026
150	total workdays
87	workdays per year
15	impacted areas
0.1000	areas per workday
8.73	average areas per year

Emissions (tons per year)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.07	0.08	1.02	0.65	423.07	0.73	0.09	0.00

STABILIZE EARTHEN EMBANKMENTS ALONG EARTH-LINED SEGMENTS

Phase #	Construction Phase	Duration	Shifts	Equipment	Count	Assumptions	Factor Type
1	stripping	236	1	dozer	1	a,	offroad
1	stripping	236	1	personnel	1	a,e,	onroad
2	stripping	236	1	dozer	1	a,c,	offroad
2	stripping	236	1	personnel	1	a,c,e,	onroad
3	topsoil moving	236	1	front end loader	1	a,	offroad
3	topsoil moving	236	1	dump truck	2	a,f	offroad
3	topsoil moving	236	1	personnel	3	a,e,	onroad
3	topsoil moving	236	1	hauling trips (material export)	7	a,b,e,	onroad
4	topsoil moving	236	1	front end loader	1	a,c,	offroad
4	topsoil moving	236	1	dump truck	2	a,c,f	offroad
4	topsoil moving	236	1	personnel	3	a,c,e,	onroad
4	topsoil moving	236	1	hauling trips (material export)	20	a,b,c,e,	onroad
5	excavation	236	1	small excavator	1	a,	offroad
5	excavation	236	1	dump truck	2	a,f	offroad
5	excavation	236	1	personnel	3	a,e,	onroad
5	excavation	236	1	hauling trips (material export)	26	a,b,e,	onroad
6	compacted backfill	236	1	front end loader	2	a,	offroad
6	compacted backfill	236	1	roller compactor (4-foot) with blade	2	a,	offroad
6	compacted backfill	236	1	personnel	4	a,e,	onroad
6	compacted backfill	236	1	hauling trips (material import)	35	a,b,e,	onroad
7	bedding material	236	1	medium sized excavator	1	a,	offroad
7	bedding material	236	1	vibratory plate compactor	1	a,	offroad
7	bedding material	236	1	front end loader	1	a,	offroad
7	bedding material	236	1	personnel	8	a,e,	onroad
7	bedding material	236	1	hauling trips (vendor delivery)	16	a,d,e,	onroad
8	riprap	236	1	personnel	1	a,e,	onroad
8	riprap	236	1	hauling trips (vendor delivery)	15	a,d,e,	onroad
9	gravel road surfacing	236	1	road grader	1	a,	offroad
9	gravel road surfacing	236	1	personnel	1	a,e,	onroad
10	chip seal/seal coat	236	1	personnel	1	a,e,	onroad

STABILIZE EARTHEN EMBANKMENTS ALONG EARTH-LINED SEGMENTS

Phase #	Construction Phase	Duration	Shifts	Equipment	Vehicle Category	Usage Factor	Trip Distance
1	stripping	236	1	dozer	Construction and Mining - Rubber Tired Dozers	0.85	--
1	stripping	236	1	personnel	Workers	1.00	22
2	stripping	236	1	dozer	Construction and Mining - Rubber Tired Dozers	0.85	--
2	stripping	236	1	personnel	Workers	1.00	22
3	topsoil moving	236	1	front end loader	Construction and Mining - Rubber Tired Loaders	0.85	--
3	topsoil moving	236	1	dump truck	Construction and Mining - Off-Highway Trucks	0.25	--
3	topsoil moving	236	1	personnel	Workers	1.00	22
3	topsoil moving	236	1	hauling trips (material export)	Hauling/Delivery	1.00	40
4	topsoil moving	236	1	front end loader	Construction and Mining - Rubber Tired Loaders	0.85	--
4	topsoil moving	236	1	dump truck	Construction and Mining - Off-Highway Trucks	0.25	--
4	topsoil moving	236	1	personnel	Workers	1.00	22
4	topsoil moving	236	1	hauling trips (material export)	Hauling/Delivery	1.00	40
5	excavation	236	1	small excavator	Construction and Mining - Excavators	0.85	--
5	excavation	236	1	dump truck	Construction and Mining - Off-Highway Trucks	0.25	--
5	excavation	236	1	personnel	Workers	1.00	22
5	excavation	236	1	hauling trips (material export)	Hauling/Delivery	1.00	40
6	compacted backfill	236	1	front end loader	Construction and Mining - Rubber Tired Loaders	0.85	--
6	compacted backfill	236	1	roller compactor (4-foot) with blade	Construction and Mining - Rollers	0.85	--
6	compacted backfill	236	1	personnel	Workers	1.00	22
6	compacted backfill	236	1	hauling trips (material import)	Hauling/Delivery	1.00	40
7	bedding material	236	1	medium sized excavator	Construction and Mining - Excavators	0.85	--
7	bedding material	236	1	vibratory plate compactor	Construction and Mining - Misc - Plate Compactors	0.85	--
7	bedding material	236	1	front end loader	Construction and Mining - Rubber Tired Loaders	0.85	--
7	bedding material	236	1	personnel	Workers	1.00	22
7	bedding material	236	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17
8	riprap	236	1	personnel	Workers	1.00	22
8	riprap	236	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17
9	gravel road surfacing	236	1	road grader	Construction and Mining - Graders	0.85	--
9	gravel road surfacing	236	1	personnel	Workers	1.00	22
10	chip seal/seal coat	236	1	personnel	Workers	1.00	22

	STABILIZE EARTHEN EMBANKMENTS ALONG EARTH-LINED SEGMENTS				Emission Factors (g/hr for offroad; g/mi for onroad)							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	stripping	236	1	dozer	1.07E+01	1.27E+01	1.31E+02	4.02E+01	4.73E+04	1.34E+02	7.41E+01	4.25E-01
1	stripping	236	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
2	stripping	236	1	dozer	1.07E+01	1.27E+01	1.31E+02	4.02E+01	4.73E+04	1.34E+02	7.41E+01	4.25E-01
2	stripping	236	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
3	topsoil moving	236	1	front end loader	8.11E+00	9.66E+00	1.22E+02	3.15E+01	3.99E+04	8.24E-01	7.58E-01	3.59E-01
3	topsoil moving	236	1	dump truck	1.92E+01	2.28E+01	1.85E+02	1.42E+02	8.46E+04	4.21E+02	4.40E+01	7.60E-01
3	topsoil moving	236	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
3	topsoil moving	236	1	hauling trips (material export)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
4	topsoil moving	236	1	front end loader	8.11E+00	9.66E+00	1.22E+02	3.15E+01	3.99E+04	8.24E-01	7.58E-01	3.59E-01
4	topsoil moving	236	1	dump truck	1.92E+01	2.28E+01	1.85E+02	1.42E+02	8.46E+04	4.21E+02	4.40E+01	7.60E-01
4	topsoil moving	236	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
4	topsoil moving	236	1	hauling trips (material export)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
5	excavation	236	1	small excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
5	excavation	236	1	dump truck	1.92E+01	2.28E+01	1.85E+02	1.42E+02	8.46E+04	4.21E+02	4.40E+01	7.60E-01
5	excavation	236	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
5	excavation	236	1	hauling trips (material export)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
6	compacted backfill	236	1	front end loader	8.11E+00	9.66E+00	1.22E+02	3.15E+01	3.99E+04	8.24E-01	7.58E-01	3.59E-01
6	compacted backfill	236	1	roller compactor (4-foot) with blade	2.71E+00	3.23E+00	8.87E+01	3.48E+01	1.69E+04	2.99E-01	2.75E-01	1.52E-01
6	compacted backfill	236	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
6	compacted backfill	236	1	hauling trips (material import)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
7	bedding material	236	1	medium sized excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
7	bedding material	236	1	vibratory plate compactor	2.15E+01	2.57E+01	7.49E+02	1.62E+01	1.54E+03	7.89E+00	5.96E+00	4.41E-02
7	bedding material	236	1	front end loader	8.11E+00	9.66E+00	1.22E+02	3.15E+01	3.99E+04	8.24E-01	7.58E-01	3.59E-01
7	bedding material	236	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
7	bedding material	236	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
8	riprap	236	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
8	riprap	236	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
9	gravel road surfacing	236	1	road grader	6.73E+00	8.00E+00	1.34E+02	2.75E+01	4.08E+04	1.25E+01	1.99E+00	3.67E-01
9	gravel road surfacing	236	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
10	chip seal/seal coat	236	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03

	STABILIZE EARTHEN EMBANKMENTS ALONG EARTH-LINED SEGMENTS				Emissions (total tons)							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	stripping	236	1	dozer	2.36E-02	2.80E-02	2.90E-01	8.88E-02	1.05E+02	2.97E-01	1.64E-01	9.40E-04
1	stripping	236	1	personnel	2.21E-04	2.37E-04	3.58E-03	1.73E-04	1.37E+00	7.64E-04	2.34E-04	1.34E-05
2	stripping	236	1	dozer	2.36E-02	2.80E-02	2.90E-01	8.88E-02	1.05E+02	2.97E-01	1.64E-01	9.40E-04
2	stripping	236	1	personnel	2.21E-04	2.37E-04	3.58E-03	1.73E-04	1.37E+00	7.64E-04	2.34E-04	1.34E-05
3	topsoil moving	236	1	front end loader	1.79E-02	2.14E-02	2.71E-01	6.97E-02	8.82E+01	1.82E-03	1.68E-03	7.93E-04
3	topsoil moving	236	1	dump truck	2.50E-02	2.97E-02	2.41E-01	1.84E-01	1.10E+02	5.48E-01	5.72E-02	9.89E-04
3	topsoil moving	236	1	personnel	6.64E-04	7.12E-04	1.07E-02	5.19E-04	4.10E+00	2.29E-03	7.02E-04	4.03E-05
3	topsoil moving	236	1	hauling trips (material export)	1.09E-03	1.24E-03	1.54E-02	1.59E-01	8.54E+01	1.74E-02	6.46E-03	7.70E-04
4	topsoil moving	236	1	front end loader	1.79E-02	2.14E-02	2.71E-01	6.97E-02	8.82E+01	1.82E-03	1.68E-03	7.93E-04
4	topsoil moving	236	1	dump truck	2.50E-02	2.97E-02	2.41E-01	1.84E-01	1.10E+02	5.48E-01	5.72E-02	9.89E-04
4	topsoil moving	236	1	personnel	6.64E-04	7.12E-04	1.07E-02	5.19E-04	4.10E+00	2.29E-03	7.02E-04	4.03E-05
4	topsoil moving	236	1	hauling trips (material export)	3.12E-03	3.56E-03	4.41E-02	4.54E-01	2.44E+02	4.98E-02	1.84E-02	2.20E-03
5	excavation	236	1	small excavator	1.22E-02	1.45E-02	2.28E-01	7.50E-02	7.27E+01	1.36E-03	1.25E-03	6.53E-04
5	excavation	236	1	dump truck	2.50E-02	2.97E-02	2.41E-01	1.84E-01	1.10E+02	5.48E-01	5.72E-02	9.89E-04
5	excavation	236	1	personnel	6.64E-04	7.12E-04	1.07E-02	5.19E-04	4.10E+00	2.29E-03	7.02E-04	4.03E-05
5	excavation	236	1	hauling trips (material export)	4.06E-03	4.62E-03	5.73E-02	5.90E-01	3.17E+02	6.47E-02	2.40E-02	2.86E-03
6	compacted backfill	236	1	front end loader	3.59E-02	4.27E-02	5.41E-01	1.39E-01	1.76E+02	3.65E-03	3.35E-03	1.59E-03
6	compacted backfill	236	1	roller compactor (4-foot) with blade	1.20E-02	1.43E-02	3.92E-01	1.54E-01	7.47E+01	1.32E-03	1.22E-03	6.71E-04
6	compacted backfill	236	1	personnel	8.86E-04	9.49E-04	1.43E-02	6.93E-04	5.47E+00	3.06E-03	9.35E-04	5.37E-05
6	compacted backfill	236	1	hauling trips (material import)	5.47E-03	6.22E-03	7.72E-02	7.94E-01	4.27E+02	8.71E-02	3.23E-02	3.85E-03
7	bedding material	236	1	medium sized excavator	1.22E-02	1.45E-02	2.28E-01	7.50E-02	7.27E+01	1.36E-03	1.25E-03	6.53E-04
7	bedding material	236	1	vibratory plate compactor	4.75E-02	5.68E-02	1.66E+00	3.58E-02	3.40E+00	1.75E-02	1.32E-02	9.76E-05
7	bedding material	236	1	front end loader	1.79E-02	2.14E-02	2.71E-01	6.97E-02	8.82E+01	1.82E-03	1.68E-03	7.93E-04
7	bedding material	236	1	personnel	1.77E-03	1.90E-03	2.86E-02	1.39E-03	1.09E+01	6.11E-03	1.87E-03	1.07E-04
7	bedding material	236	1	hauling trips (vendor delivery)	1.03E-03	1.18E-03	1.46E-02	1.50E-01	8.07E+01	1.65E-02	6.10E-03	7.28E-04
8	riprap	236	1	personnel	2.21E-04	2.37E-04	3.58E-03	1.73E-04	1.37E+00	7.64E-04	2.34E-04	1.34E-05
8	riprap	236	1	hauling trips (vendor delivery)	9.69E-04	1.10E-03	1.37E-02	1.41E-01	7.56E+01	1.54E-02	5.72E-03	6.83E-04
9	gravel road surfacing	236	1	road grader	1.49E-02	1.77E-02	2.96E-01	6.08E-02	9.03E+01	2.77E-02	4.40E-03	8.12E-04
9	gravel road surfacing	236	1	personnel	2.21E-04	2.37E-04	3.58E-03	1.73E-04	1.37E+00	7.64E-04	2.34E-04	1.34E-05
10	chip seal/seal coat	236	1	personnel	2.21E-04	2.37E-04	3.58E-03	1.73E-04	1.37E+00	7.64E-04	2.34E-04	1.34E-05

NOTE: Stabilization of earthen embankments along earth-lined segments phasing is assumed to be performed concurrently (i.e. overlapping)
[Appendix G of the Delta-Mendota Canal Feasibility Study]

Emissions (total tons)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.33	0.39	5.77	3.77	2,558.73	2.57	0.63	0.02

Stabilize Canal Banks Along Earthlined Segment (low flow work)

10/01/2025	10/06/2026
236	total workdays
175	workdays per year

Emissions (tons per year)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.33	0.39	5.77	3.77	2,558.73	2.57	0.63	0.02

Phase #	MODIFICATION OF EARTH-LINED SEGMENT Construction Phase	Duration	Shifts	Equipment	Count	Assumptions	Factor Type
1	canal prism excavation	60	2	track loader	1	a,c,	offroad
1	canal prism excavation	60	2	long reach excavator	1	a,c,	offroad
1	canal prism excavation	60	2	hauling trips (excavation)	36	a,b,c,e,f	onroad
1	canal prism excavation	60	2	personnel	5	a,c,e,	onroad
2	surface prep and compaction	60	1	small dozer	2	a,	offroad
2	surface prep and compaction	60	1	roller compactor	2	a,	offroad
2	surface prep and compaction	60	1	excavator w plate compactor	4	a,	offroad
2	surface prep and compaction	60	1	excavator	4	a,	offroad
2	surface prep and compaction	60	1	personnel	12	a,e,	onroad
3	geocomposite liner	60	1	excavator	1	a,	offroad
3	geocomposite liner	60	1	personnel	24	a,e,	onroad
4	backfill	60	2	conveyor	1	a,d,	offroad
4	backfill	60	2	dozer	1	a,d,	offroad
4	backfill	60	2	compactor	1	a,d,	offroad
4	backfill	60	2	excavator w plate compactor	4	a,d,	offroad
4	backfill	60	2	excavator	4	a,d,	offroad
4	backfill	60	2	personnel	15	a,d,e,	onroad
4	backfill	60	2	hauling trips (material import)	49	a,d,b,c,e,f	onroad

Phase #	MODIFICATION OF EARTH-LINED SEGMENT Construction Phase	Duration	Shifts	Equipment	Vehicle Category	Usage Factor	Trip Distance
1	canal prism excavation	60	2	track loader	Construction and Mining - Skid Steer Loaders	0.85	--
1	canal prism excavation	60	2	long reach excavator	Construction and Mining - Excavators	0.85	--
1	canal prism excavation	60	2	hauling trips (excavation)	Hauling/Delivery	1.00	40
1	canal prism excavation	60	2	personnel	Workers	1.00	22
2	surface prep and compaction	60	1	small dozer	Construction and Mining - Rubber Tired Dozers	0.85	--
2	surface prep and compaction	60	1	roller compactor	Construction and Mining - Rollers	0.85	--
2	surface prep and compaction	60	1	excavator w plate compactor	Construction and Mining - Excavators	0.85	--
2	surface prep and compaction	60	1	excavator	Construction and Mining - Excavators	0.85	--
2	surface prep and compaction	60	1	personnel	Workers	1.00	22
3	geocomposite liner	60	1	excavator	Construction and Mining - Excavators	0.85	--
3	geocomposite liner	60	1	personnel	Workers	1.00	22
4	backfill	60	2	conveyor	Construction and Mining - Other	0.85	--
4	backfill	60	2	dozer	Construction and Mining - Rubber Tired Dozers	0.85	--
4	backfill	60	2	compactor	Construction and Mining - Misc - Plate Compactors	0.85	--
4	backfill	60	2	excavator w plate compactor	Construction and Mining - Excavators	0.85	--
4	backfill	60	2	excavator	Construction and Mining - Excavators	0.85	--
4	backfill	60	2	personnel	Workers	1.00	22
4	backfill	60	2	hauling trips (material import)	Hauling/Delivery	1.00	40

	MODIFICATION OF EARTH-LINED SEGMENT				Emission Factors (g/hr for offroad; g/mi for onroad)							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	canal prism excavation	60	2	track loader	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
1	canal prism excavation	60	2	long reach excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
1	canal prism excavation	60	2	hauling trips (excavation)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
1	canal prism excavation	60	2	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
2	surface prep and compaction	60	1	small dozer	1.07E+01	1.27E+01	1.31E+02	4.02E+01	4.73E+04	1.34E+02	7.41E+01	4.25E-01
2	surface prep and compaction	60	1	roller compactor	2.71E+00	3.23E+00	8.87E+01	3.48E+01	1.69E+04	2.99E-01	2.75E-01	1.52E-01
2	surface prep and compaction	60	1	excavator w plate compactor	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
2	surface prep and compaction	60	1	excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
2	surface prep and compaction	60	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
3	geocomposite liner	60	1	excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
3	geocomposite liner	60	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
4	backfill	60	2	conveyor	6.08E+00	7.24E+00	1.22E+02	4.66E+01	4.10E+04	7.57E-01	6.97E-01	3.69E-01
4	backfill	60	2	dozer	1.07E+01	1.27E+01	1.31E+02	4.02E+01	4.73E+04	1.34E+02	7.41E+01	4.25E-01
4	backfill	60	2	compactor	2.15E+01	2.57E+01	7.49E+02	1.62E+01	1.54E+03	7.89E+00	5.96E+00	4.41E-02
4	backfill	60	2	excavator w plate compactor	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
4	backfill	60	2	excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
4	backfill	60	2	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
4	backfill	60	2	hauling trips (material import)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02

	MODIFICATION OF EARTH-LINED SEGMENT				Emissions (tons per operation area)							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	canal prism excavation	60	2	track loader	2.57E-03	3.06E-03	8.69E-02	4.21E-02	1.51E+01	2.75E-04	2.53E-04	1.36E-04
1	canal prism excavation	60	2	long reach excavator	6.19E-03	7.36E-03	1.16E-01	3.82E-02	3.69E+01	6.91E-04	6.36E-04	3.32E-04
1	canal prism excavation	60	2	hauling trips (excavation)	1.43E-03	1.63E-03	2.02E-02	2.08E-01	1.12E+02	2.28E-02	8.44E-03	1.01E-03
1	canal prism excavation	60	2	personnel	2.81E-04	3.02E-04	4.55E-03	2.20E-04	1.74E+00	9.71E-04	2.97E-04	1.71E-05
2	surface prep and compaction	60	1	small dozer	1.20E-02	1.43E-02	1.48E-01	4.52E-02	5.31E+01	1.51E-01	8.33E-02	4.78E-04
2	surface prep and compaction	60	1	roller compactor	3.05E-03	3.63E-03	9.98E-02	3.91E-02	1.90E+01	3.36E-04	3.09E-04	1.71E-04
2	surface prep and compaction	60	1	excavator w plate compactor	1.24E-02	1.47E-02	2.32E-01	7.63E-02	7.39E+01	1.38E-03	1.27E-03	6.64E-04
2	surface prep and compaction	60	1	excavator	1.24E-02	1.47E-02	2.32E-01	7.63E-02	7.39E+01	1.38E-03	1.27E-03	6.64E-04
2	surface prep and compaction	60	1	personnel	6.76E-04	7.24E-04	1.09E-02	5.28E-04	4.17E+00	2.33E-03	7.13E-04	4.10E-05
3	geocomposite liner	60	1	excavator	3.09E-03	3.68E-03	5.80E-02	1.91E-02	1.85E+01	3.46E-04	3.18E-04	1.66E-04
3	geocomposite liner	60	1	personnel	1.35E-03	1.45E-03	2.18E-02	1.06E-03	8.34E+00	4.66E-03	1.43E-03	8.19E-05
4	backfill	60	2	conveyor	6.84E-03	8.14E-03	1.37E-01	5.24E-02	4.61E+01	8.52E-04	7.83E-04	4.14E-04
4	backfill	60	2	dozer	1.20E-02	1.43E-02	1.48E-01	4.52E-02	5.31E+01	1.51E-01	8.33E-02	4.78E-04
4	backfill	60	2	compactor	2.41E-02	2.89E-02	8.42E-01	1.82E-02	1.73E+00	8.88E-03	6.71E-03	4.96E-05
4	backfill	60	2	excavator w plate compactor	2.48E-02	2.95E-02	4.64E-01	1.53E-01	1.48E+02	2.77E-03	2.54E-03	1.33E-03
4	backfill	60	2	excavator	2.48E-02	2.95E-02	4.64E-01	1.53E-01	1.48E+02	2.77E-03	2.54E-03	1.33E-03
4	backfill	60	2	personnel	8.44E-04	9.05E-04	1.37E-02	6.60E-04	5.21E+00	2.91E-03	8.92E-04	5.12E-05
4	backfill	60	2	hauling trips (material import)	1.95E-03	2.22E-03	2.75E-02	2.82E-01	1.52E+02	3.10E-02	1.15E-02	1.37E-03

NOTE: Modification of earth-lined segments phasing is assumed to be performed concurrently (i.e. overlapping), with 36 instances of canal prism excavation and 4 instances of backfill occuring simultaneously [Appendix G of the Delta-Mendota Canal Feasibility Study]

Emissions (tons per year - Appendix G Schedule)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.80	0.95	17.38	13.44	8,419.45	1.85	0.87	0.08

Stabilize Canal Banks Along Earthlined Segment (low flow work)

10/01/2025	10/06/2026
60	total workdays
60	workdays per year [6 days per week for this portion of construction]

Emissions (tons per year - half intensity)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.40	0.48	8.69	6.72	4,209.73	0.93	0.43	0.04

CHECK STRUCTURES AND WASTEWAYS

Phase #	Construction Phase	Duration	Shifts	Equipment	Count	Assumptions	Factor Type
1	Coffer dam	40	1	crane	1	a,	offroad
1	Coffer dam	40	1	personnel	8	a,	onroad
1	Coffer dam	40	1	hauling trips (supersack delivery)	2	a,e,f,	onroad
2	Install beams	10	1	crane	1	a,	offroad
2	Install beams	10	1	personnel	5	a,	onroad
2	Install beams	10	1	hauling trips (vendor delivery)	1	a,b,c,	onroad
3	Sikawrap	19	1	aerial lift	2	a,	offroad
3	Sikawrap	19	1	personnel	4	a,	onroad
4	Gate modifications	20	1	crane	1	a,	offroad
4	Gate modifications	20	1	aerial lift	1	a,	offroad
4	Gate modifications	20	1	personnel	5	a,	onroad
4	Gate modifications	20	1	hauling trips (vendor delivery)	1	a,f,	onroad

	CHECK STRUCTURES AND WASTEWAYS						
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**Vehicle Category**	**Usage Factor**	**Trip Distance**
1	Coffer dam	40	1	crane	Construction and Mining - Cranes	0.85	--
1	Coffer dam	40	1	personnel	Workers	1.00	22
1	Coffer dam	40	1	hauling trips (supersack delivery)	Hauling/Delivery	1.00	17
2	Install beams	10	1	crane	Construction and Mining - Cranes	0.85	--
2	Install beams	10	1	personnel	Workers	1.00	22
2	Install beams	10	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17
3	Sikawrap	19	1	aerial lift	Construction and Mining - Other	0.85	--
3	Sikawrap	19	1	personnel	Workers	1.00	22
4	Gate modifications	20	1	crane	Construction and Mining - Cranes	0.85	--
4	Gate modifications	20	1	aerial lift	Construction and Mining - Other	0.85	--
4	Gate modifications	20	1	personnel	Workers	1.00	22
4	Gate modifications	20	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17

	CHECK STRUCTURES AND WASTEWAYS				**Emission Factors (g/hr for offroad; g/mi for onroad)**							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	Coffer dam	40	1	crane	5.03E+00	5.98E+00	9.58E+01	2.54E+01	3.72E+04	6.69E-01	6.15E-01	3.35E-01
1	Coffer dam	40	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
1	Coffer dam	40	1	hauling trips (supersack delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
2	Install beams	10	1	crane	5.03E+00	5.98E+00	9.58E+01	2.54E+01	3.72E+04	6.69E-01	6.15E-01	3.35E-01
2	Install beams	10	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
2	Install beams	10	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
3	Sikawrap	19	1	aerial lift	6.08E+00	7.24E+00	1.22E+02	4.66E+01	4.10E+04	7.57E-01	6.97E-01	3.69E-01
3	Sikawrap	19	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
4	Gate modifications	20	1	crane	5.03E+00	5.98E+00	9.58E+01	2.54E+01	3.72E+04	6.69E-01	6.15E-01	3.35E-01
4	Gate modifications	20	1	aerial lift	6.08E+00	7.24E+00	1.22E+02	4.66E+01	4.10E+04	7.57E-01	6.97E-01	3.69E-01
4	Gate modifications	20	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
4	Gate modifications	20	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02

	CHECK STRUCTURES AND WASTEWAYS				**Emissions (tons per impacted structure)**							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	Coffer dam	40	1	crane	1.88E-03	2.24E-03	3.59E-02	9.54E-03	1.40E+01	2.51E-04	2.31E-04	1.26E-04
1	Coffer dam	40	1	personnel	3.00E-04	3.22E-04	4.85E-03	2.35E-04	1.85E+00	1.04E-03	3.17E-04	1.82E-05
1	Coffer dam	40	1	hauling trips (supersack delivery)	2.19E-05	2.49E-05	3.09E-04	3.18E-03	1.71E+00	3.49E-04	1.29E-04	1.54E-05
2	Install beams	10	1	crane	4.71E-04	5.60E-04	8.98E-03	2.38E-03	3.49E+00	6.26E-05	5.76E-05	3.14E-05
2	Install beams	10	1	personnel	4.69E-05	5.03E-05	7.58E-04	3.67E-05	2.90E-01	1.62E-04	4.95E-05	2.84E-06
2	Install beams	10	1	hauling trips (vendor delivery)	2.74E-06	3.12E-06	3.86E-05	3.97E-04	2.14E-01	4.36E-05	1.62E-05	1.93E-06
3	Sikawrap	19	1	aerial lift	2.16E-03	2.58E-03	4.34E-02	1.66E-02	1.46E+01	2.70E-04	2.48E-04	1.31E-04
3	Sikawrap	19	1	personnel	7.13E-05	7.64E-05	1.15E-03	5.58E-05	4.40E-01	2.46E-04	7.53E-05	4.32E-06
4	Gate modifications	20	1	crane	9.42E-04	1.12E-03	1.80E-02	4.77E-03	6.98E+00	1.25E-04	1.15E-04	6.28E-05
4	Gate modifications	20	1	aerial lift	1.14E-03	1.36E-03	2.28E-02	8.73E-03	7.68E+00	1.42E-04	1.31E-04	6.91E-05
4	Gate modifications	20	1	personnel	9.38E-05	1.01E-04	1.52E-03	7.34E-05	5.79E-01	3.24E-04	9.91E-05	5.69E-06
4	Gate modifications	20	1	hauling trips (vendor delivery)	5.47E-06	6.23E-06	7.73E-05	7.95E-04	4.27E-01	8.72E-05	3.23E-05	3.86E-06

NOTE: Check structure and wasteway phasing is assumed to be performed concurrently (i.e. overlapping) for all phases but coffer dam construction [Appendix G of the Delta-Mendota Canal Feasibility Study]

Emissions (tons per impacted structure)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.01	0.01	0.14	0.05	52.21	0.00	0.00	0.00

Check Structures and Wasteways Modifications (low flow work)

10/01/2025	10/06/2026
1,163	total workdays
87	workdays per year
17	impacted structures
0.0146	areas per workday
1.28	average structures per year

Emissions (tons per year)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.01	0.01	0.18	0.06	66.65	0.00	0.00	0.00

	UTILITY CROSSINGS						
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**Count**	**Assumptions**	**Factor Type**
1	Construction of foundations	10	1	small excavator	1	a,	offroad
1	Construction of foundations	10	1	skid steer	1	a,	offroad
1	Construction of foundations	10	1	personnel	5	a,g	onroad
1	Construction of foundations	10	1	hauling trips (vendor delivery)	2	a,b,c,g	onroad
2	Demolition of old utility	3	1	crane	1	a,	offroad
2	Demolition of old utility	3	1	front end loader	1	a,	offroad
2	Demolition of old utility	3	1	skid steer	1	a,	offroad
2	Demolition of old utility	3	1	dump truck	2	a,h	offroad
2	Demolition of old utility	3	1	personnel	6	a,g	onroad
2	Demolition of old utility	3	1	hauling trips (demolition)	2	a,d,e,f,g	onroad
3	Install new span	2	1	crane	1	a,	offroad
3	Install new span	2	1	personnel	5	a,g	onroad
3	Install new span	2	1	hauling trips (vendor delivery)	1	a,b,c,f,g	onroad

Phase #	UTILITY CROSSINGS Construction Phase	Duration	Shifts	Equipment	Vehicle Category	Usage Factor	Trip Distance
1	Construction of foundations	10	1	small excavator	Construction and Mining - Excavators	0.85	--
1	Construction of foundations	10	1	skid steer	Construction and Mining - Skid Steer Loaders	0.85	--
1	Construction of foundations	10	1	personnel	Workers	1.00	22
1	Construction of foundations	10	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17
2	Demolition of old utility	3	1	crane	Construction and Mining - Cranes	0.85	--
2	Demolition of old utility	3	1	front end loader	Construction and Mining - Rubber Tired Loaders	0.85	--
2	Demolition of old utility	3	1	skid steer	Construction and Mining - Skid Steer Loaders	0.85	--
2	Demolition of old utility	3	1	dump truck	Construction and Mining - Off-Highway Trucks	0.25	--
2	Demolition of old utility	3	1	personnel	Workers	1.00	22
2	Demolition of old utility	3	1	hauling trips (demolition)	Hauling/Delivery	1.00	40
3	Install new span	2	1	crane	Construction and Mining - Cranes	0.85	--
3	Install new span	2	1	personnel	Workers	1.00	22
3	Install new span	2	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17

	UTILITY CROSSINGS				Emission Factors (g/hr for offroad; g/mi for onroad)							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	Construction of foundations	10	1	small excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
1	Construction of foundations	10	1	skid steer	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
1	Construction of foundations	10	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
1	Construction of foundations	10	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
2	Demolition of old utility	3	1	crane	5.03E+00	5.98E+00	9.58E+01	2.54E+01	3.72E+04	6.69E-01	6.15E-01	3.35E-01
2	Demolition of old utility	3	1	front end loader	8.11E+00	9.66E+00	1.22E+02	3.15E+01	3.99E+04	8.24E-01	7.58E-01	3.59E-01
2	Demolition of old utility	3	1	skid steer	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
2	Demolition of old utility	3	1	dump truck	1.92E+01	2.28E+01	1.85E+02	1.42E+02	8.46E+04	4.21E+02	4.40E+01	7.60E-01
2	Demolition of old utility	3	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
2	Demolition of old utility	3	1	hauling trips (demolition)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
3	Install new span	2	1	crane	5.03E+00	5.98E+00	9.58E+01	2.54E+01	3.72E+04	6.69E-01	6.15E-01	3.35E-01
3	Install new span	2	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
3	Install new span	2	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02

	UTILITY CROSSINGS				Emissions (tons per impacted structure)							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	Construction of foundations	10	1	small excavator	5.16E-04	6.14E-04	9.67E-03	3.18E-03	3.08E+00	5.76E-05	5.30E-05	2.77E-05
1	Construction of foundations	10	1	skid steer	2.14E-04	2.55E-04	7.25E-03	3.51E-03	1.26E+00	2.29E-05	2.11E-05	1.13E-05
1	Construction of foundations	10	1	personnel	4.69E-05	5.03E-05	7.58E-04	3.67E-05	2.90E-01	1.62E-04	4.95E-05	2.84E-06
1	Construction of foundations	10	1	hauling trips (vendor delivery)	5.47E-06	6.23E-06	7.73E-05	7.95E-04	4.27E-01	8.72E-05	3.23E-05	3.86E-06
2	Demolition of old utility	3	1	crane	1.41E-04	1.68E-04	2.69E-03	7.15E-04	1.05E+00	1.88E-05	1.73E-05	9.41E-06
2	Demolition of old utility	3	1	front end loader	2.28E-04	2.71E-04	3.44E-03	8.86E-04	1.12E+00	2.32E-05	2.13E-05	1.01E-05
2	Demolition of old utility	3	1	skid steer	6.42E-05	7.64E-05	2.17E-03	1.05E-03	3.77E-01	6.87E-06	6.32E-06	3.39E-06
2	Demolition of old utility	3	1	dump truck	3.17E-04	3.78E-04	3.06E-03	2.34E-03	1.40E+00	6.97E-03	7.28E-04	1.26E-05
2	Demolition of old utility	3	1	personnel	1.69E-05	1.81E-05	2.73E-04	1.32E-05	1.04E-01	5.83E-05	1.78E-05	1.02E-06
2	Demolition of old utility	3	1	hauling trips (demolition)	3.97E-06	4.52E-06	5.61E-05	5.76E-04	3.10E-01	6.33E-05	2.34E-05	2.80E-06
3	Install new span	2	1	crane	9.42E-05	1.12E-04	1.80E-03	4.77E-04	6.98E-01	1.25E-05	1.15E-05	6.28E-06
3	Install new span	2	1	personnel	9.38E-06	1.01E-05	1.52E-04	7.34E-06	5.79E-02	3.24E-05	9.91E-06	5.69E-07
3	Install new span	2	1	hauling trips (vendor delivery)	5.47E-07	6.23E-07	7.73E-06	7.95E-05	4.27E-02	8.72E-06	3.23E-06	3.86E-07

NOTE: Utility crossing phasing is assumed to be performed concurrently (i.e. overlapping) [Appendix G of the Delta-Mendota Canal Feasibility Study]

Emissions (tons per impacted structure)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.00	0.00	0.03	0.01	10.21	0.01	0.00	0.00

Impacted Pipline Crossing Replacements (all season work)

514	total workdays
262	workdays per year
36	impacted structures
0.0700	areas per workday
18.35	average structures per year

Emissions (tons per year)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.03	0.04	0.58	0.25	187.33	0.14	0.02	0.00

DRAINAGE STRUCTURES

Phase #	Construction Phase	Duration	Shifts	Equipment	Count	Assumptions	Factor Type
1	Install trash racks at the entrances of all drain inlets	3	1	excavator	1	a,	offroad
1	Install trash racks at the entrances of all drain inlets	3	1	personnel	4	a,	onroad
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	excavator	1	a,	offroad
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	skid steer	1	a,	offroad
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	dump truck	1	a,e	offroad
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	personnel	4	a,	onroad
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	hauling trips (vendor delivery)	2	a,b,c,d,	onroad
3	Raise the headwalls at the entrances of drain inlets	5	1	skid steer	1	a,	offroad
3	Guard rails and ladder steps for each turnout stilling pit	5	1	personnel	4	a,	onroad
3	Guard rails and ladder steps for each turnout stilling pit	5	1	hauling trips (vendor delivery)	2	a,b,c,d,	onroad
4	Replace headwalls at culverts and overchutes at locations where raising the embankment will require higher walls	5	1	skid steer	1	a,	offroad
4	Replace headwalls at culverts and overchutes at locations where raising the embankment will require higher walls	5	1	personnel	4	a,	onroad
4	Replace headwalls at culverts and overchutes at locations where raising the embankment will require higher walls	5	1	hauling trips (vendor delivery)	2	a,b,c,d,	onroad

DRAINAGE STRUCTURES

Phase #	Construction Phase	Duration	Shifts	Equipment	Vehicle Category	Usage Factor	Trip Distance
1	Install trash racks at the entrances of all drain inlets	3	1	excavator	Construction and Mining - Excavators	0.85	--
1	Install trash racks at the entrances of all drain inlets	3	1	personnel	Workers	1.00	22
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	excavator	Construction and Mining - Excavators	0.85	--
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	skid steer	Construction and Mining - Skid Steer Loaders	0.85	--
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	dump truck	Construction and Mining - Off-Highway Trucks	0.25	--
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	personnel	Workers	1.00	22
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17
3	Raise the headwalls at the entrances of drain inlets	5	1	skid steer	Construction and Mining - Skid Steer Loaders	0.85	--
3	Guard rails and ladder steps for each turnout stilling pit	5	1	personnel	Workers	1.00	22
3	Guard rails and ladder steps for each turnout stilling pit	5	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17
4	Replace headwalls at culverts and overchutes at locations where raising the embankment will require higher walls	5	1	skid steer	Construction and Mining - Skid Steer Loaders	0.85	--
4	Replace headwalls at culverts and overchutes at locations where raising the embankment will require higher walls	5	1	personnel	Workers	1.00	22
4	Replace headwalls at culverts and overchutes at locations where raising the embankment will require higher walls	5	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17

	DRAINAGE STRUCTURES				Emission Factors (g/hr for offroad; g/mi for onroad)							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	Install trash racks at the entrances of all drain inlets	3	1	excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
1	Install trash racks at the entrances of all drain inlets	3	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	excavator	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	skid steer	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	dump truck	1.92E+01	2.28E+01	1.85E+02	1.42E+02	8.46E+04	4.21E+02	4.40E+01	7.60E-01
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
3	Raise the headwalls at the entrances of drain inlets	5	1	skid steer	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
3	Guard rails and ladder steps for each turnout stilling pit	5	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
3	Guard rails and ladder steps for each turnout stilling pit	5	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
4	Replace headwalls at culverts and overchutes at locations where raising the embankment will require higher walls	5	1	skid steer	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
4	Replace headwalls at culverts and overchutes at locations where raising the embankment will require higher walls	5	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
4	Replace headwalls at culverts and overchutes at locations where raising the embankment will require higher walls	5	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02

	DRAINAGE STRUCTURES				Emissions (tons per impacted structure)							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	Install trash racks at the entrances of all drain inlets	3	1	excavator	1.55E-04	1.84E-04	2.90E-03	9.54E-04	9.24E-01	1.73E-05	1.59E-05	8.31E-06
1	Install trash racks at the entrances of all drain inlets	3	1	personnel	1.13E-05	1.21E-05	1.82E-04	8.80E-06	6.95E-02	3.89E-05	1.19E-05	6.83E-07
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	excavator	5.16E-05	6.14E-05	9.67E-04	3.18E-04	3.08E-01	5.76E-06	5.30E-06	2.77E-06
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	skid steer	2.14E-05	2.55E-05	7.25E-04	3.51E-04	1.26E-01	2.29E-06	2.11E-06	1.13E-06
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	dump truck	5.29E-05	6.29E-05	5.10E-04	3.91E-04	2.33E-01	1.16E-03	1.21E-04	2.09E-06
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	personnel	3.75E-06	4.02E-06	6.07E-05	2.93E-06	2.32E-02	1.30E-05	3.96E-06	2.28E-07
2	Stabilize the areas downstream of each culvert and overchute through earth work and installation of riprap for erosion protection	1	1	hauling trips (vendor delivery)	5.47E-07	6.23E-07	7.73E-06	7.95E-05	4.27E-02	8.72E-06	3.23E-06	3.86E-07
3	Raise the headwalls at the entrances of drain inlets	5	1	skid steer	1.07E-04	1.27E-04	3.62E-03	1.76E-03	6.28E-01	1.15E-05	1.05E-05	5.65E-06
3	Guard rails and ladder steps for each turnout stilling pit	5	1	personnel	1.88E-05	2.01E-05	3.03E-04	1.47E-05	1.16E-01	6.48E-05	1.98E-05	1.14E-06
3	Guard rails and ladder steps for each turnout stilling pit	5	1	hauling trips (vendor delivery)	2.74E-06	3.12E-06	3.86E-05	3.97E-04	2.14E-01	4.36E-05	1.62E-05	1.93E-06
4	Replace headwalls at culverts and overchutes at locations where raising the embankment will require higher walls	5	1	skid steer	1.07E-04	1.27E-04	3.62E-03	1.76E-03	6.28E-01	1.15E-05	1.05E-05	5.65E-06
4	Replace headwalls at culverts and overchutes at locations where raising the embankment will require higher walls	5	1	personnel	1.88E-05	2.01E-05	3.03E-04	1.47E-05	1.16E-01	6.48E-05	1.98E-05	1.14E-06
4	Replace headwalls at culverts and overchutes at locations where raising the embankment will require higher walls	5	1	hauling trips (vendor delivery)	2.74E-06	3.12E-06	3.86E-05	3.97E-04	2.14E-01	4.36E-05	1.62E-05	1.93E-06

NOTE: Drainage structures phasing is assumed to be performed concurrently (i.e. overlapping) [Appendix G of the Delta-Mendota Canal Feasibility Study]

Emissions (tons per impacted structure)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.00	0.00	0.01	0.01	3.64	0.00	0.00	0.00

Impacted Pipline Crossing Replacements (all season work)

745	total workdays
262	workdays per year
25	impacted structures
0.0336	areas per workday
8.79	average structures per year

Emissions (tons per year)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.00	0.01	0.12	0.06	32.02	0.01	0.00	0.00

	TURNOUTS						
Phase #	Construction Phase	Duration	Shifts	Equipment	Count	Assumptions	Factor Type
1	Corregated metal pipe to raise the manholes/pits for the water meter	2	1	service truck with crane	1	a,	offroad
1	Corregated metal pipe to raise the manholes/pits for the water meter	2	1	personnel	3	a,	onroad
2	Concrete work to raise the stilling pits	2	1	skid steer	1	a,	offroad
2	Concrete work to raise the stilling pits	2	1	personnel	3	a,	onroad
2	Concrete work to raise the stilling pits	2	1	hauling trips (vendor delivery)	2	a,b,c,d,	onroad
3	Guard rails and ladder steps for each turnout stilling pit	2	1	service truck with crane	1	a,	offroad
3	Guard rails and ladder steps for each turnout stilling pit	2	1	personnel	3	a,	onroad
3	Guard rails and ladder steps for each turnout stilling pit	2	1	hauling trips (vendor delivery)	2	a,b,c,d,	onroad
4	Monitoring wells standpipe raise	2	1	personnel	3	a,	onroad

TURNOUTS

Phase #	Construction Phase	Duration	Shifts	Equipment	Vehicle Category	Usage Factor	Trip Distance
1	Corregated metal pipe to raise the manholes/pits for the water meter	2	1	service truck with crane	Construction and Mining - Cranes	0.85	--
1	Corregated metal pipe to raise the manholes/pits for the water meter	2	1	personnel	Workers	1.00	22
2	Concrete work to raise the stilling pits	2	1	skid steer	Construction and Mining - Skid Steer Loaders	0.85	--
2	Concrete work to raise the stilling pits	2	1	personnel	Workers	1.00	22
2	Concrete work to raise the stilling pits	2	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17
3	Guard rails and ladder steps for each turnout stilling pit	2	1	service truck with crane	Construction and Mining - Cranes	0.85	--
3	Guard rails and ladder steps for each turnout stilling pit	2	1	personnel	Workers	1.00	22
3	Guard rails and ladder steps for each turnout stilling pit	2	1	hauling trips (vendor delivery)	Hauling/Delivery	1.00	17
4	Monitoring wells standpipe raise	2	1	personnel	Workers	1.00	22

	TURNOUTS				Emission Factors (g/hr for offroad; g/mi for onroad)							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	Corregated metal pipe to raise the manholes/pits for the water meter	2	1	service truck with crane	5.03E+00	5.98E+00	9.58E+01	2.54E+01	3.72E+04	6.69E-01	6.15E-01	3.35E-01
1	Corregated metal pipe to raise the manholes/pits for the water meter	2	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
2	Concrete work to raise the stilling pits	2	1	skid steer	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
2	Concrete work to raise the stilling pits	2	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
2	Concrete work to raise the stilling pits	2	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
3	Guard rails and ladder steps for each turnout stilling pit	2	1	service truck with crane	5.03E+00	5.98E+00	9.58E+01	2.54E+01	3.72E+04	6.69E-01	6.15E-01	3.35E-01
3	Guard rails and ladder steps for each turnout stilling pit	2	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03
3	Guard rails and ladder steps for each turnout stilling pit	2	1	hauling trips (vendor delivery)	1.50E-02	1.71E-02	2.12E-01	2.18E+00	1.17E+03	2.39E-01	8.86E-02	1.06E-02
4	Monitoring wells standpipe raise	2	1	personnel	3.92E-02	4.20E-02	6.34E-01	3.07E-02	2.42E+02	1.35E-01	4.14E-02	2.38E-03

	TURNOUTS				Emissions (tons per impacted structure)							
Phase #	**Construction Phase**	**Duration**	**Shifts**	**Equipment**	**ROG**	**TOG**	**CO**	**NOx**	**CO2e**	**PM10**	**PM2.5**	**SOx**
1	Corregated metal pipe to raise the manholes/pits for the water meter	2	1	service truck with crane	9.42E-05	1.12E-04	1.80E-03	4.77E-04	6.98E-01	1.25E-05	1.15E-05	6.28E-06
1	Corregated metal pipe to raise the manholes/pits for the water meter	2	1	personnel	5.63E-06	6.03E-06	9.10E-05	4.40E-06	3.48E-02	1.94E-05	5.95E-06	3.41E-07
2	Concrete work to raise the stilling pits	2	1	skid steer	4.28E-05	5.10E-05	1.45E-03	7.02E-04	2.51E-01	4.58E-06	4.21E-06	2.26E-06
2	Concrete work to raise the stilling pits	2	1	personnel	5.63E-06	6.03E-06	9.10E-05	4.40E-06	3.48E-02	1.94E-05	5.95E-06	3.41E-07
2	Concrete work to raise the stilling pits	2	1	hauling trips (vendor delivery)	1.09E-06	1.25E-06	1.55E-05	1.59E-04	8.55E-02	1.74E-05	6.46E-06	7.71E-07
3	Guard rails and ladder steps for each turnout stilling pit	2	1	service truck with crane	9.42E-05	1.12E-04	1.80E-03	4.77E-04	6.98E-01	1.25E-05	1.15E-05	6.28E-06
3	Guard rails and ladder steps for each turnout stilling pit	2	1	personnel	5.63E-06	6.03E-06	9.10E-05	4.40E-06	3.48E-02	1.94E-05	5.95E-06	3.41E-07
3	Guard rails and ladder steps for each turnout stilling pit	2	1	hauling trips (vendor delivery)	1.09E-06	1.25E-06	1.55E-05	1.59E-04	8.55E-02	1.74E-05	6.46E-06	7.71E-07
4	Monitoring wells standpipe raise	2	1	personnel	5.63E-06	6.03E-06	9.10E-05	4.40E-06	3.48E-02	1.94E-05	5.95E-06	3.41E-07

NOTE: Turnouts phasing is assumed to be performed partially concurrently (i.e. any two phases overlapping) [Appendix G of the Delta-Mendota Canal Feasibility Study]

Emissions (tons per impacted structure)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.00	0.00	0.01	0.00	1.96	0.00	0.00	0.00

Impacted Pipline Crossing Replacements (all season work)

514	total workdays
262	workdays per year
82	impacted structures
0.1595	areas per workday
41.80	average structures per year

Emissions (tons per year)

ROG	TOG	CO	NOx	CO2e	PM10	PM2.5	SOx
0.01	0.01	0.23	0.08	81.80	0.01	0.00	0.00

Fugitive Dust Emissions
Bulldozing

Equations (AP-42, Chapter 11.9):

$$TSP = \frac{5.7(s)^{1.2}}{M^{1.3}} \quad \text{and} \quad PM15 = \frac{1.0(s)^{1.5}}{M^{1.4}}$$

where:

s = silt content	6.9 %	(AP-42, Table 11.9-3, Overburden)
M = material moisture content	7.9 %	(AP-42, Table 11.9-3, Overburden)

Scaling Factors

PM10	0.75	(multiply the 15-micron equation by this fraction to determine emissions)
PM2.5	0.105	(multiply the TSP equation by this fraction to determine emissions)

Bulldozing Emissions

	EF	**EF (incl. watering)**	**EF (incl. watering)**
Size	**lb/hr**	**lb/hr**	**g/hr**
PM10	0.75	0.29	133.16
PM2.5	0.41	0.16	73.20

Dust Control
61% reduction from watering at least 3 times per day
Source: CalEEMod

Applicable to…
Construction and Mining - Rubber Tired Dozers

Fugitive Dust Emissions
Grading

Operating Schedule
7.1 miles per hour (AP-42, Table 11.9-3)

Equations (AP-42, Chapter 11.9):

$TSP = 0.040(S)^{2.5}$ and $PM15 = 0.051(S)^{2.0}$

where:
S = mean vehicle speed, miles per hour

Scaling Factors

PM10	0.60	(multiply the 15-micron equation by this fraction to determine emissions)
PM2.5	0.031	(multiply the TSP equation by this fraction to determine emissions)

Grading Emission Factors

Size	EF lb/VMT	EF (incl. watering) lb/VMT	EF (incl. watering) g/hr
PM10	1.54	0.60	11.73
PM2.5	0.17	0.06	1.27

Dust Control
61% reduction from watering at least 3 times per day
Source: CalEEMod

Applicable to…
Construction and Mining - Graders

Total Grading Performed
https://caleemod.com/documents/user-guide/CalEEMod_User_Guide_v2022.1.pdf

$E_p = EF_p \times VMT$ and $VMT = AS \div Wb \times UC_1 \div UC_2$

where:
E = emissions (lb/day).
EF = emission factor (lb/VMT).
VMT = vehicle miles traveled (mile).
As = the acreage of the grading site (acre/day).
Wb = Blade width of the grading equipment. CalEEMod assumes a default blade width of 12 feet based on Caterpillar's 140 Motor Grader (Caterpillar 2021).
UC1 = unit conversion from acre to square feet (43,560 sqft/acre).
UC2 = unit conversion from feet to miles (5,280 feet/mile).
p = pollutant (PM10 or PM2.5).

Table G-14. Daily Acres Graded by Equipment Type

Equipment	Acres Graded per 8 Hour Day
Crawler Tractors	0.5
Graders	0.5
Rubber Tired Dozers	0.5
Scrapers	1

Source: South Coast Air Quality Management District Construction Survey
https://www.caleemod.com/documents/user-guide/08_Appendix%20G.xlsx

Fugitive Dust Emissions
Material Handling

Equation (AP-42, Chapter 13.2.4):

$$E = k(0.0032)\frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

where:
E = emission factor, pound per ton
k = particle size multiplier
U = mean wind speed, miles per hour
M = material moisture content, %

Average Wind Speed 6.08 mph
Source: WeatherWX, San Joaquin County Avg. Wind Speed based on the past 10 years of data. Accessed on: June 1, 2022. Available at: https://www.weatherwx.com/hazardoutlook/ca/san+joaquin+county.html.

Material Moisture Content: 7.9 %
Source: EPA. 1998. AP-42, Chapter 11-9, Overburden moisture content, bulldozing.

Material Handling Emissions

Size	k	EF lb/ton	EF (incl. watering) g/cubic yard
PM10	0.35	2.1E-04	0.093
PM2.5	0.053	3.2E-05	0.014

Density
1.25 tons per cubic yard
Note: CalEEMod assumes haul trucks can handle 20 tons or 16 cy.

Number of Drops
2 drops per truck

Dust Control
61% reduction from watering at least 3 times per day

Source: CalEEMod

Workdays per Year
262 days

Annual Emissions	Total Cubic Yards	Total Handling Emissions (g) PM10	Total Handling Emissions (g) PM2.5	Workdays	Emissions per Year (ton/yr) PM10	Emissions per Year (ton/yr) PM2.5
BridgeReplacement	72,000	6,725	1,018	1,910	0.0010	0.0002
ConcreteLining EmbankmentRaise	570,276	53,267	8,066	1,063	0.0145	0.0022
ConcreteLiningRepairs	45,000	4,203	636	150	0.0046	0.0007
StabilizeEarthenEmbankments	467,988	43,713	6,619	236	0.0482	0.0073
ModificationOfEarthLinedSegment	6,779,918	633,286	95,898	60	0.2327	0.0352
UtilityCrossings	60	6	1	514	0.0000	0.0000
CheckStructuresAndWasteways	0	0	0	1,163	0.0000	0.0000
Turnouts	0	0	0	514	0.0000	0.0000
DrainageStructures	0	0	0	745	0.0000	0.0000

Fugitive Dust Emissions
Paved Road Dust

Equation 1:

$$E = k(sL)^{0.91} \times (W)^{1.02}$$

where: E = particulate emission factor (having units matching the units of k),
k = particle size multiplier for particle size range and units of interest (see below),
sL = road surface silt loading (grams per square meter) (g/m2), and
W = average weight (tons) of the vehicles traveling the road.

Equation 2:

$$E_{ext} = [k(sL)^{0.91} \times (W)^{1.02}](1 - P/4N)$$

where: k, sL, and W are as defined in Equation 1 and
E_{ext} = annual or other long-term average emission factor in the same units as k,
P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and
N = number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly).

Particle Size Multipliers for Paved Road Equation

Size Range [a]	Ref.	Particle Size Multiplier, k [b]		
		g/VKT	g/VMT	lb/VMT
$PM_{2.5}$	[c]	0.15	0.25	0.00054
PM_{10}		0.62	1.00	0.0022
PM_{15}		0.77	1.23	0.0027
PM_{30}	[d]	3.23	5.24	0.011

Source: AP-42, Table 13.2.1-1
Notes:
[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.

[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT). The multiplier k includes unit conversions to produce emission factors in the units shown for the indicated size range from the mixed units required in Equation 1.
[c] The k-factors for $PM_{2.5}$ were based on the average $PM_{2.5}$:PM_{10} ratio of test runs in Reference 30.
[d] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

Default Assumptions

Number precipitation days >0.1 inches
San Joaquin Valley Air Basin 45

Road silt loading 0.03 g/m^2 (AP-42, ADT > 10,000, ubiquitous baseline)
Average vehicle weight 2.2 tons

Source: CalEEMod

Paved Road Dust Emission Factors

Air Basin	Emission Factor (g/VMT)			
	Uncontrolled		Controlled	
	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
San Joaquin Valley	0.092	0.023	0.089	0.022

Note:
Controlled emission factor only applicable to long-term (annual) emissions; uncontrolled emission factor used for daily emissions.

Fugitive Dust Emissions
Unpaved Road Dust

Equations (AP-42, Chapter 13.2.2):

$$E = k(s/12)^a (W/3)^b$$

$$E_{ext} = E[(365 - P)/365]$$

where:
k, a, and b are empirical constants
E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
Eext = annual size-specific emission factor extrapolated for natural mitigation
P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation

silt content (construction)	8.5 %	(AP-42, Table 13.2.2-1)
days of precipitation	49	(CalEEMod default)
Unloaded truck weight	17 tons	
Loaded truck weight	29 tons	
Average vehicle weight	23 tons	(estimated from eqiupment specifications)

Unmitigated Unpaved Road Dust Emissions

Size	k	a	b	EF, lb/VMT		EF (incl. watering)
				Uncontrolled	Controlled	g/VMT
PM10	1.5	0.9	0.45	2.7	2.4	419.15
PM2.5	0.15	0.9	0.45	0.3	0.2	41.91

Source: AP-42, Table 13.2.2-2

Dust Control
61% reduction from watering at least 3 times per day
Source: CalEEMod

Applicable to…
Construction and Mining - Off-Highway Trucks

EMISSION FACTORS ASSUMING 100% TIER 4 FINAL (2015 OR NEWER) EQUIPMENT FLEET

https://arb.ca.gov/emfac/emissions-inventory/062ea65a6d880915702749cabdedeae6aa349a1e

Model Output: OFFROAD2021 (v1.0.2) Emissions Inventory
Region Type: Air Basin
Region: San Joaquin Valley
Calendar Year: 2025
Scenario: All Adopted Rules - Exhaust
Vehicle Classification: OFFROAD2021 Equipment Types
Units: tons/day for Emissions, gallons/year for Fuel, hours/year for Activity, Horsepower-hours/year for Horsepower-hours

Note on CO2e Factors: CO2e factors are calculated from the CO2 emission factors present in the OFFROAD model. CH4 and N2O components of CO2e are based on OFFROAD fuel estimates and Table 5 of the USEIA Emission Factors for Greenhouse Gas Inventories document dated April 1, 2022 (https://www.epa.gov/system/files/documents/2022-04/ghg_emission_factors_hub.pdf). Global warming potentials are consistent with IPCC AR4.

vmt-weighted aggregate

Region	Calendar Ye	Vehicle Category	Fuel	Avg_HP	g/hr ROG	g/hr TOG	g/hr CO	g/hr NOx	g/hr CO2e	g/hr PM10	g/hr PM2.5	g/hr SOx
San Joaquin Valley	2025	Construction and Mining - Bore/Drill Rigs	Diesel	2.14E+02	7.69E+00	9.15E+00	1.63E+02	5.15E+01	5.83E+04	1.04E+00	9.60E-01	5.24E-01
San Joaquin Valley	2025	Construction and Mining - Cranes	Diesel	2.38E+02	5.03E+00	5.98E+00	9.58E+01	2.54E+01	3.72E+04	6.69E-01	6.15E-01	3.35E-01
San Joaquin Valley	2025	Construction and Mining - Crawler Tractors	Diesel	2.18E+02	7.49E+00	8.91E+00	1.46E+02	4.46E+01	5.08E+04	9.47E-01	8.72E-01	4.56E-01
San Joaquin Valley	2025	Construction and Mining - Excavators	Diesel	1.57E+02	5.50E+00	6.55E+00	1.03E+02	3.39E+01	3.29E+04	6.15E-01	5.66E-01	2.95E-01
San Joaquin Valley	2025	Construction and Mining - Graders	Diesel	1.83E+02	6.73E+00	8.00E+00	1.34E+02	2.75E+01	4.08E+04	1.25E+01	1.99E+00	3.67E-01
San Joaquin Valley	2025	Construction and Mining - Misc - Asphalt Pavers	Gasoline	4.22E+01	1.84E+01	2.20E+01	1.54E+03	3.59E+01	2.25E+04	1.50E+00	1.14E+00	2.36E-01
San Joaquin Valley	2025	Construction and Mining - Misc - Bore/Drill Rigs	Gasoline	8.56E+01	1.90E+01	2.27E+01	1.24E+03	5.43E+01	5.36E+04	3.64E+00	2.75E+00	5.12E-01
San Joaquin Valley	2025	Construction and Mining - Misc - Concrete/Industrial Saws	Diesel	3.30E+01	5.30E+00	6.41E+00	8.56E+01	7.02E+01	1.40E+04	2.80E-01	2.57E-01	1.77E-01
San Joaquin Valley	2025	Construction and Mining - Misc - Concrete/Industrial Saws	Gasoline	4.63E+01	1.95E+01	2.33E+01	1.41E+03	4.00E+01	2.92E+04	1.96E+00	1.48E+00	3.07E-01
San Joaquin Valley	2025	Construction and Mining - Misc - Cranes	Gasoline	6.23E+01	1.55E+01	1.85E+01	1.17E+03	3.64E+01	2.50E+04	1.68E+00	1.27E+00	2.45E-01
San Joaquin Valley	2025	Construction and Mining - Misc - Dumpers/Tenders	Gasoline	8.62E+00	2.05E+01	2.46E+01	8.02E+02	1.61E+01	1.65E+03	9.20E+00	6.95E+00	4.28E-02
San Joaquin Valley	2025	Construction and Mining - Misc - Other	Gasoline	1.26E+02	1.60E+01	1.91E+01	1.48E+03	5.79E+01	4.73E+04	3.28E+00	2.48E+00	4.55E-01
San Joaquin Valley	2025	Construction and Mining - Misc - Other	Diesel	1.36E+01	4.63E+00	5.61E+00	2.75E+01	3.52E+01	4.92E+03	1.36E+00	1.25E+00	7.20E-02
San Joaquin Valley	2025	Construction and Mining - Misc - Paving Equipment	Gasoline	4.28E+01	1.60E+01	1.91E+01	1.20E+03	3.08E+01	2.06E+04	1.38E+00	1.04E+00	2.27E-01
San Joaquin Valley	2025	Construction and Mining - Misc - Plate Compactors	Gasoline	6.13E+00	2.15E+01	2.57E+01	7.49E+02	1.62E+01	1.54E+03	7.89E+00	5.96E+00	4.41E-02
San Joaquin Valley	2025	Construction and Mining - Misc - Plate Compactors	Diesel	8.00E+00	1.88E+00	2.28E+00	1.19E+01	1.43E+01	2.01E+03	5.57E-01	5.13E-01	3.05E-02
San Joaquin Valley	2025	Construction and Mining - Misc - Rollers	Gasoline	6.18E+01	2.31E+01	2.76E+01	1.91E+03	5.25E+01	3.07E+04	2.06E+00	1.56E+00	3.02E-01
San Joaquin Valley	2025	Construction and Mining - Misc - Rough Terrain Forklifts	Gasoline	8.43E+01	2.20E+01	2.63E+01	1.47E+03	5.94E+01	4.35E+04	2.94E+00	2.22E+00	4.11E-01
San Joaquin Valley	2025	Construction and Mining - Misc - Rubber Tired Loaders	Gasoline	6.78E+01	1.73E+01	2.07E+01	1.25E+03	4.43E+01	2.93E+04	1.98E+00	1.49E+00	2.79E-01
San Joaquin Valley	2025	Construction and Mining - Misc - Signal Boards	Diesel	6.07E+00	2.70E+00	3.27E+00	1.73E+01	2.05E+01	2.91E+03	7.96E-01	7.32E-01	4.39E-02
San Joaquin Valley	2025	Construction and Mining - Misc - Signal Boards	Gasoline	7.83E+00	3.30E+01	3.95E+01	1.47E+03	2.87E+01	2.73E+03	1.86E+01	1.41E+01	7.37E-02
San Joaquin Valley	2025	Construction and Mining - Misc - Skid Steer Loaders	Gasoline	5.00E+01	1.53E+01	1.83E+01	1.13E+03	3.21E+01	2.34E+04	1.57E+00	1.18E+00	2.41E-01
San Joaquin Valley	2025	Construction and Mining - Misc - Tampers/Rammers	Gasoline	4.21E+00	1.04E+01	1.24E+01	5.26E+02	9.55E+00	1.06E+03	7.51E+00	5.68E+00	3.99E-02
San Joaquin Valley	2025	Construction and Mining - Misc - Tractors/Loaders/Backhoes	Gasoline	6.30E+01	1.59E+01	1.90E+01	1.17E+03	4.44E+01	2.42E+04	1.63E+00	1.23E+00	2.26E-01
San Joaquin Valley	2025	Construction and Mining - Misc - Trenchers	Gasoline	3.90E+01	1.86E+01	2.23E+01	1.62E+03	3.47E+01	2.08E+04	1.39E+00	1.05E+00	2.23E-01
San Joaquin Valley	2025	Construction and Mining - Off-Highway Tractors	Diesel	1.27E+02	5.72E+00	6.81E+00	1.07E+02	4.37E+01	3.03E+04	5.83E-01	5.36E-01	2.73E-01
San Joaquin Valley	2025	Construction and Mining - Off-Highway Trucks	Diesel	4.08E+02	1.92E+01	2.28E+01	1.85E+02	1.42E+02	8.46E+04	4.21E+02	4.40E+01	7.60E-01
San Joaquin Valley	2025	Construction and Mining - Other	Diesel	1.81E+02	6.08E+00	7.24E+00	1.22E+02	4.66E+01	4.10E+04	7.57E-01	6.97E-01	3.69E-01
San Joaquin Valley	2025	Construction and Mining - Pavers	Diesel	1.36E+02	4.23E+00	5.03E+00	1.26E+02	3.27E+01	3.08E+04	5.46E-01	5.02E-01	2.77E-01
San Joaquin Valley	2025	Construction and Mining - Paving Equipment	Diesel	1.33E+02	3.98E+00	4.74E+00	1.03E+02	3.46E+01	2.58E+04	4.77E-01	4.39E-01	2.32E-01
San Joaquin Valley	2025	Construction and Mining - Rollers	Diesel	8.11E+01	2.71E+00	3.23E+00	8.87E+01	3.48E+01	1.69E+04	2.99E-01	2.75E-01	1.52E-01
San Joaquin Valley	2025	Construction and Mining - Rough Terrain Forklifts	Diesel	1.00E+02	3.18E+00	3.79E+00	1.25E+02	4.81E+01	2.20E+04	3.91E-01	3.60E-01	1.98E-01
San Joaquin Valley	2025	Construction and Mining - Rubber Tired Dozers	Diesel	2.18E+02	1.07E+01	1.27E+01	1.31E+02	4.02E+01	4.73E+04	1.34E+02	7.41E+01	4.25E-01
San Joaquin Valley	2025	Construction and Mining - Rubber Tired Loaders	Diesel	2.03E+02	8.11E+00	9.66E+00	1.22E+02	3.15E+01	3.99E+04	8.24E-01	7.58E-01	3.59E-01
San Joaquin Valley	2025	Construction and Mining - Scrapers	Diesel	3.67E+02	1.36E+01	1.62E+01	1.97E+02	5.34E+01	9.65E+04	1.73E+00	1.59E+00	8.68E-01
San Joaquin Valley	2025	Construction and Mining - Skid Steer Loaders	Diesel	6.60E+01	2.29E+00	2.72E+00	7.73E+01	3.75E+01	1.34E+04	2.44E-01	2.25E-01	1.21E-01
San Joaquin Valley	2025	Construction and Mining - Surfacing Equipment	Diesel	2.79E+02	5.02E+00	5.98E+00	1.06E+02	4.59E+01	4.58E+04	8.16E-01	7.51E-01	4.11E-01
San Joaquin Valley	2025	Construction and Mining - Tractors/Loaders/Backhoes	Diesel	9.76E+01	3.99E+00	4.74E+00	1.04E+02	4.20E+01	1.96E+04	4.17E-01	3.83E-01	1.76E-01
San Joaquin Valley	2025	Construction and Mining - Trenchers	Diesel	7.90E+01	4.04E+00	4.80E+00	9.12E+01	5.57E+01	2.25E+04	3.94E-01	3.62E-01	2.02E-01

EMISSION FACTORS ASSUMING 2015 OR NEWER EQUIPMENT FLEET

https://arb.ca.gov/emfac/emissions-inventory/1d6cf1a0d18800fbedf621f66e2c676b88c2f699

Global Warming Potentials

1	*25*	*298*
CO2	*CH4*	*N2O*

Source: IPCC AR4

Source: EMFAC2017 (v1.0.3) Emissions Inventory
Region Type: Air Basin
Region: San Joaquin Valley
Calendar Year: 2025
Season: Annual
Vehicle Classification: EMFAC2011 Categories
Units: miles/day for VMT, trips/day for Trips, tons/day for Emissions, 100 vmt-weighted aggregate

Region	Calendar Year	Vehicle Category	NOx_TOTEX (g/mi)	PM2.5_TOTA (g/mi)	PM10_TOTAI (g/mi)	CO2_TOTEX (g/mi)	CH4_TOTEX (g/mi)	N2O_TOTEX (g/mi)	ROG_TOTAL (g/mi)	TOG_TOTAL (g/mi)	CO_TOTEX (g/mi)	SOx_TOTEX (g/mi)
SAN JOAQUIN VALLEY	2025	LDA	2.95E-02	4.14E-02	1.35E-01	2.29E+02	4.45E-03	5.39E-03	3.56E-02	3.82E-02	6.09E-01	2.26E-03
SAN JOAQUIN VALLEY	2025	LDT1	3.16E-02	4.15E-02	1.35E-01	2.68E+02	4.79E-03	5.41E-03	4.28E-02	4.56E-02	6.35E-01	2.65E-03
SAN JOAQUIN VALLEY	2025	LDT2	3.47E-02	4.15E-02	1.35E-01	2.74E+02	6.17E-03	6.09E-03	5.10E-02	5.47E-02	7.25E-01	2.71E-03
SAN JOAQUIN VALLEY	2025	T6 instate construction heavy	2.05E+00	8.83E-02	2.39E-01	1.10E+03	6.75E-04	1.73E-01	1.45E-02	1.66E-02	2.00E-01	1.04E-02
SAN JOAQUIN VALLEY	2025	T6 instate construction small	2.22E+00	8.87E-02	2.39E-01	1.13E+03	7.04E-04	1.77E-01	1.52E-02	1.73E-02	2.16E-01	1.06E-02
Los Angeles (SC)	2025	Workers	3.07E-02	4.14E-02	1.35E-01	2.40E+02	4.83E-03	5.54E-03	3.92E-02	4.20E-02	6.34E-01	2.38E-03
Los Angeles (SC)	2025	Hauling/Delivery	2.18E+00	8.86E-02	2.39E-01	1.12E+03	6.97E-04	1.76E-01	1.50E-02	1.71E-02	2.12E-01	1.06E-02

"Workers" category includes the vmt-aggregated factors of the LDA, LDT1, and LDT2 vehicle categories.
"Hauling/Delivery" category includes the vmt-aggregated factors of the T6 instate construction * vehicle categories.

Appendix J
Greenhouse Gas Emissions Technical Appendix

Appendix J Greenhouse Gas Emissions Technical Appendix

This appendix documents the greenhouse gas (GHG) emissions technical analysis to support the impact analysis in the Environmental Assessment/Initial Study (EA/IS) and describes the potential greenhouse gas emissions that could result from the implementation of the No Action/No Project Alternative (subsequently identified as the No Action Alternative) and the Proposed Action/Proposed Project (subsequently identified as the Proposed Action) considered by the EA/IS.

J.1 Existing Conditions

GHGs—carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride, hydrofluorocarbons, and perfluorocarbons—are emitted from human activities and natural systems into the atmosphere and trap heat that would otherwise be released into space. Thermal radiation absorbed by GHGs is reradiated in all directions, including back toward the Earth's surface. This results in an increase of the Earth's surface temperatures above what they would be without the presence of GHGs, which are persistent and remain in the atmosphere for long periods. GHGs differ from criteria pollutants in that GHG emissions do not cause direct adverse human health effects. Rather, the direct environmental effect of GHG emissions is the increase in global temperatures, which in turn has numerous indirect effects on the environment and humans.

Most CO_2 emissions from human activities, known as anthropogenic emissions, are attributed to the burning of fossil fuels for electricity, heat, and transportation and land use changes such as deforestation. Scientific research shows that global GHG emissions from anthropogenic sources have grown since preindustrial times, and continue to grow, with 78 percent of global CO_2 emissions between 1970 and 2010 from fuel combustion and industrial processes (Intergovernmental Panel on Climate Change [IPCC] 2014). In 2020, global average atmospheric concentrations of CO_2 reached 413 parts per million (ppm), atmospheric concentrations of CH_4 reached 1,889 parts per billion (ppb), and atmospheric concentrations of N_2O reached 333 ppb, respectively 149 percent, 262 percent, and 123 percent of preindustrial (1750) levels (World Meteorological Organization [WMO] 2021). These levels are nearly twice the natural range over the last 800,000 years as measured in ice core samples (WMO 2019).

If left unchecked, by the end of the century CO_2 concentrations could reach levels three times higher than preindustrial times, leading to climate change that threatens public health, the economy, and the environment. Efforts are underway globally to both mitigate GHG emissions to reduce further climate change and to adapt to the unavoidable changes in climate that will result from past and future GHG emissions. However, recent studies show that global GHG emissions continue to rise (U.S. Global Change Research Program 2014).

J.2 Assessment Methodology

J.2.1 Construction

Construction emissions are described as temporary or "short-term" in duration. These temporary and short-term emissions have the potential to represent a significant impact to GHG emissions and climate change. The predominant GHG emission source from construction activities is vehicle exhaust from on- and off-road vehicle fuel combustion.

The emissions estimation method (i.e., specific emission calculation equations and sources) incorporates data sourced from project specific equipment lists, equipment activities, phasing, material quantities, and worker counts, in addition to typical construction parameters from the California Air Pollution Control Officers Association (CAPCOA) California Emission Estimator Model (CalEEMod) version 2022.1, and emission factors from the California Air Resources Board (CARB)'s EMFAC2017 and OFFROAD2021 models (CAPCOA 2022; California Air Resources Board [CARB] 2022a, 2022b; Bureau of Reclamation [Reclamation] 2022). Although a more recent version of the EMFAC model, EMFAC2021, has been developed by CARB, that model has not yet been approved by the United States Environmental Protection Agency (USEPA) for use in regulatory purposes and was not used in this assessment. In the estimation of construction equipment GHG emission factors, only equipment of model year 2015 or newer, representative of USEPA Tier 4 final engine standard equipment, were considered. Hauling and delivery vehicles were also assumed to be of model year 2015 or newer.

Task-specific construction equipment, personnel, haul and excavation quantities, and scheduling information was derived from Reclamation's *Delta-Mendota Canal Subsidence Project: Feasibility Study of the Structural Alternatives* (*Feasibility Study of the Structural Alternatives*), completed in 2021. It was assumed that 50 percent of necessary backfill material would be reused from materials excavated on-site. Haul trucks were assumed to be at least 10 cubic yards (CY) in capacity for all construction. Vendor delivery trip counts, if not provided in *Feasibility Study of the Structural Alternatives* for a given element of action construction, were estimated based on the estimated typical square-footage of the construction element and default vendor delivery rates from CalEEMod. Haul route, worker commute, and vendor delivery distances were based on default regional values from the CalEEMod.

The OFFROAD2021 model does not estimate emissions of CH_4 and N_2O; therefore, it was necessary to estimate these emissions separately. Emission factors for Construction/Mining Equipment in Table 5 from the USEPA's 2022 emission factors hub release was used to estimate these emissions (USEPA 2022).

Each GHG contributes to climate change differently, as expressed by its global warming potential (GWP). GHG emissions are discussed in terms of CO_2 equivalent (CO_2e) emissions, which express, for a given mixture of GHG, the amount of CO_2 that would have the same GWP over a specific timescale. CO_2e is determined by multiplying the mass of each GHG by its GWP.

This analysis uses the GWP from the IPCC Fourth Assessment Report (IPCC 2007) for a 100-year time period to estimate CO_2e. This approach is consistent with the federal GHG Reporting Rule (40 Code of Federal Regulations [CFR] 98), as effective on January 1, 2014 (78 FR 71904) and California's 2000-2019 GHG Inventory Trends Report (CARB 2021). The GWPs used in this analysis are 25 for CH_4 and 298 for N_2O.

Detailed construction emission calculations are provided in Appendix I2.

J.2.2 Operation

While the Proposed Action would modify the structure of the existing canal, these modifications would not be expected to result an operational change to GHG emissions relative to the existing, or future no action, conditions. Therefore, emissions of GHG potentially attributable to canal operation were not quantified.

J.3 Significance Criteria

The thresholds of significance for impacts address the environmental checklist items from Appendix G of the State California Environmental Quality Act (CEQA) Guidelines as well as federal GHG requirements. The Proposed Action would result in a significant impact with respect to GHGs if they would either:

1. Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment.
2. Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the GHG emissions.

The environmental checklist from Appendix G of the State CEQA Guidelines indicates that a project would result in a significant impact on air quality if it would (1) generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment; or (2) conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the GHG emissions.

The San Joaquin Valley Air Pollution Control District (SJVAPCD) and Bay Area Air Quality Management District (BAAQMD) each publish guidance to assist lead agencies with uniform procedures for addressing air quality and GHG impacts in applicable environmental documents within their respective air basins. However, neither agency has promulgated specific quantitative criteria for project-level GHG emissions increases above which a project would result in a significant impact on the environment (BAAQMD 2017; SJVAPCD 2015). SJVAPCD has recommended a tiered approach for assessing the project-level significance of stationary source projects relative to a project's compliance with an applicable GHG mitigation program, implementation of best performance standards (BPS), or GHG emission performance criterion of 29 percent reduction relative to a business-as-usual baseline. However, because the Proposed Action would not involve the installation of new stationary sources or emission sources to which BPS could be applicable, this threshold is not inappropriate for the Delta-Mendota Canal (DMC) Subsidence Correction Project.

No quantitative threshold has been promulgated by an applicable agency that would be perfectly aligned to extraordinary maintenance activities such as those of the Proposed Action. However, the South Coast Air Quality Management District (SCAQMD), which has jurisdiction over the South Coast Air Basin, a region with comparable air quality to that of the San Joaquin Valley Air Basin, has adopted a quantitative significance criterion of 10,000 metric tons CO_2e ($MTCO_2e$) per year for project operations (SCAQMD 2008). Since GHG are an inherently cumulative impact, SCAQMD stipulates that construction GHG emissions be amortized over the presumed project lifetime and added to annual operational emissions for comparison against this criterion. A conservative project lifetime of 30 years is recommended by SCAMQD. The SCAQMD considers this threshold to be adequate to capture GHG emissions increases above which could hinder implementation of the

State's GHG reduction goals, including Assembly Bill (AB) 32. Because of the inclusion of construction-related emissions in this quantitative threshold and the relationship with complying with AB 32, the SCAQMD's method of quantifying emissions and the associated significance threshold was used in this analysis.

The significance criterion of 10,000 $MTCO_2e$ increase is based on the difference between the presumed GHG emissions of the Proposed Action and a presumed baseline. For the purposes of this analysis, as explained earlier, implementation of the Proposed Action would result in no change to GHG emissions from canal operations relative to the existing conditions or future no action (No Action Alternative) conditions. Similarly, no project-related construction GHG emissions would be assumed under the existing conditions or future no action (No Action Alternative) conditions. Therefore, the amortized construction GHG emissions were compared against a baseline of zero GHG emissions for the determination of significance relative to both the National Environmental Policy Act and CEQA requirements.

J.4 Plan Consistency

The Proposed Action was compared to various plans, policies, and regulations that were enacted to reduce GHG emissions. If it is found to be consistent with the applicable plans, then impacts associated with construction and operation would be less than significant for the second criterion related to GHG impacts.

J.4.1 Initial Scoping Plan

The Proposed Action was compared to the AB 32 Initial Scoping Plan (CARB 2008) for consistency. The initial scoping plan contains a variety of strategies that were designed to reduce the state's GHG emissions. Table J-1 summarizes the 18 strategies contained in the initial scoping plan and the Proposed Action were evaluated for consistency.

Table J-1. Initial Scoping Plan Measures Consistency Analysis

Emission Reduction Measure	Project Consistency
1. California Cap-and-Trade Program Linked to Western Climate Initiative Partner Jurisdictions. Implement a broad-based California cap-and-trade program to provide a firm limit on emissions. Link the California cap–and-trade program with other Western Climate Initiative Partner programs to create a regional market system to achieve greater environmental and economic benefits for California. Ensure California's program meets all applicable AB 32 requirements for market-based mechanisms.	**Not Applicable.** The Project is not a part of an industry that is required to comply with the cap-and-trade regulations.
2. California Light-Duty Vehicle GHG Standards. Implement adopted Pavley standards and planned second phase of the program. Align zero-emission vehicle, alternative and renewable fuel and vehicle technology programs with long-term climate change goals.	**Not Applicable.** This is a statewide measure that is not implemented by a Project proponent.

Emission Reduction Measure	Project Consistency
3. Energy Efficiency. Maximize energy efficiency building and appliance standards, and pursue additional efficiency efforts including new technologies, and new policy and implementation mechanisms. Pursue comparable investment in energy efficiency from all retail providers of electricity in California (including both investor-owned and publicly owned utilities).	**Not Applicable.** No new buildings would be built under the Proposed Action.
4. Renewables Portfolio Standard. Achieve 33 percent renewable energy mix statewide.	**Not Applicable.** This is a statewide measure that is not implemented by a project proponent.
5. Low Carbon Fuel Standard. Develop and adopt the Low Carbon Fuel Standard.	**Not Applicable.** This is a statewide measure that is not implemented by a project proponent.
6. Regional Transportation-Related GHG Targets. Develop regional GHG emissions reduction targets for passenger vehicles.	**Not Applicable.** The regional transportation plans developed for the Bay Area contain provisions required under Senate Bill 375 to reduce GHG emissions from vehicle miles traveled. The regional transportation plans do not have any requirements that apply to the Proposed Action.
7. Vehicle Efficiency Measures. Implement light-duty vehicle efficiency measures.	**Not Applicable.** This is a statewide measure that is not implemented by a project proponent.
8. Goods Movement. Implement adopted regulations for the use of shore power for ships at berth. Improve efficiency in goods movement activities.	**Not Applicable.** The Project does not propose any changes to goods movement from trucks, ports, and other related facilities.
9. Million Solar Roofs Program. Install 3,000 megawatts of solar-electric capacity under California's existing solar programs.	**Not Applicable.** The Project does not impede the ability of the state to install additional solar roofs.
10. Medium/Heavy-Duty Vehicles. Adopt medium and heavy-duty vehicle efficiency measures.	**Not Applicable.** This is a statewide measure that is not implemented by a project proponent.
11. Industrial Emissions. Require assessment of large industrial sources to determine whether individual sources within a facility can cost-effectively reduce GHG emissions and provide other pollution reduction benefits. Reduce GHG emissions from fugitive emissions from oil and gas extraction and gas transmission. Adopt and implement regulations to control fugitive methane emissions and reduce flaring at refineries.	**Not Applicable.** This measure only applies to major industrial facilities emitting more than 500,000 $MTCO_2e$ per year.
12. High-Speed Rail. Support implementation of a high-speed rail system.	**Not Applicable.** This is a statewide measure that is not implemented by a project proponent.

Emission Reduction Measure	Project Consistency
13. Green Building Strategy. Expand the use of green building practices to reduce the carbon footprint of California's new and existing inventory of buildings.	**Not Applicable.** No new buildings will be built under the Proposed Action.
14. High Global Warming Potential Gases. Adopt measure to reduce high global warming potential gases.	**Not Applicable.** This Project does not include air conditioning or refrigeration.
15. Recycling and Waste. Reduce methane emissions at landfills. Increase waste diversion, composting and other beneficial uses of organic materials, and mandate commercial recycling. Move toward zero-waste.	**Not Applicable.** Project operations would not result in the generation of waste.
16. Sustainable Forests. Preserve forest sequestration and encourage the use of forest biomass for sustainable energy generation.	**Not Applicable.** The Proposed Action would not be in forested areas or areas zoned as forestland.
17. Water. Continue efficiency programs and use cleaner energy sources to move and treat water.	**Consistent**. Operation of the Proposed Action would be consistent with energy efficiency and clean power requirements established by the state and local municipalities.
18. Agriculture. In the near-term, encourage investment in manure digesters and at the five-year Scoping Plan update determine if the program should be made mandatory by 2020.	**Not Applicable.** The Project site is not designated or in use for agricultural purposes.

Source: CARB 2008
Key: AB = Assembly Bill; GHG = greenhouse gas; $MTCO_2e$ = metric tons carbon dioxide equivalent

J.4.2 Climate Change Scoping Plan Update

California's 2017 Climate Change Scoping Plan (CARB 2017) contains various emission reduction strategies to help the state to meet the goals of Executive Order B-30-15 and Senate Bill (SB) 32 to achieve a 2030 goal of reducing GHG emissions 40 percent below 2020 levels. The updated scoping plan contains various emission reduction measures that are specific to the water sector. Table J-2 summarizes the various measures and evaluates if the Proposed Action would be consistent.

Table J-2. 2017 Updated Scoping Plan Measures Consistency Analysis

Emission Reduction Measure	Project Consistency
1. As directed by Governor Brown's Executive Order B-37-16, California Department of Water Resources (DWR) and State Water Resource Control Board (SWRCB) will develop and implement new water use targets to generate more statewide water conservation than existing targets (the existing state law requires a 20 percent reduction in urban per capita water use by 2020 [SBx7-7, Steinberg, Chapter 4, Statutes of 2009]). The new water use targets will be based on strengthened standards for indoor use, outdoor irrigation, commercial, industrial, and institutional water use.	**Not Applicable.** The Proposed Action would not impede DWR's and SWRCB's ability to implement statewide water conservation targets.

Emission Reduction Measure	Project Consistency
2. SWRCB will develop long-term water conservation regulation, and permanently prohibit practices that waste potable water.	**Not Applicable.** The Proposed Action would not impede SWRCB's ability to implement its recommendations to use water more wisely.
3. DWR and SWRCB will develop and implement actions to minimize water system leaks, and to set performance standards for water loss, as required by SB 555 (Wolk, Chapter 679, Statutes of 2015).	**Not Applicable.** The measure is only applicable to urban retail water suppliers.
4. DWR and California Department of Food and Agriculture (CDFA) will update existing requirements for agricultural water management plans to increase water system efficiency.	**Not Applicable.** The Proposed Action would not impede DWR's and CDFA's ability to increase agricultural water system efficiency.
5. California Energy Commission (CEC) will certify innovative technologies for water conservation and water loss detection and control.	**Not Applicable.** The measure is only applicable at utility, household, and appliance levels.
6. CEC will continue to update the state's Appliance Efficiency Regulations (California Code of Regulations, Title 20, Sections 1601–1608) for appliances offered for sale in California to establish standards that reduce energy consumption for devices that use electricity, gas, and/or water.	**Not Applicable.** The Proposed Action would not involve operation of appliances subject to the emission reduction measure.
7. CalEPA will oversee development of a voluntary registry for GHG emissions resulting from the water-energy nexus, as required by SB 1425 (Pavley, Chapter 596, Statutes of 2016).	**Not Applicable.** The Proposed Action would not impede the state's ability to develop a GHG emission registry.
8. The State Water Project (SWP) has entered long-term contracts to procure renewable electricity from 140 MW solar installations in California.	**Not Applicable.** The Proposed Action would not interfere with the ability of the SWP to procure renewable electricity.
9. As described in its Climate Action Plan, DWR will continue to increase the use of renewable energy to operate the SWP.	**Not Applicable.** The Proposed Action would not interfere with the ability of DWR to increase its renewable energy use.

Source: CARB 2017
Key: CalEPA = California Environmental Protection Agency; CDFA = California Department of Food and Agriculture; CEC = California Energy Commission; DWR = Department of Water Resources; GHG = greenhouse gas; MW = megawatt; SB = Senate Bill; SWP = State Water Project; SWRCB = State Water Resources Control Board

J.5 Project Impacts and Mitigation Measures

J.5.1 No Action Alternative

Impact GHG-1: Would the alternative generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment?

Under the No Action Alternative, no action would be taken to restore, or otherwise offset, conveyance capacity lost in the DMC. As such, no construction-related GHG emissions would occur. Future changes in operation would likely occur to compensate for the effects of any future land subsidence on the capacity of the DMC. However, these changes would not be expected to result in substantial increases to the coverage or frequency of stagnant or atrophic conditions which might result in operational GHG emissions. **Therefore, the No Action Alternative would have no impact to GHG emissions.**

Impact GHG-2: Would the alternative conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing GHG emissions?

Because no actions would be taken under the No Action Alternative and potential future operational changes would not be expected to meaningfully change operational GHG emissions, there would be no Project-related change to GHG emissions relative to existing conditions, and this alternative would not conflict with an applicable plan, policy, or regulation adopted to reduce GHG emissions. **Therefore, this alternative would have no impacts.**

J.5.2 Raise Deficient Structures Alternative (Proposed Action)

J.5.2.1 Impact GHG-1: Would the alternative generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment?

Under the Proposed Action, construction would last for approximately seven and a half years, with the time spent at various locations along the canal. As discussed previously, construction of new facilities that would result in permanent, operational GHG emissions are not proposed under the Proposed Action, therefore GHG emissions from operation of the DMC would be unchanged relative to existing or future no action (No Action Alternative) conditions. As shown in Table J-3, construction activities along the canal would generate GHG emissions throughout the construction period. Detailed GHG emission summaries and calculations are presented in Appendix I2.

Table J-3. Total GHG Emissions from the Construction of the Proposed Action

Construction	Construction GHG Emissions	Significance Criteria	Exceeds Criteria?
Proposed Action	10,188 total $MTCO_2e$[1,2]	n/a	n/a
Amortized Over 30 Years	340 $MTCO_2e$ per year[1]	10,000 $MTCO_2e$ per year	no

Source: CDM Smith 2022

Notes:

[1] CO_2e emissions are estimated from emissions of CO_2, CH_4, and N_2O using IPCC AR4 GWP of 1, 25, and 298 respectively.

[2] The presented value represents the total GHGs emitted over the construction period including exhaust from equipment used during all elements of Project construction, exhaust from hauling and delivery vehicle trips, and exhaust from worker commute vehicles.

Key: GHG = greenhouse gas; $MTCO_2e$ = metric tons CO_2 equivalent; n/a = not applicable

As presented above, GHG emissions from construction activities would total 10,188 $MTCO_2e$ over the entire construction period. Consistent with SCAQMD guidance, when amortized over a presumed Project lifetime of 30 years, this would result in an annual contribution of 340 $MTCO_2e$ per year from construction. Since the change to GHG emissions from DMC operations would be zero, the amortized construction emissions alone were compared against, and do not exceed, the 10,000 $MTCO_2e$ per year significance criteria. **Therefore, environmental impacts from GHG emissions from the Proposed Action would be less than significant.**

Impact GHG-2: Would the alternative conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing GHG emissions?

A consistency analysis, presented in Section J.4, was completed to evaluate whether the Proposed Action would conflict with an applicable plan, policy, or regulation adopted to reduce GHG emissions. The Proposed Action would not conflict with CARB's AB 32 Initial Scoping Plan and Climate Change Scoping Plan Update. **Impacts would therefore be less than significant.**

J.5.3 Mitigation Measures

No mitigation measures would be necessary to reduce the impacts of the Proposed Action to a less than significant level.

J.6 References

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Appendix K
Noise and Vibration Calculations

Construction Noise - Traffic
Proposed Action

Table 1. Construction Vehicles - Equivalent Noise Levels

Type	Roadway	No Action Alternative (2026) AADT	Maximum Daily Truck Hauling Trips	Maximum Daily Worker Trips	Speed (mph)	Equivalency Factor for Heavy-Duty Vehicles	Equivalent Vehicles	Total With Project	Increase Ratio
Fresno County									
State Route	SR-33 (south of DMC)	13,500	112	147	55	10.4	1,312	14,812	1.10
State Route	SR-33 (north of DMC)	2,700	112	147	55	10.4	1,312	4,012	1.49
Merced County									
State Route	SR-165 (south of DMC)	1,400	35	80	55	10.4	444	1,844	1.32
State Route	SR-165 (north of DMC)	1,600	35	80	55	10.4	444	2,044	1.28
State Route	SR-152 (east of DMC)	28,000	35	80	55	10.4	444	28,444	1.02
State Route	SR-152 (west of DMC)	23,800	35	80	55	10.4	444	24,244	1.02
State Route	SR-33 (south of DMC)	11,700	35	80	55	10.4	444	12,144	1.04
State Route	SR-33 (north of DMC)	12,200	35	80	55	10.4	444	12,644	1.04
Interstate	I-5 at SR-152	39,500	70	162	55	10.4	890	40,390	1.02
Stanislaus County									
Interstate	I-5 at SR-130	50,100	105	242	55	10.4	1,334	51,434	1.03
San Joaquin County									
State Route	SR-132 (east of DMC)	14,600	26	80	55	10.4	350.4	14,950	1.02
State Route	SR-132 (west of DMC)	17,600	26	80	55	10.4	350.4	17,950	1.02
Interstate	I-5 (north of DMC)	32,500	26	80	55	10.4	350.4	32,850	1.01
Interstate	I-5 (south of DMC)	31,600	26	80	55	10.4	350.4	31,950	1.01
Interstate	I-205 (west of DMC)	135,700	26	80	55	10.4	350.4	136,050	1.00
Interstate	I-205 (east of DMC)	109,800	26	80	55	10.4	350.4	110,150	1.00
Alameda County									
Interstate	I-580 west of I-205/I-580 split	151,500	26	80	55	10.4	350	151,850	1.00

Note:
Impacts would be significant if equivalent traffic volume increases by nine times (10 dBA increase).

Maximum **1.49**
Significant? **No**

Doubling of the noise source produces only a 3 dB increase, which is a barely perceptible change; therefore, there would be no audible change in traffic noise.
FHWA. 2011. Highway Traffic Noise: Analysis and Abatement Guidance.

Table 2. Number of Equivalent Vehicles as a Function of Vehicle Type and Speed Based on TNM Reference Energy Mean Emission Levels

Speed (km/h [mph])		Equivalent Vehicles		
		1 Heavy Truck	1 Medium Truck	1 Auto
56	(35)	19.1	7.1	1
64	(40)	15.1	5.8	1
72	(45)	12.9	5	1
80	(50)	11.5	4.5	1
88.5	(55)	10.4	4.1	1
97	(60)	9.6	3.7	1
105	(65)	7.9	3.5	1
113	(70)	8.3	3.2	1

Source: Caltrans. 2009. Technical Noise Supplement. Prepared by ICF Jones & Stokes. November.

Construction Vibration - Equipment
Proposed Action

Table 3. Construction Vibration

				At Source	Residence off Canyon Road
			Distance (ft):	25	93
Phase	Equipment Description	Equivalent Equipment Types	Number of Equipment	PPV (in/sec)	PPV (in/sec)
Canal Lining and Embankment Raises	Small dozer	Small bulldozer	1	0.003	0.000418
	Front End loader	Large Bulldozer	1	0.089	0.012404
	Small Excavator	Small bulldozer	1	0.003	0.000418
	End Dumps	Loaded Trucks	2	0.152	0.021185
	Front End loader	Large Bulldozer	1	0.089	0.012404
	Compacter with blade	Large Bulldozer	1	0.089	0.012404
	Pickup Trucks	Loaded Trucks	7	0.532	0.074148
	Skid Steer	Small bulldozer	1	0.003	0.000418
Canal Lining and Embankment Raises Total				**N/A**	**0.133800**

				At Source	Residence off W Nees Ave
			Distance (ft):	25	350
Phase	Equipment Description	Equivalent Equipment Types	Number of Equipment	PPV (in/sec)	PPV (in/sec)
Stabilize Canal Banks Along Earth-lined Segment	Small Dozer	Small bulldozer	2	0.006	0.000115
	Front End loader	Loaded Trucks	5	0.380	0.007254
	Dump Truck	Loaded Trucks	9	0.684	0.013058
	Small Excavator	Small bulldozer	1	0.003	0.000057
	4-foot rollers compactor with blade	Vibratory Roller	2	0.420	0.008018
	Medium Excavator with Vibratory Plate Compactor	Vibratory Roller	1	0.210	0.004009
	Road Grader	Large Bulldozer	1	0.089	0.001699
Stabilize Canal Banks Along Earth-lined Segment Total				**N/A**	**0.034209**

				At Source	Residence off Dirt Road
			Distance (ft):	25	515
Phase	Equipment Description	Equivalent Equipment Types	Number of Equipment	PPV (in/sec)	PPV (in/sec)
Concrete Lining Repairs	Excavator	Large Bulldozer	1	0.089	0.000952
	Dump Truck	Loaded Trucks	2	0.152	0.001626
	Skid Steer	Small bulldozer	1	0.003	0.000032
Concrete Lining Repairs Total				**N/A**	**0.002610**

				At Source	Residence off S Lammers Road
			Distance (ft):	25	145
Phase	Equipment Description	Equivalent Equipment Types	Number of Equipment	PPV (in/sec)	PPV (in/sec)
Replace Impacted Vehicle Bridges	Service Truck	Loaded Trucks	1	0.076	0.005441
	Crane	Large Bulldozer	2	0.178	0.012743
	Sawcut	n/a	1	n/a	n/a
	Dozer	Small bulldozer	1	0.003	0.000215
	End Dumps	Loaded Trucks	6	0.456	0.032645
	Compactor	Vibratory Roller	1	0.210	0.015034
	Excavator	Large Bulldozer	1	0.089	0.006372
	Tractor	Large Bulldozer	1	0.089	0.006372
	Drill Rig	Pile Driver (impact)	1	0.644	0.046105
	Skid Steer	Large Bulldozer	1	0.089	0.006372
	Trucks	Loaded Trucks	4	0.304	0.021764
	Snooper Truck	Large Bulldozer	1	0.089	0.006372
	Paver	Vibratory Roller	1	0.210	0.015034
Replace Impacted Vehicle Bridges Total				**N/A**	**0.174467**

				At Source	Residence off N Oxford Ave
			Distance (ft):	25	227
Phase	Equipment Description	Equivalent Equipment Types	Number of Equipment	PPV (in/sec)	PPV (in/sec)
Replace Impacted Pipeline Crossings	Small Excavator	Small bulldozer	1	0.003	0.000110
	Skid Steer	Large Bulldozer	1	0.089	0.003253
	Crane	Large Bulldozer	1	0.089	0.003253
	Front end Loader	Loaded Trucks	1	0.076	0.002778
	Dump Trucks	Loaded Trucks	2	0.152	0.005555
Replace Impacted Pipeline Crossings Total				**N/A**	**0.014948**

				At Source	Residence off Moranga Road
			Distance (ft):	25	273
Phase	Equipment Description	Equivalent Equipment Types	Number of Equipment	PPV (in/sec)	PPV (in/sec)
Modifications to Check Structures and Wasteways	Crane	Large Bulldozer	2	0.178	0.004933
	Aerial Lifts	Large Bulldozer	3	0.267	0.007399
Modifications to Check Structures and Wasteways Total				**N/A**	**0.012332**

				At Source	Residence off Gravel Pit Road
			Distance (ft):	25	178
Phase	Equipment Description	Equivalent Equipment Types	Number of Equipment	PPV (in/sec)	PPV (in/sec)
Modifications to Turnouts	Service Truck	Loaded Trucks	2	0.152	0.008001
	Crane	Large Bulldozer	2	0.178	0.009369
	Skid Steer	Large Bulldozer	1	0.089	0.004685
Modifications to Turnouts Total				**N/A**	**0.022054**

				At Source	Residence off West Side Freeway
			Distance (ft):	25	174
Phase	Equipment Description	Equivalent Equipment Types	Number of Equipment	PPV (in/sec)	PPV (in/sec)
Modifications to Drainage Structures	Excavator	Large Bulldozer	2	0.178	0.009694
	Skid Steer	Large Bulldozer	2	0.178	0.009694
	Dump Truck	Loaded Trucks	1	0.076	0.004139
Modifications to Drainage Structures Total				**N/A**	**0.023527**

Significance Threshold

0.3 in/sec

Table 4. Construction Vibration Summary Table

Construction Component	Maximum PPV (in/sec)
Canal Lining and Embankment Raises	0.133800
Stabilize Canal Banks Along Earth-lined Segment	0.034209
Concrete Lining Repairs	0.002610
Replace Impacted Vehicle Bridges	0.174467
Replace Impacted Pipeline Crossings	0.014948
Modifications to Check Structures and Wasteways	0.012332
Modifications to Turnouts	0.022054
Modifications to Drainage Structures	0.023527

Significance Threshold

0.3 in/sec

Table 5. Vibration Source Levels for Construction Equipment

Equipment	PPV at 25 ft (in/sec)	Approximate Lv† at 25 ft
Pile Driver (impact)	0.644	104
Pile Driver (sonic)	0.17	93
Clam shovel drop (slurry wall)	0.202	94
Hydromill (slurry wall) - in soil	0.008	66
Hydromill (slurry wall) - in rock	0.017	75
Vibratory Roller	0.21	94
Hoe Ram	0.089	87
Large Bulldozer	0.089	87
Caisson Drilling	0.089	87
Loaded Trucks	0.076	86
Jackhammer	0.035	79
Small bulldozer	0.003	58

Source: Federal Transit Administration. 2006. Transit Noise and Vibration Impact Assessment. FTA-VA-90-1003-06. May.
Note:
Values for pile drivers are based on the typical vibration source levels.
† RMS velocity in decibels (VdB) re 1 micro-inch/second

Appendix L
Traffic and Transportation
Technical Appendix

Appendix L Traffic and Transportation Technical Appendix

This appendix documents the traffic and transportation technical analysis to support the impact analysis in the Environmental Assessment/Initial Study (EA/IS) and describes the traffic and transportation operations that could be potentially affected by the implementation of the No Action/No Project Alternative (subsequently identified as the No Action Alternative) and the Proposed Action/Proposed Project (subsequently identified as the Proposed Action) considered by the EA/IS. Effects on traffic and transportation operations resulting from the construction and operation associated with the Proposed Action may occur in the San Joaquin Valley region alongside the Delta-Mendota Canal (DMC). The appendix provides detailed information about traffic flow assessment methods, trip generation, and roadway operations under the Proposed Action.

L.1 Existing Conditions

A performance measure called "Level of Service" (LOS) is used to characterize traffic operating conditions of a circulation element. Progressively worsening traffic operating conditions are given the letter grades "A" through "F." Table L-1 summarizes the traffic operating conditions associated with each LOS designation.

Table L-1. Level of Service Characteristics

LOS	Traffic Condition
A	Free flow conditions; Low volumes; high operating speeds; uninterrupted flow; no restriction on maneuverability; drivers maintain desired speeds; little or no delays.
B	Stable flow conditions; operating speeds beginning to be restricted.
C	Stable flow but speed and maneuverability restricted by higher traffic volumes; satisfactory operating speed for urban conditions; delays at signals.
D	Approaching unstable flow; low speeds; major delays at signals; little freedom to maneuver.
E	Lower operating speeds; volume at or near capacity; unstable flow; major delays and stoppages.
F	Forced flow conditions; low speeds; volumes below capacity, may be zero; stoppages for long periods because of downstream congestion.

Source: Transportation Research Board 2016

Key: LOS = level of service

Traffic analysis in the state of California is guided by standards set at the state level by the California Department of Transportation (Caltrans), and by local jurisdictions. State highways fall under the jurisdiction of Caltrans. Other roadways fall under the local jurisdiction, either city or county, in which they are located.

The locations selected for analysis are all regional routes, including state routes and interstate highways. Therefore, Caltrans' standard regarding the desired performance level of traffic conditions on roadways is referenced. Caltrans' *Guide for the Preparation of Traffic Impact Studies* (California Department of Transportation [Caltrans] 2002) mentions that Caltrans endeavors to maintain a target LOS at the transition between LOS "C" and LOS "D" on State highway facilities. However, Caltrans acknowledges that this may not always be feasible and recommends that the lead agency consult with Caltrans to determine the appropriate target LOS. Therefore, LOS D is considered to be the applicable standard in this analysis, and a change in LOS from D to E would be considered a Project impact. It is also stated in Caltrans' *Highway Design Manual* (Caltrans 2020) that the target LOS is E for urban areas and D for rural areas. Since the DMC crossings within the Project limits are mostly in rural area, LOS D is identified as the appropriate significance threshold for this analysis.

Table L-2 provides LOS criteria (thresholds) for Merced County roadways for identifying daily LOS. Because LOS criteria are not available or applicable from the general plan documents of other counties, the generalized LOS volumes from *Highway Capacity Manual* (HCM), Sixth Edition was used for identifying daily LOS. Table L-3 through Table L-6 shows the LOS criteria for relevant roadway types. The Highway Capacity Software, version 7.9.6, which is based on the HCM methodology, was used to identify LOS for the study roadway segments in the a.m. and p.m. peak hours.

Table L-2. Level of Service Criteria for Roadways – Merced County

#	Area	Facility	Interchanges	Intersections	Flow	Lanes	Median	Level of Service (Average Annual Daily Traffic)				
								A	B	C	D	E
1	Urban	Freeway	< 2 miles apart	-	-	4	N/A	22,000	36,000	52,000	67,000	76,500
2	Urban	Expressway	-	-	-	4	Divided	-	-	21,400	31,100	32,900
3	Urban	Highway	-	-	Uninterrupted	2	Undivided	2,000	7,000	13,800	19,600	27,000
4	Urban	Highway	-	< 2/mile	-	2	Undivided	-	4,200	13,800	16,400	16,900
5	Urban	Highway	-	< 4.5/mile	-	2	Undivided	-	1,900	11,200	15,400	16,300
6	Urban	Collector	-	-	-	2	Undivided	-	-	4,800	10,000	12,600
7	Urban	Highway	-	< 4.5/mile	-	4	Undivided	-	3,500	23,200	29,100	30,600
8	Urban	Arterial	-	-	-	4	Undivided	-	-	15,600	27,800	29,400
9	Urban	Highway	-	< 2/mile	-	4	Undivided	3,500	20,900	24,600	25,700	-
10	Urban	Collector	-	-	-	4	Undivided	-	-	9,800	19,200	22,800
11	Urban	Highway	-	< 2/mile	-	2	Undivided	-	4,000	13,100	15,500	16,300
12	Urban	Arterial	-	-	-	2	Undivided	-	-	7,000	13,600	14,600
13	Transition	Freeway	-	-	-	4	-	23,500	38,700	52,500	62,200	69,100
14	Transition	Collector	-	-	-	2	Undivided	-	-	4,400	9,400	12,000
15	Rural	Freeway	-	-	-	6	-	33,100	54,300	73,900	87,400	97,200
16	Rural	Freeway	-	-	-	4	-	21,300	35,300	47,900	56,600	63,000
17	Rural	Nonfreeway	-	-	Uninterrupted	4	Divided	17,500	28,600	40,800	52,400	58,300
18	Rural	Nonfreeway	-	-	Isolated Stops	4	-	-	2,900	17,400	23,000	25,200
19	Rural	Nonfreeway	-	-	Uninterrupted	2	Undivided	2,600	5,300	8,600	13,800	22,300
20	Rural	Nonfreeway	-	-	Isolated Stops	2	Undivided	-	1,900	8,000	10,700	12,100
21	Suburban	Nonfreeway	-	-	Interrupted	4	Divided	-	5,300	25,200	29,400	31,200
22	Suburban	Highway	-	-	Uninterrupted	2	Undivided	2,500	7,200	12,700	17,300	23,500
23	Suburban	Arterial	-	-	Interrupted	2	Undivided	-	2,200	11,000	13,900	14,900
24	Suburban	Collector	-	-	-	2	Undivided	-	-	1,900	7,600	10,100

Source: Merced County 2013

Key: N/A = not applicable; < = less than

Table L-3. Daily Service Volume Table for Rural Basic Freeway Segments

		Four-Lane Freeways				Six-Lane Freeways				Eight-Lane Freeways			
K	**D**	**LOS B**	**LOS C**	**LOS D**	**LOS E**	**LOS B**	**LOS C**	**LOS D**	**LOS E**	**LOS B**	**LOS C**	**LOS D**	**LOS E**
Level Terrain													
0.08	0.50	52.8	72.8	88.7	100.7	79.3	109.2	133.0	151.1	105.7	145.5	177.3	201.4
	0.55	48.0	66.2	80.6	91.6	72.1	99.2	120.9	137.3	96.1	132.3	161.2	183.1
	0.60	44.0	60.6	73.9	83.9	66.1	91.0	110.8	125.9	88.1	121.3	147.8	167.9
	0.65	40.6	56.0	68.2	77.5	61.0	84.0	102.3	116.2	81.3	112.0	136.4	154.9
0.09	0.50	47.0	64.7	78.8	89.5	70.5	97.0	118.2	134.3	93.9	129.4	157.6	179.0
	0.55	42.7	58.8	71.6	81.4	64.1	88.2	107.5	122.1	85.4	117.6	143.3	162.8
	0.60	39.1	53.9	65.7	74.6	58.7	80.9	98.5	111.9	78.3	107.8	131.3	149.2
	0.65	36.1	49.8	60.6	68.9	54.2	74.6	90.9	103.3	72.3	99.5	121.2	137.7
0.10	0.50	42.3	58.2	70.9	80.6	63.4	87.3	106.4	120.9	84.6	116.4	141.8	161.1
	0.55	38.4	52.9	64.5	73.2	57.6	79.4	96.7	109.9	76.9	105.9	129.0	146.5
	0.60	35.2	48.5	59.1	67.1	52.8	72.8	87.9	100.7	70.5	97.0	118.2	134.3
	0.65	32.5	44.8	54.6	62.0	48.8	67.2	80.6	93.0	65.0	89.6	109.1	124.0
0.11	0.50	38.4	52.9	64.5	73.2	57.6	79.4	74.4	109.9	76.9	105.9	129.0	146.5
	0.55	34.9	48.1	58.6	66.6	52.4	72.2	88.7	99.9	69.9	96.2	117.2	133.2
	0.60	32.0	44.1	53.7	61.0	48.0	66.2	81.8	91.6	64.1	88.2	107.5	122.1
	0.65	29.6	40.7	49.6	56.3	44.3	61.1	96.7	84.5	59.1	81.4	99.2	112.7
0.12	0.50	35.2	48.5	59.1	67.1	52.8	72.8	87.9	100.7	70.5	97.0	118.2	134.3
	0.55	32.0	44.1	53.7	61.0	48.0	66.2	80.6	91.6	64.1	88.2	107.5	122.1
	0.60	29.4	40.4	49.3	56.0	44.0	60.6	73.9	83.9	58.7	80.9	98.5	111.9
	0.65	27.1	37.3	45.5	51.6	40.6	56.0	68.2	77.5	54.2	74.6	90.9	103.3

Source: Transportation Research Board 2016

Key: LOS = level of service, Unit: 1,000 veh/day

Table L-4. Generalized Daily Service Volumes for Rural Multilane Highways

		Four-Lane Freeways				Six-Lane Freeways				Eight-Lane Freeways			
K	D	LOS B	LOS C	LOS D	LOS E	LOS B	LOS C	LOS D	LOS E	LOS B	LOS C	LOS D	LOS E
Level Terrain													
0.08	0.50	42.4	60.9	75.8	86.4	63.6	91.3	113.7	129.6	84.9	121.8	151.6	172.9
	0.55	38.6	55.4	68.9	78.6	57.9	83.0	103.4	117.9	77.1	110.7	137.8	157.1
	0.60	35.4	50.7	63.2	72.0	53.0	76.1	94.8	108.0	70.7	101.5	126.3	144.0
	0.65	32.6	46.8	58.3	66.5	49.0	70.3	87.5	99.7	65.3	93.7	116.6	133.0
0.09	0.50	37.7	54.1	67.4	76.8	56.6	81.2	101.1	115.2	75.4	108.2	134.8	153.7
	0.55	34.3	49.2	61.3	69.8	51.4	73.8	91.9	104.8	68.6	98.4	122.5	139.7
	0.60	31.4	45.1	56.2	64.0	47.1	67.7	84.2	96.0	62.9	90.2	112.3	128.0
	0.65	29.0	41.6	51.8	59.1	43.5	62.4	77.7	88.6	58.0	83.3	103.7	118.2
0.10	0.50	33.9	48.7	60.6	69.1	50.6	73.1	91.0	106.7	67.9	97.4	121.3	138.3
	0.55	30.9	44.3	55.1	62.9	46.3	66.4	82.7	94.3	61.7	88.6	110.3	125.7
	0.60	28.3	40.6	50.5	57.6	42.4	60.9	75.8	86.4	56.6	81.2	101.1	115.2
	0.65	26.1	37.5	46.6	53.2	39.2	56.2	70.0	79.8	52.2	74.9	93.3	106.4
0.11	0.50	30.9	44.3	55.1	62.9	46.3	66.4	82.7	94.3	61.7	88.6	110.3	125.7
	0.55	28.1	40.3	50.1	57.1	42.1	60.4	75.2	85.7	56.1	80.5	100.2	114.3
	0.60	25.7	36.9	45.9	52.4	38.6	55.4	68.9	78.6	51.4	73.8	91.9	104.8
	0.65	23.7	34.1	42.4	48.4	35.6	51.1	63.6	72.5	47.5	68.1	84.8	96.7
0.12	0.50	28.3	40.6	50.5	57.6	42.4	60.9	75.8	86.4	56.6	81.2	101.1	115.2
	0.55	25.7	36.9	45.9	52.4	38.6	55.4	68.9	78.6	51.4	73.8	91.9	104.8
	0.60	23.6	33.8	42.1	48.0	35.4	50.7	63.2	72.0	47.1	67.7	84.2	96.0
	0.65	21.8	31.2	38.9	44.3	32.6	46.8	58.3	66.5	43.5	62.4	77.7	88.6

Source: Transportation Research Board 2016

Key: N/A = not applicable; LOS = level of service. K factor: The percentage of the Annual Average Daily Traffic in both directions during the peak hour; D factor: The percentage of traffic in the peak direction during the peak hour. Unit: 1,000 vehicles per day

Table L-5. Generalized Daily Service Volumes for Two-Lane Highways

		Class I - Level				Class I - Rolling				Class II - Rolling			
K-Factor	D-Factor	LOS B	LOS C	LOS D	LOS E	LOS B	LOS C	LOS D	LOS E	LOS B	LOS C	LOS D	LOS E
0.09	50%	5.5	9.3	16.5	31.2	4.2	8.4	15.7	30.3	5.0	9.8	18.2	31.2
	55%	4.9	8.7	14.9	30.2	3.7	7.9	14.0	29.2	4.1	8.7	16.0	30.2
	60%	4.4	8.1	13.9	27.6	3.7	6.2	12.8	26.8	3.7	7.9	14.6	27.6
	65%	4.1	7.9	12.9	25.5	3.4	5.9	11.4	24.7	3.3	5.9	13.2	25.5
0.10	50%	5.0	8.4	14.8	28.0	3.8	7.6	14.2	27.2	4.4	8.8	16.3	28.0
	55%	4.4	7.9	13.4	27.1	3.3	7.1	12.6	26.3	3.7	7.9	14.4	27.1
	60%	4.0	7.3	12.5	24.9	3.3	5.6	11.5	24.1	3.3	7.1	13.1	24.9
	65%	3.7	7.1	11.6	23.0	3.0	5.3	10.3	22.3	3.0	5.3	11.9	23.0
0.12	50%	4.1	7.0	12.4	23.4	3.1	6.3	11.8	22.7	3.7	7.4	13.6	23.4
	55%	3.7	6.5	11.2	22.6	2.8	5.9	10.5	21.9	3.1	6.5	12.0	22.6
	60%	3.3	6.1	10.4	20.7	2.7	4.7	9.6	20.1	2.7	5.9	10.9	20.7
	65%	3.1	5.9	9.6	19.1	2.5	4.4	8.5	18.5	2.4	4.4	9.9	19.1
0.14	50%	3.5	6.0	10.6	20.0	2.7	5.4	10.1	19.4	3.2	6.3	11.7	20.0
	55%	3.1	5.6	9.6	19.4	2.4	5.1	9.0	18.8	2.6	5.6	10.3	19.4
	60%	2.8	5.2	8.9	17.7	2.3	4.0	8.2	17.2	2.3	5.1	9.4	17.7
	65%	2.6	5.1	8.2	16.4	2.1	3.8	7.3	15.9	2.1	3.8	8.5	16.4

Source: Transportation Research Board 2016

Notes: Volumes are thousands of vehicles per day

Assumed values for all entries: 10% trucks, peak hour factor (PHF) = 0.88, 12-foot lanes, 6-foot shoulders, 10 access points per mile.

Assumed values for Class I – Level: Base free flow speed (BFFS) = 65 miles per hour (mph), 20% no-passing zones.

Assumed values for Class I – Rolling: BFFS = 60 mph, 40% no-passing zones.

Assumed values for Class II – Rolling: BFFS = mph, 60% no-passing zones

Key: N/A = not applicable; LOS = level of service. K factor: The percentage of the Annual Average Daily Traffic in both directions during the peak hour; D factor: The percentage of traffic in the peak direction during the peak hour.

Unit: 1,000 vehicles per day

Table L-6. Generalized Daily Service Volumes for Urban Street Facilities

Daily Service Volume by Lanes, LOS, and Speed (1,000 vehicles per day)													
		Four-Lane Freeways				Six-Lane Freeways				Eight-Lane Freeways			
K-Factor	D-Factor	LOS B	LOS C	LOS D	LOS E	LOS B	LOS C	LOS D	LOS E	LOS B	LOS C	LOS D	LOS E
Posted Speed = 30 miles per hour													
0.09	0.55	N/A	1.7	11.8	17.8	N/A	2.2	24.7	35.8	N/A	2.6	38.7	54.0
	0.56	N/A	1.6	10.8	16.4	N/A	2.0	22.7	32.8	N/A	2.4	35.6	49.5
0.10	0.55	N/A	1.6	10.7	16.1	N/A	2.0	22.3	32.2	N/A	2.4	34.9	48.6
	0.60	N/A	1.4	9.8	14.7	N/A	1.8	20.4	29.5	N/A	2.2	32.0	44.5
0.11	0.55	N/A	1.4	9.7	14.6	N/A	1.8	20.3	29.3	N/A	2.1	31.7	44.1
	0.60	N/A	1.3	8.9	13.4	N/A	1.7	18.6	26.9	N/A	2.0	29.1	40.5
Posted Speed = 45 miles per hour													
0.09	0.55	N/A	7.7	15.9	18.3	N/A	16.5	33.6	36.8	N/A	25.4	51.7	55.3
	0.60	N/A	7.1	14.5	16.8	N/A	15.1	30.8	33.7	N/A	23.4	47.4	50.7
0.10	0.55	N/A	7.0	14.3	16.5	N/A	14.9	30.2	33.1	N/A	23.0	46.5	49.7
	0.60	N/A	6.4	13.1	15.1	N/A	13.6	27.7	30.3	N/A	21.0	42.7	45.6
0.11	0.55	N/A	6.3	13.0	15.0	N/A	13.5	27.5	30.1	N/A	20.9	42.3	45.2
	0.60	N/A	5.8	11.9	13.8	N/A	12.4	25.2	27.6	N/A	19.1	38.8	41.5

Source: Transportation Research Board 2016

Key: N/A = not applicable; LOS = level of service. K factor: The percentage of the Annual Average Daily Traffic in both directions during the peak hour; D factor: The percentage of traffic in the peak direction during the peak hour.
LOS cannot be achieved with the following assumptions: no roundabouts or all-way STOP-controlled intersections along the facility; coordinated, semiactuated traffic signals; Arrival Type 4; 120-s cycle time; protected left-turn phases; 0.45 weighted average g/C ratio; exclusive left-turn lanes with adequate queue storage provided at traffic signals; no exclusive right-turn lanes provided; no restrictive median; two-mile facility length; 10 percent of traffic turns left and 10 percent of traffic turns right at each traffic signal; peak hour factor = 0.92; and base saturation flow rate = 1,900 passenger cars per hour per lane.
Additional assumptions for 30-mile per hour facilities: signal spacing = 1,050 feet and 20 access points per mile.
Additional assumptions for 45-mile per hour facilities: signal spacing = 1,500 feet and 10 access points per mile.
Unit: 1,000 veh/day

Table L-7 shows the roadway locations in different areas surrounding the proposed construction sites along the Project limits for the traffic and transportation impact analysis. These locations represent key regional roadways where the trucks hauling materials and personnel trips would occur near DMC crossings. Daily traffic volumes and K and D factors[1] for these locations were collected from Caltrans' Traffic Census Program (Caltrans 2019) to develop the existing traffic volumes. In cases where the peak hour data was not available, the K and D factors of a nearby location along the same study roadway were used to derive the peak hour volumes.

[1] K factor: The percentage of the Annual Average Daily Traffic in both directions during the peak hour; D factor: The percentage of traffic in the peak direction during the peak hour.

Table L-7. Study Roadway Locations

Roadway	Location
Fresno County Area	
SR 33	S of DMC (FRE 62.506), N of DMC (FRE 79.905)
Merced County/Los Banos Area	
SR 165	S of DMC (MER 0.000), N of DMC (MER 3.749)
SR 152	W of DMC (MER 13.848), E of DMC (MER 19.268)
SR 33	S of DMC (MER 13.238), N of DMC (MER 15.6)
I-5	At SR 152 (MER 17.578)
Stanislaus County Area	
I-5	At SR 130 (STA 15.855)
San Joaquin County/Tracy Area	
SR 132	E of DMC (SJ 3.24), W of DMC (SJ 3.24)
I-5	N of DMC (SJ 3.444), S of DMC (SJ 3.444)
I-205	W of DMC (SJ 0.000), E of DMC (SJ 1.377)
Alameda County Area	
I-580	W of I-205/I-580 split

Key: DMC = Delta-Mendota Canal; E = east; FRE = Fresno; I = Interstate; MER = Merced; N = North; S = South; SJ = San Joaquin; SR = state route; W = west

L.2 Traffic Flow Assessment Methodology

The Proposed Action would result in increases in traffic during construction and small or no changes during operations. This impact assessment analyzes the increase in traffic that would occur during construction based on changes to the LOS. Because all the roadway segments being analyzed are either Interstates or state highways that fall under Caltrans' jurisdiction, Caltrans' standard of LOS D is used to identify traffic impacts. In addition to daily operations, the impact assessment includes a.m. and p.m. peak hours. It is assumed that the a.m. peak hour occurs between 7 a.m. and 9 a.m., and the p.m. peak hour occurs between 4 p.m. and 6 p.m.

For the Proposed Action, construction data (number of construction trucks, construction locations and schedule, number of workers, and worker schedule) were used to identify anticipated short-term construction-related trip generation. There is no long-term operations-related trip generation anticipated. These additional short-term trips were assigned to roadways located near the service areas to determine traffic operations under the Proposed Action. Using the traffic operations' assessment methods mentioned above, potential transportation impacts to neighboring roadways were determined for the Proposed Action.

L.3 Trip Generation

L.3.1 No Action Alternative

No additional construction truck trips and personnel trips would be generated on top of background trip under the No Action Alternative.

L.3.2 Raise Deficient Structures Alternative (Proposed Action)

The maximum daily delivery/hauling truck trips and maximum daily personnel for relevant Project elements for the Proposed Action were identified from Appendix G – Construction Schedules and Assumptions of the Bureau of Reclamation's (Reclamation's) 2021 *Delta-Mendota Canal Subsidence Project- Feasibility Study of the Structural Alternatives*. These numbers were then converted to maximum daily one-way truck trips and worker trips as summarized in Table L-8. For worker trips, the number of personnel was multiplied by two to derive total one-way in and out trips. For the "Bridge Replacement" Project element, up to three bridge replacements are anticipated to occur concurrently; therefore, the number was further multiplied by three. For the "Check Structures and Wasteways Modifications" Project element, up to two check structures/wasteways are anticipated to be modified concurrently; therefore, the number was multiplied by two.

Table L-8. Trip Generation Under the Proposed Action

Project Element	Truck Trips		Worker Trips		Impact Location
	Unit One-Way	Total In & Out	Number of Personnel	Total In & Out	
Bridge Replacement	12	36	12	72	Throughout Project
Concrete Lining with Embankment Raise	32	32	23	46	Throughout Project
Concrete Lining Repairs	8	8	6	12	Throughout Project
Stabilize Canal Banks Along Earthen-lined Segment	119	119	26	52	MP 98.64 - 116.41 (Between Stations 4535+00 and 5476+35)
Impacted Pipeline Crossing Replacements	5	5	16	32	Throughout Project
Check Structures and Wasteways Modifications	2	4	14	56	Throughout Project
Turnout Modifications	4	4	6	12	Throughout Project
Drainage Structure Modifications	16	16	6	12	Throughout Project

Key: MP = Mile Post

All Project elements except "Stabilize Canal Banks Along Earthen-lined Segment" are located throughout the Project limits, and construction activities move along the Project limits. Therefore, the trips from these construction activities are assumed to occur in all study areas listed above. For the "Stabilize Canal Banks Along Earthen-lined Segment" Project element, the construction activities are limited to the segment between Mile Post (MP) 98.64 - 116.41 (between Stations 4535+00 and 5476+35), so the impact location is limited to the Fresno County area.

These trips were distributed into the study roadways in different areas based on the assumed labor and material sources. The distributed trips represent the maximum possible trips that could occur at the study roadway locations on a daily level. Figure L-1 through Figure L-5 illustrate conceptually where the study roadways are located and the percentage distributions of the truck and worker trips, for each focused study area.

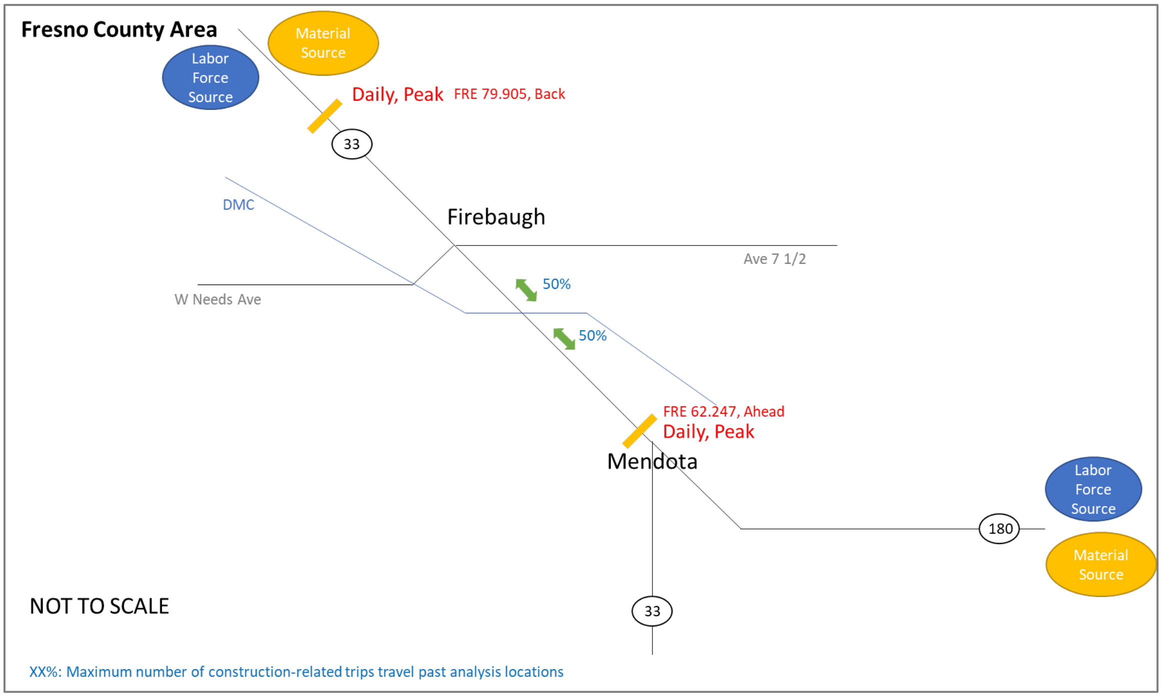

Figure L-1. Study Roadways and Construction Trips Distribution in Fresno County Area

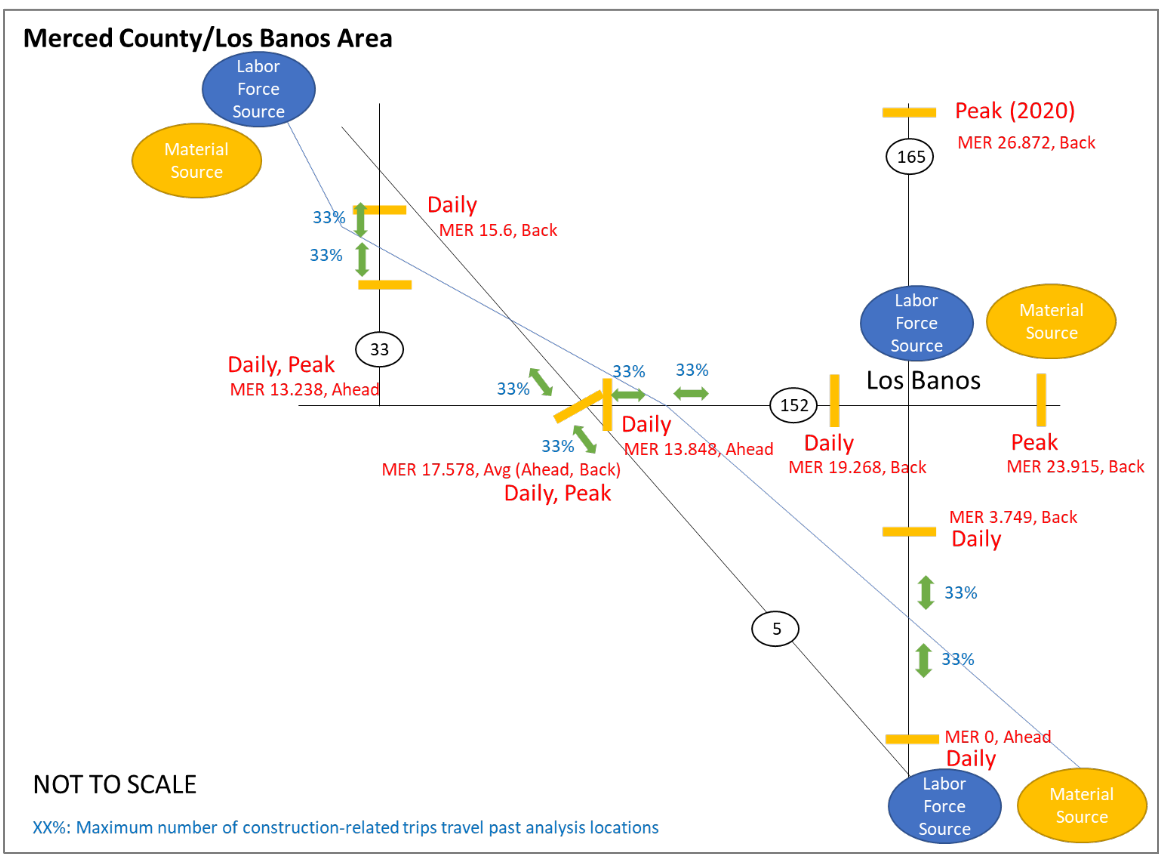

Figure L-2. Study Roadways and Construction Trips Distribution in Merced County/ Los Banos Area

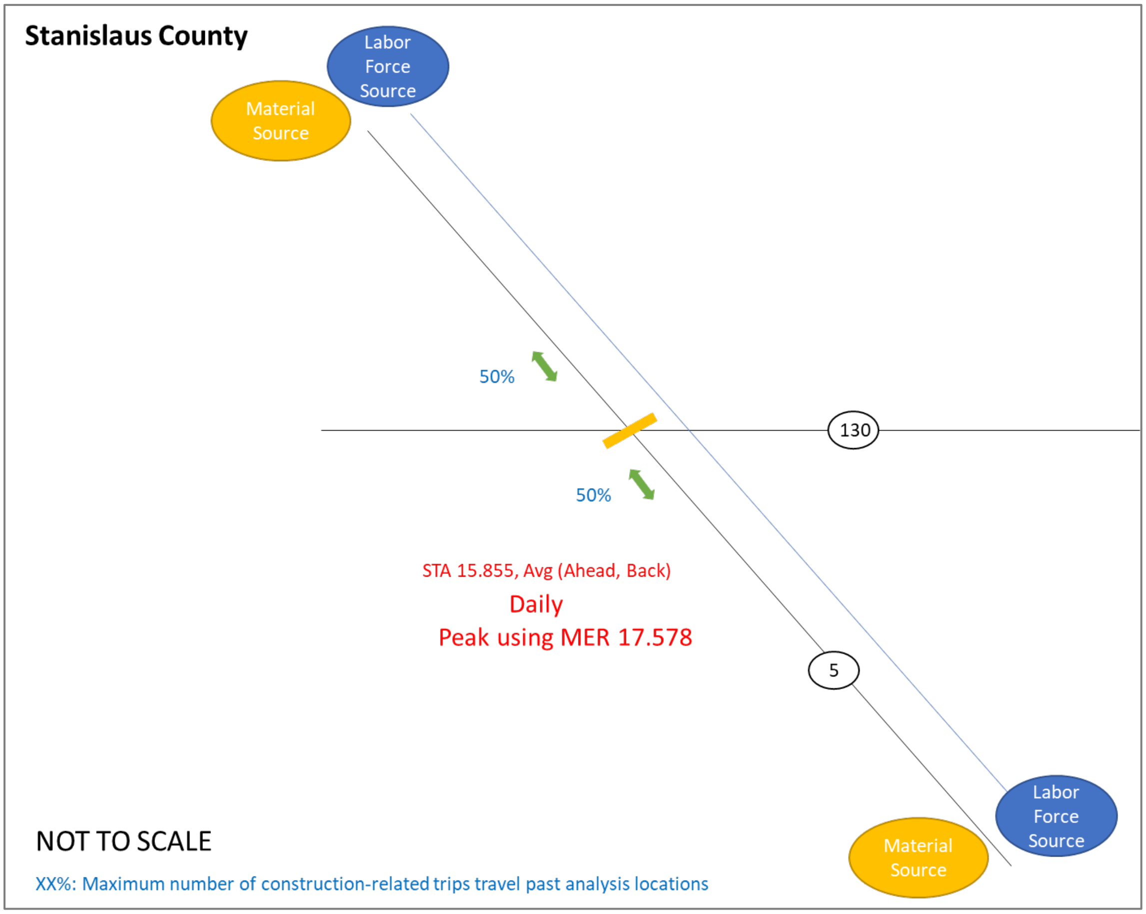

Figure L-3. Study Roadways and Construction Trips Distribution in Stanislaus County Area

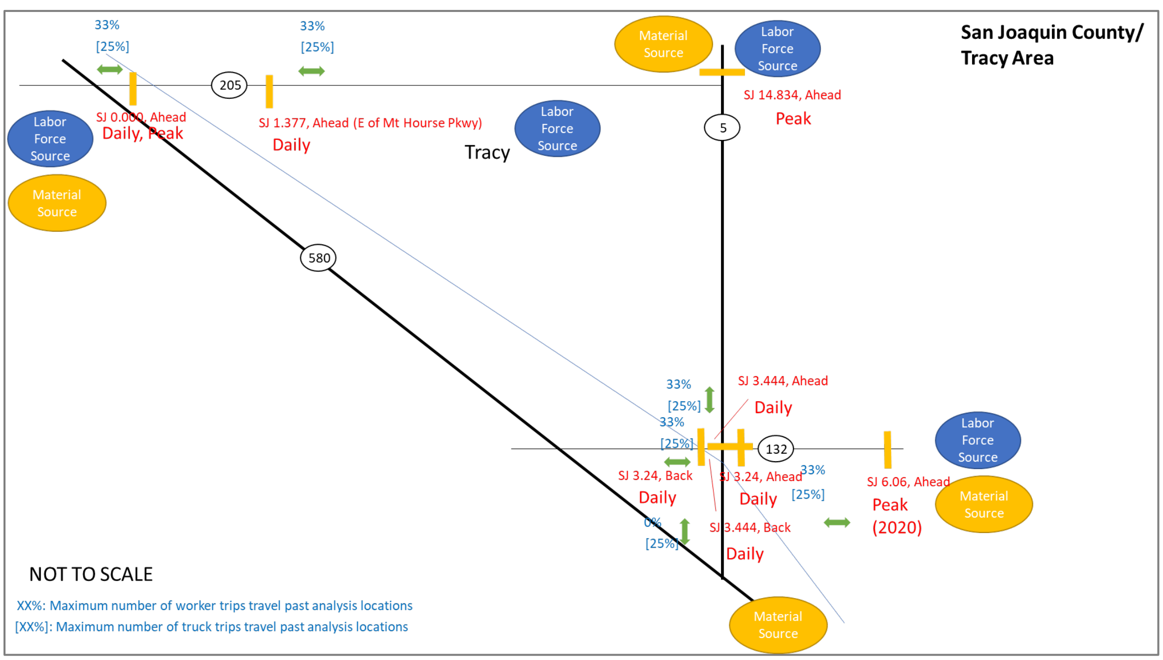

Figure L-4. Study Roadways and Construction Trips Distribution in San Joaquin County/Tracy Area

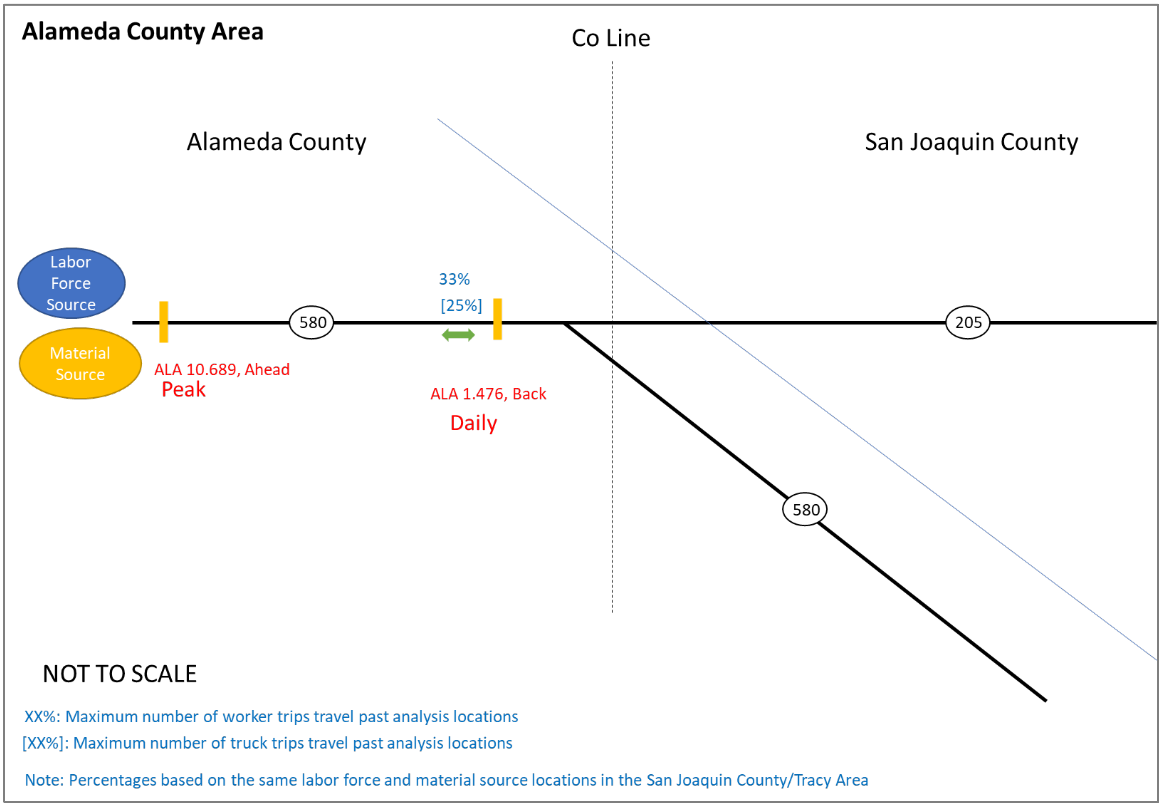

Figure L-5. Study Roadways and Construction Trips Distribution in Alameda County Area

A maximum of 224 truck trips and 294 worker trips would be involved with implementation of the Proposed Action. The construction year considered for analyzing the Proposed Action is 2026. It is assumed that all of the construction truck trips would be distributed throughout the 24-hour construction, so that 10 percent of the daily trips would occur during the a.m./p.m. peak hour. From Appendix G – Construction Schedules and Assumptions of Reclamation's 2021 *Delta-Mendota Canal Subsidence Project: Feasibility Study of the Structural Alternatives*, there would be two 10-hour shifts per day. It is assumed that the construction personnel are equally distributed between these two shifts, and trips would occur inbound before 6 a.m. and before 6 p.m., and outbound after 6 a.m. and after 6 p.m. Therefore, only the nighttime worker trips would occur during the a.m./p.m. peak hours. Nighttime workers would leave the site during the a.m. peak period and enter the site during the p.m. peak period. The Proposed Action is not expected to add any long-term trips to the Project site after construction is complete.

L.4 Roadway Operations

Existing traffic conditions are based on 2019 traffic volumes derived from Caltrans' Traffic Census Program (Caltrans 2019). Since the Project limits are in rural area, background traffic growth is expected to be minimal. For this analysis, it was assumed that background traffic would increase at 0.5 percent annually from 2019 to 2026.

L.4.1 No Action Alternative

Since there are no additional construction-related trips generated under the No Action Alternative, traffic volumes under this alternative only include projected background traffic. Therefore, roadway operations under this alternative are expected to be the same as background roadway operations.

L.4.2 Raise Deficient Structures Alternative (Proposed Action)

Roadway operations during construction of the Proposed Action are summarized in Table L-9 through Table L-11, respectively for daily, a.m. and p.m. peak hour periods.

For daily operations, the added construction-related trips would not change the LOS at any of the study roadway segments, except at the location of Interstate 5 (I-5) at State Route (SR) 130 in Stanislaus County. Even though LOS degrades from C to D after the construction-related trips are added on this segment, the LOS during construction does not exceed the threshold of significance (LOS D).

Table L-9. Daily Roadway Operations Under the Proposed Action

Roadway	No Action (2026) Volume (AADT)	No Action LOS (2026)	Maximum Daily Truck Trips	Maximum Daily Worker Trips	Total Volume (2026) (AADT)	LOS (2026)	LOS Change
Fresno County Area							
SR 33 south of DMC	13,500	D	112	147	13,759	D	No Change
SR 33 north of DMC	2,700	C	112	147	2,959	C	No Change
Merced County/Los Banos Area							
SR 165 south of DMC	1,400	A	35	80	1,515	A	No Change
SR 165 north of DMC	1,600	A	35	80	1,715	A	No Change
SR 152 west of DMC	28,000	B	35	80	28,115	B	No Change
SR 152 east of DMC	23,800	C	35	80	23,915	C	No Change
SR 33 south of DMC	11,700	D	35	80	11,815	D	No Change
SR 33 north of DMC	12,200	D	35	80	12,315	D	No Change
I-5 at SR 152	39,500	C	70	162	39,732	C	No Change

Roadway	No Action (2026) Volume (AADT)	No Action LOS (2026)	Maximum Daily Truck Trips	Maximum Daily Worker Trips	Total Volume (2026) (AADT)	LOS (2026)	LOS Change
Stanislaus County Area							
I-5 at SR 130	50,100	C	105	242	50,447	D	Higher but does not exceed LOS D
San Joaquin County/Tracy Area							
SR 132 east of DMC	14,600	B	26	80	14,706	B	No Change
SR 132 west of DMC	17,600	B	26	80	17,706	B	No Change
I-5 north of DMC	32,500	B	26	80	32,606	B	No Change
I-5 south of DMC	31,600	B	26	80	31,706	B	No Change
I-205 west of DMC	135,700	F	26	80	135,806	F	No Change
I-205 east of DMC	109,800	C	26	80	109,906	C	No Change
Alameda County Area							
I-580 west of I-205/I-580 Split	151,500	E	26	80	151,606	E	No Change

Key: AADT = annual average daily traffic; DMC = Delta-Mendota Canal; I = interstate; LOS = level of service; SR = state route

For a.m. and p.m. peak hour operations, the added construction-related trips would not change the LOS at any of the study roadway segments or intersections, except at the following locations in Fresno County:

- SR 33 northbound segment north of DMC (a.m. and p.m. peak hours)
- SR 33 southbound segment north of DMC (p.m. peak hour)

Even though LOS degrades after the construction-related trips are added on this segment during these peak hours, the LOS during construction does not exceed the threshold of significance (LOS D).

Table L-10. A.M. Peak Hour Roadway Operations Under the Proposed Action

Roadway	No Action (2026) Volume (AADT)	No Action LOS (2026)	Maximum Truck Trips	Maximum Worker Trips	Total Volume (2026) (AADT)	LOS (2026)	LOS Change
Fresno County Area							
SR 33 south of DMC NB	450	C	6	0	456	C	No Change
SR 33 south of DMC SB	450	C	6	74	530	C	No Change
SR 33 north of DMC NB	450	B	6	74	530	C	Higher but does not exceed LOS D
SR 33 north of DMC SB	50	A	6	0	56	A	No Change
Merced County/Los Banos Area							
SR 165 south of DMC NB	50	A	2	0	52	A	No Change
SR 165 south of DMC SB	50	A	2	40	92	A	No Change
SR 165 north of DMC NB	50	A	2	40	92	A	No Change
SR 165 north of DMC SB	50	A	2	0	52	A	No Change
SR 152 west of DMC EB	900	A	2	0	902	A	No Change
SR 152 west of DMC WB	1,350	B	2	40	1,392	B	No Change
SR 152 east of DMC EB	700	A	2	40	742	A	No Change
SR 152 east of DMC WB	1,150	B	2	0	1,152	B	No Change
SR 33 south of DMC NB	700	E	2	0	702	E	No Change
SR 33 south of DMC SB	400	C	2	40	442	C	No Change
SR 33 north of DMC NB	700	D	2	40	742	D	No Change
SR 33 north of DMC SB	450	D	2	0	452	D	No Change
I-5 at SR 152 NB	1,000	A	4	81	1,085	A	No Change
I-5 at SR 152 SB	2,300	C	4	81	2,385	C	No Change
Stanislaus County Area							
I-5 at SR 130 NB	1,250	B	5	121	1,376	B	No Change
I-5 at SR 130 SB	2,900	D	5	121	3,026	D	No Change
San Joaquin County/Tracy Area							
SR 132 east of DMC EB	50	A	1	40	91	A	No Change
SR 132 east of DMC WB	1,350	B	1	0	1,351	B	No Change
SR 132 west of DMC EB	50	A	1	0	51	A	No Change
SR 132 west of DMC WB	1,600	B	1	40	1,641	B	No Change
I-5 north of DMC NB	1,200	B	1	40	1,241	B	No Change
I-5 north of DMC SB	1,100	A	1	0	1,101	A	No Change
I-5 south of DMC NB	1,150	A	1	0	1,151	A	No Change
I-5 south of DMC SB	1,100	A	1	0	1,101	A	No Change
I-205 west of DMC EB	5,000	D	1	0	5,001	D	No Change
I-205 west of DMC WB	4,950	D	1	40	4,991	D	No Change
I-205 east of DMC EB	4,050	B	1	40	4,091	B	No Change

Roadway	No Action (2026) Volume (AADT)	No Action LOS (2026)	Maximum Truck Trips	Maximum Worker Trips	Total Volume (2026) (AADT)	LOS (2026)	LOS Change
I-205 east of DMC WB	4,050	B	1	0	4,051	B	No Change
Alameda County Area							
I-580 west of I-205/I-580 Split EB	5,700	C	1	0	5,701	C	No Change
I-580 west of I-205/I-580 Split WB	3,450	B	1	40	3,491	B	No Change

Key: DMC = Delta-Mendota Canal; AADT = annual average daily traffic; I = interstate; LOS = level of service; NB = northbound; SB = southbound; EB = eastbound; WB = westbound.

Table L-11. P.M. Peak Hour Roadway Operations Under the Proposed Action

Roadway	No Action (2026) Volume (AADT)	No Action LOS (2026)	Maximum Truck Trips	Maximum Worker Trips	Total Volume (2026) (AADT)	LOS (2026)	LOS Change
Fresno County Area							
SR 33 south of DMC NB	650	D	6	74	730	D	No Change
SR 33 south of DMC SB	700	D	6	0	706	D	No Change
SR 33 south of DMC NB	800	C	6	0	806	D	Higher but does not exceed LOS D
SR 33 north of DMC SB	50	A	6	74	130	B	Higher but does not exceed LOS D
Merced County/Los Banos Area							
SR 165 south of DMC NB	50	A	2	40	92	A	No Change
SR 165 south of DMC SB	50	A	2	0	52	A	No Change
SR 165 north of DMC NB	100	B	2	0	102	A	No Change
SR 165 north of DMC SB	50	A	2	40	92	A	No Change
SR 152 west of DMC EB	1,350	B	2	40	1,392	B	No Change
SR 152 west of DMC WB	1,150	A	2	0	1,152	A	No Change

Roadway	No Action (2026) Volume (AADT)	No Action LOS (2026)	Maximum Truck Trips	Maximum Worker Trips	Total Volume (2026) (AADT)	LOS (2026)	LOS Change
SR 152 east of DMC EB	1,150	B	2	0	1,152	B	No Change
SR 152 east of DMC WB	1,000	B	2	40	1,042	B	No Change
SR 33 south of DMC NB	650	E	2	40	692	E	No Change
SR 33 south of DMC SB	400	C	2	0	402	C	No Change
SR 33 north of DMC NB	650	D	2	0	652	D	No Change
SR 33 north of DMC SB	400	C	2	40	442	C	No Change
I-5 at SR 152 NB	2,400	C	4	81	2,485	C	No Change
I-5 at SR 152 SB	2,150	C	4	81	2,235	C	No Change
Stanislaus County Area							
I-5 at SR 130 NB	3,000	D	5	121	3,126	D	No Change
I-5 at SR 130 SB	2,750	D	5	121	2,876	D	No Change
San Joaquin County/Tracy Area							
SR 132 east of DMC EB	1,200	A	1	0	1,201	A	No Change
SR 132 east of DMC WB	250	A	1	40	291	A	No Change
SR 132 west of DMC EB	1,450	B	1	40	1,491	B	No Change
SR 132 west of DMC WB	300	A	1	0	301	A	No Change
I-5 north of DMC NB	1,250	B	1	0	1,251	B	No Change
I-5 north of DMC SB	900	A	1	40	941	A	No Change
I-5 south of DMC NB	1,200	A	1	0	1,201	A	No Change
I-5 south of DMC SB	900	A	1	0	901	A	No Change
I-205 west of DMC EB	5,350	E	1	40	5,391	E	No Change
I-205 west of DMC WB	2,650	B	1	0	2,651	B	No Change
I-205 east of DMC EB	4,300	B	1	0	4,301	B	No Change
I-205 east of DMC WB	2,150	A	1	40	2,191	A	No Change

Roadway	No Action (2026) Volume (AADT)	No Action LOS (2026)	Maximum Truck Trips	Maximum Worker Trips	Total Volume (2026) (AADT)	LOS (2026)	LOS Change
Alameda County Area							
I-580 west of I-205/I-580 Split EB	3,700	B	1	40	3,741	B	No Change
I-580 west of I-205/I-580 Split WB	7,250	C	1	0	7,251	C	No Change

Key: AADT = annual average daily traffic; DMC = Delta-Mendota Canal; I = interstate; LOS = level of service; NB = northbound; SB = southbound; EB = eastbound; WB = westbound

L.5 Significance Criteria

Impacts related to traffic and transportation would be considered significant if they result in one or more of the following conditions or situations: (1) conflict with a program, plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities; (2) increase traffic substantially in relation to the existing traffic load and capacity of the street system; (3) substantially increase hazards because of a geometric design feature or incompatible uses; or (4) result in inadequate emergency access. The significance criteria apply to all transportation systems that could be affected by the Project.

L.6 Project Impacts and Mitigation Measures

L.6.1 No Action Alternative

L.6.1.1 Conflict with a program plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities.

Under the No Action Alternative, no actions would be taken to restore, or otherwise offset, conveyance capacity lost in the DMC. No construction or changes to existing operations in the study area would occur. Therefore, this alternative would not conflict with the goals and objectives of any applicable programs, plans, ordinances, or policies in relevant jurisdictions that establish roadway performance standards. **There would be no impact under the No Action Alternative.**

L.6.1.2 Cause a substantial increase in traffic in relation to the existing traffic load and capacity of the street system.

Under the No Action Alternative, no actions would be taken to restore, or otherwise offset, conveyance capacity lost in the DMC. No construction or changes to existing operations in the study area would occur. Therefore, this alternative would not result in a substantial increase in traffic in relation to the existing traffic load and roadway capacity. **There would be no impact under the No Action Alternative**.

L.6.1.3 Substantially increase traffic hazards because of a geometric design feature or incompatible uses.

Under the No Action Alternative, no actions would be taken to restore, or otherwise offset, conveyance capacity lost in the DMC. Therefore, this alternative would not result in a substantial increase in traffic hazards. **There would be no impact under the No Action Alternative**.

L.6.1.4 Result in inadequate emergency access.

Under the No Action Alternative, no actions would be taken to restore, or otherwise offset, conveyance capacity lost in the DMC. Therefore, this alternative would not result in inadequate emergency access. **There would be no impact under the No Action Alternative**.

L.6.2 Proposed Action

L.6.2.1 Conflict with a program plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities.

Construction-related and operation-related traffic under the Proposed Action would not permanently alter transit services or the physical characteristics of the roadway system; therefore, it would not conflict with the goals and objectives of any applicable programs, plans, ordinances, or policies in relevant jurisdictions that establish roadway performance standards. **There would be no impact under the Proposed Action.**

L.6.2.2 Cause a substantial increase in traffic in relation to the existing traffic load and capacity of the street system.

For daily operations, the added construction-related trips would not change the LOS at any of the study roadway segments, except for I-5 at SR 130 in Stanislaus County. Even though LOS degrades at this location, it does not exceed Caltrans' threshold of significance (LOS D). For peak hour operations, the added construction-related trips would not change the LOS at any of the study roadway segments, except at the following locations: SR 33 north of DMC northbound and southbound in Fresno County. Even though LOS degrades at these locations, it does not exceed Caltrans' threshold of significance. Therefore, construction-related and operation-related traffic under the Proposed Action would not result in a substantial increase in traffic in relation to the existing traffic load and roadway capacity. **This impact would be less than significant**.

L.6.2.3 Substantially increase traffic hazards because of a geometric design feature or incompatible uses.

Construction equipment and construction worker vehicle trips under the Proposed Action would increase traffic hazards at key roadway segments and intersections close to the DMC crossings, including SR 33 in Fresno County, SR 165, SR 152, and SR 33 in Merced County, and SR 132 in San Joaquin County. **Therefore, construction of the Proposed Action would increase the potential for traffic hazards at roadways segments and intersections, resulting in a potentially significant impact**. With implementation of Mitigation Measure (MM) TR-1, described in Section L.6.4, a temporary traffic control plan would be developed, which would outline that signage at roadways and intersections identified as dangerous would be installed warning motorists of slow-moving construction traffic and lane closures. In addition, traffic controls like flaggers or temporary traffic lights would be installed where construction equipment will be entering roadways to reduce conflicts during periods of high traffic volume in and around each construction site. **As such,**

potential traffic hazard impacts under the Proposed Action would be less than significant after mitigation.

L.6.2.4 Result in inadequate emergency access.

Construction traffic has the potential to limit or slow this emergency access. Therefore, construction of the Proposed Action would potentially conflict with emergency vehicles, resulting in a significant impact. With implementation of MM TR-1, described in Section L.6.3, construction contractors must implement dust abatement and perform proper construction traffic management actions, including signage warning motorists of construction activity and traffic controls like flaggers or temporary traffic lights where construction equipment will be entering roadways, to avoid conflicts with emergency responders entering and existing the area during an emergency. As such, traffic emergency access impacts under the Proposed Action would be less than significant.

L.6.3 Mitigation Measures

MM TR-1: Develop a Temporary Traffic Control Plan. The following construction management actions will be documented in a temporary traffic control plan developed by the contractor as a requirement that will be included in its construction contract. The temporary traffic control plan will be submitted for Caltrans' review and approval during the Encroachment Permit process.

Construction contractors will install signage at roadways and intersections identified as dangerous in accordance with the California Manual on Uniform Traffic Control Devices guidelines warning motorists of slow-moving construction traffic and lane closures. Signage must also be posted at these locations one month in advance to allow motorists time to plan for delays or alternate routes.

Construction contractors must implement dust abatement and perform proper construction traffic management actions, including signage warning motorists of construction activity and traffic controls like flaggers or temporary traffic lights where construction equipment will be entering roadways, to reduce conflicts during periods of high traffic volume in and around each construction site and to avoid conflicts with emergency responders entering and existing the area during an emergency.

In addition to the temporary traffic control plan, before the initiation of any construction actions, construction contractors must develop and adhere to a health and safety plan outlining all applicable Occupational Safety and Health Administration requirements, and important traffic safety plans, including identification of emergency access routes in and through construction areas that would still need to be kept clear at all times during construction. The health and safety plan must include coordination with emergency service personnel to ensure adequate mitigation for all impacts.

L.7 References

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Appendix M
Biological Survey Report

Appendix M Biological Survey Report

This appendix documents the biological resources technical analysis conducted to support the impact analysis presented in the Environmental Assessment/Initial Study (EA/IS). The analysis describes the biological resources that could be potentially affected by the implementation of the Proposed Action/Proposed Project (subsequently identified as the Proposed Action) considered in the EA/IS, provides an evaluation of potential impacts on those biological resources from construction and operation of the Proposed Action, and outlines the mitigation measures to be implemented to avoid or minimize impacts on biological resources.

M.1 Existing Conditions

A biological survey report (BSR) was prepared to identify special-status species and other sensitive biological resources that may occur in or near the Study Area (Attachment 1). The BSR presents findings from desktop research and field surveys conducted between March 31 and April 22, 2022; documents the potential for the occurrence of special-status plant and wildlife species protected by the federal and/or state governments within the study area and provides landscape-level reconnaissance mapping of vegetation and habitats. The existing conditions descriptions included in subsequent sections are summarized from the detailed information presented in the BSR.

The Study Area considered in the BSR is consistent with the Project area being evaluated for the biological resources analysis presented in this appendix. The study area (hereafter referred to as the Project area) includes approximately 5,461 acres along the Delta-Mendota Canal (DMC) alignment between the C.W. "Bill" Jones Pumping Plant (Jones Pumping Plant) at Mile 2.68 at Kelso Road near the northern end of the canal and the outlet at the Mendota Pool at Mile 116.48, the southern terminus of the canal. The northernmost segment between the Tracy Fish Facility and Kelso Road will not be affected by the Proposed Action under consideration, including related construction access or staging, and is therefore excluded from the Project area. Along the length of the DMC alignment, the Project area includes the inner canal banks, which are concrete-lined in certain areas and earthen-lined in others, the operations and maintenance access roads, the wetted channel of the canal itself, the outer embankment of the canal, and infrastructure, including bridges, overchutes, pipe crossings, culverts, and tunnels. In most areas along the length of the Project area, a portion of the adjacent land that lies at the toe of the outer canal embankment is also included.

At locations where streams or ditches cross over or under the canal at culverts, the Project area includes the area within the stream or ditch for 100 feet in both the upstream and downstream directions from the culvert wingwall. In addition, the Project area includes sections where the canal transitions to underground siphon or conveyance piping.

M.1.1 Existing Land Uses and Habitat Types

Habitat types mapped within the Project area include agriculture, annual grassland, alkaline emergent wetland, freshwater emergent wetland, freshwater forested wetland, intermittent stream channels, irrigation canals, maintained agricultural ditches and drainage features, ponds, riparian woodland, ruderal/developed, as well as riverine and emergent wetland within the channel of the DMC itself (identified as "DMC – Riverine" and "DMC - Freshwater Emergent Wetland" respectively). The acreage of each habitat type within the Project area and its classification as a sensitive habitat is summarized in Table M-1. Sensitive habitats include riparian corridors, wetlands, habitats for legally protected species, areas of high biological diversity, areas supporting rare or special-status wildlife habitat, and unusual or regionally restricted habitat types. The habitats within the channel of the DMC itself (i.e., DMC – Riverine and DMC - Freshwater Emergent Wetland) are characterized by marginal conditions and generally demonstrate minimal emergent vegetative cover typically consisting of a narrow band of floating water primrose (*Ludwigia peploides*) along the canal edges. As such, areas within the DMC itself lack suitable habitat for special status species, and thus are not considered sensitive habitats.

Table M-1. Summary of Habitat Types by Area

Habitat Type	Area Sum (Acres)	Sensitive
Agriculture	284	
Annual Grassland	770	
Alkaline Emergent Wetland	7	X
Freshwater Emergent Wetland	21	X
Freshwater Forested Wetland	2	X
Intermittent Channel	10	X
Irrigation Canal	7	
Maintained Agriculture Ditches and Drainage Features	109	X
Pond	1	X
Riparian Woodland	1	X
Ruderal/Developed	2,667	
DMC - Riverine	1,527	
DMC - Freshwater Emergent Wetland	55	
Total	5,461	

Vegetation types considered sensitive include those identified as sensitive on the *California Natural Communities List* (i.e., those habitats that are rare or endangered within the borders of California) (California Department of Fish and Wildlife [CDFW] 2022a) and those that are occupied by species listed under the federal Endangered Species Act (ESA) or are designated critical habitat in accordance with ESA. Critical Habitat Mapping Unit CCS-2B for the California red-legged frog (*Rana draytonii*) lies immediately west of the Project area and overlaps a narrow approximately 0.6-acre section of the Project area along the west side of the canal between Kelso Road and Mountain House Road (U.S. Fish and Wildlife Service [USFWS] 2022). Mapping Unit (59 FR 65256 65279) for Delta smelt (*Hypomesus transpacificus*) designated by USFWS on January 18, 1995, lies north of, and also overlaps portions of the Project area between Mountain House Road and the Tracy Fish Facility.

Specific habitats may also be identified as sensitive in city or county general plans or ordinances. Sensitive habitats are regulated under federal regulations (such as the Clean Water Act [CWA] and Executive Order 11990 – Protection of Wetlands), state regulations (such as the California Environmental Quality Act [CEQA] and the CDFW Streambed Alteration Program), or local ordinances or policies (such as city or county tree ordinances and general plan policies).

The locations and areal extents of habitat types occurring within the Project area are depicted in Figure E, *Habitat Types*, in Attachment 1, and a discussion of each habitat type is included in Section 4.1 of Attachment 1.

M.1.2 Special-Status Species

Published occurrence data within the Project area and surrounding United States Geological Survey (USGS) quadrangles were evaluated to compile a table of special-status species known to occur in the vicinity of the Project area, as described in Section 4 of Attachment 1. Special-status species are defined as those plants and animals that are legally protected under the ESA, the California Endangered Species Act (CESA), or other regulations; and species that are considered sufficiently rare by the scientific community to qualify for such listing. Each special-status species known to occur in the vicinity of the Project area was evaluated for their likelihood to occur within and immediately adjacent to the Project area. Based on existing habitat conditions, species-specific habitat requirements, known occurrence records, and/or direct observations recorded during biological surveys, a total of 53 special-status species were identified has having the potential to occur in the Project area as summarized in Table M-2. Further information regarding the historical and current ranges, habitat preferences, and life histories of these species is provided in Section 4.3 of Attachment 1. All other special-status species evaluated are not expected to occur in the Project area based on the species-specific rationale presented in Attachment B of Attachment 1. Those species not expected to occur are therefore not expected to be impacted by the Proposed Action considered and are not discussed further. Special-status fish species that occur in the vicinity of the Project area are noted in Attachment B of Attachment 1 but are presumed absent from the Project area because the Project area is located downstream of the Tracy Fish Facility, which prevents fish from entering the DMC from the southern Delta.

Table M-2. Special-Status Wildlife Species with Potential to Occur in the Project Area

Species	Status (USFWS/CDFW/CNPS)	General Habitat	Potential Occurrence within Project Area
MAMMALS			
Antrozous pallidus Pallid bat	-- / CSC / --	Occurs in a wide variety of habitats including grasslands, shrublands, arid desert areas, oak savanna, coastal forested areas, and coniferous forests of the mountain regions of California. Most common in open, dry habitats with rocky areas for roosting. Day roosts include caves, crevices, mines, and occasionally hollow trees and buildings. Seems to prefer rocky outcrops, cliffs, and crevices with access to open habitats for foraging. Similar structures are used for night roosting and will also use more open sites such as eaves, awnings, and open areas under bridges for feeding roosts.	**Moderate:** Suitable foraging habitat is present in the Project area. This species has the potential to use bridges and other canal infrastructure for roosting. There are no California Natural Diversity Database (CNDDB) occurrences reported within 3.1 miles of the Project area.
Corynorhinus townsendii Townsend's big-eared bat	-- / CSC / --	Found primarily in rural settings from inland deserts to coastal redwoods, oak woodland of the inner Coast Ranges and Sierra foothills, and low to mid-elevation mixed coniferous-deciduous forests. Typically roost during the day in limestone caves, lava tubes, and mines, but can roost in buildings that offer suitable conditions. Night roosts are in more open settings and include bridges, rock crevices, and trees.	**Moderate:** Suitable foraging habitat is present in the Project area. This species has the potential to use bridges and other canal infrastructure for roosting. There are no CNDDB occurrences reported within 3.1 miles of the Project area.
Eumops perotis californicus Western mastiff bat	-- / CSC / --	Many open habitats including conifer and deciduous woodlands, coastal scrub, grassland, and chaparral. Roost in crevices in cliff faces, high buildings, trees, and tunnels.	**Moderate:** Suitable grassland and woodland foraging habitat is present within the Project area. This species has the potential to use bridges and other canal infrastructure for roosting. One CNDDB occurrence is recorded within 3.1 miles of the Project area, dated 1911.

Species	Status (USFWS/CDFW /CNPS)	General Habitat	Potential Occurrence within Project Area
Lasiurus blossevilii Western red bat	-- / CSC / --	Roosting habitat includes trees and sometimes shrubs in forests and woodlands from sea level up through mixed conifer forests. Roost sites are often in edge habitats adjacent to streams, fields, or urban areas. Feeds over a wide variety of habitats, including grasslands, shrublands, open woodlands and forests, and croplands.	**Moderate:** Suitable foraging habitat is present in the Project area. This species has the potential to use bridges and other canal infrastructure for roosting. One CNDDB record was recorded within 3.1 miles of the Project area, dated 1999.
Taxidea taxus American badger	-- / CSC / --	Dry, open grasslands, fields, pastures savannas, and mountain meadows near timberline are preferred. The principal requirements seem to be sufficient food, friable soils, and relatively open, uncultivated grounds.	**Moderate:** Suitable grassland, field, and pasture habitats are present within the Project area. There are 19 CNDDB occurrences reported within 3.1 miles of the Project area. There is one CNDDB occurrence reported within 1 mile of the Project area dated 2007.
Vulpes macrotis mutica San Joaquin Kit Fox	FE / ST / --	Open, level areas with loose-textured soils supporting scattered, shrubby vegetation with little human disturbance. Live in annual grasslands or grassy open stages dominated by scattered brush, shrubs, and scrub.	**Moderate:** Suitable grassland foraging habitat is present within and adjacent to the Project area. Potential prey is present, and burrows of suitable size were observed within the Project area. There are 57 CNDDB occurrences reported within 3.1 miles of the Project area. There are 25 CNDDB occurrences reported within 1 mile of the Project area, the most recent dated 2004.
BIRDS			
Agelaius tricolor Tricolored Blackbird	-- / ST&CSC / --	Nest in colonies in dense riparian vegetation, along rivers, lagoons, lakes, and ponds. Forages over grassland or aquatic habitats.	**Moderate (nesting):** Limited suitable riparian habitat is present within the Project area. There are 32 CNDDB occurrences reported within 3.1 miles of the Project area, the most recent is dated 2015.

Species	Status (USFWS/CDFW /CNPS)	General Habitat	Potential Occurrence within Project Area
Ammodramus savannarum Grasshopper Sparrow	-- / CSC / --	Open fields, grassland, hayfields, and prairies.	**Moderate:** Suitable grassland and open pasture habitat is present within the Project area. The Project area is within the species' known breeding range. There are no CNDDB occurrences reported within 3.1 miles of the Project area.
Aquila chrysaetos Golden Eagle	--/ CFP / --	Use rolling foothills, mountain terrain, wide arid plateaus deeply cut by streams and canyons, open mountain slopes, cliffs, and rocky outcrops. Nest in secluded cliffs with overhanging ledges as well as large trees.	**Moderate (nesting):** Suitable foothill grassland habitat is present within the Project area, but little nesting habitat was observed. This species was observed in flight during the April 2022 reconnaissance-level surveys.
Asio flammeus Short-Eared Owl	-- / CSC / --	Usually found in open areas with few trees, such as annual and perennial grasslands, prairies, meadows, dunes, irrigated lands, and saline and freshwater emergent marshes. Dense vegetation is required for roosting and nesting cover. This includes tall grasses, brush, ditches, and wetlands. Open, treeless areas containing elevated sites for perching, such as fence posts or small mounds, are also needed. Some individuals breed in northern California.	**Moderate (nesting):** Suitable grassland, pasture, and wetland habitats are present within the Project area. The Project area is within the species' known breeding range. There are no CNDDB occurrences reported within 3.1 miles of the Project area.
Athene cunicularia Burrowing Owl	-- / CSC / --	Year-round resident of open, dry grassland and desert habitats, and in grass, forb and open shrub stages of pinyon-juniper and ponderosa pine habitats. Frequent open grasslands and shrublands with perches and burrows. Use rodent burrows (often California ground squirrel) for roosting and nesting cover. Pipes, culverts, and nest boxes may be substituted for burrows in areas where burrows are not available.	**High:** Suitable open grassland habitat is present within and adjacent to the Project area. Presence of ground squirrel burrows provide suitable nesting habitat. There are 69 CNDDB occurrences reported within 3.1 miles of the Project area and 29 occurrences within one mile of the Project area.

Species	Status (USFWS/CDFW /CNPS)	General Habitat	Potential Occurrence within Project Area
Buteo swainsoni Swainson's Hawk	-- / ST / --	Generally found associated with plains, range, open hills, and sparse trees. Suitable nesting habitat includes trees within mature riparian forest or corridors, lone oak trees and oak groves, and mature roadside trees. Nest sites are generally adjacent to, or within easy flying distance to suitable foraging habitat that provides available prey resources. Within California, the majority of breeding for this species occurs within the Central Valley.	**Moderate (nesting):** This species was observed during the April 2022 surveys soaring above grassland and agricultural habitats. Suitable foraging and nest sites are present within the Project area. The Project area is within the known range of this species.
Circus hudsonius Northern Harrier	-- / CSC / --	Generally found in flat open areas with tall, dense grasses, shrubs, and edges for cover and breeding. Use tall grasses in wetlands or at wetland borders for nesting.	**Moderate (nesting):** This species was observed in flight during the April 2022 surveys. Suitable grassland foraging habitat is present within the Project area and limited wetland nesting habitat is present.
Elanus leucurus White-Tailed Kite	-- / CFP / --	Open groves, river valleys, marshes, and grasslands. Prefer such area with low roosts (fences etc.). Nest in shrubs and trees adjacent to grasslands.	**Moderate (nesting):** Suitable foraging and nesting habitat is present within the Project area. The Project area is within the known range of this species.
Lanius ludovicianus Loggerhead Shrike	-- / CSC / --	Resident in dry open grasslands and agricultural areas.	**Moderate (nesting):** Suitable foraging habitat is present within the Project area; limited nesting habitat was observed. The Project area is within the known breeding range for this species. There are two CNDDB occurrences within 3.1 miles of the Project area, the most recent dated 2005.

Species	Status (USFWS/CDFW /CNPS)	General Habitat	Potential Occurrence within Project Area
Melospiza melodia Song Sparrow ("Modesto" population)	-- / CSC / --	A common resident of most of California, except in higher mountains and southern deserts. Prefers riparian, fresh or saline emergent wetland, and wet meadows at all seasons. Breeds in riparian thickets of willows, other shrubs, vines, and tall herbs, and in fresh or saline emergent vegetation. In northern California also breeds in damp thickets and coastal scrub where fog drip and a moist climate compensate for a lack of surface water. Usually avoids densely wooded habitats, except along edges.	**Moderate (nesting):** Suitable wetland foraging and nesting habitat is present within the Project area. The Project area is within the known yearlong range for this species.
Xanthocephalus Yellow-Headed Blackbird	-- / CSC / --	Found in freshwater marshes and sloughs, fields, and open pastures. Breeds in freshwater sloughs, marshy lake borders, tall cattails growing in water up to 3-4' deep.	**Moderate (nesting):** Suitable foraging and nesting habitat is present within the Project area. The Project area is within the known range for this species. There are no CNDDB occurrences reported within 3.1 miles of the Project area.
AMPHIBIANS			
Ambystoma californiense California Tiger Salamander - Central California DPS	FT / ST / --	Annual grassland and grassy understory of valley-foothill hardwood habitats in central and northern California. Need underground refuges and vernal pools or other seasonal water sources.	**Moderate:** Suitable upland and breeding habitat is present within and adjacent to the Project area. The Project area is within the known range of this species. There are five CNDDB occurrences reported within 1.3 miles of the Project area, the most recent dated 2016.

Species	Status (USFWS/CDFW/CNPS)	General Habitat	Potential Occurrence within Project Area
Rana draytonii California red-legged frog	FT / CSC / --	Lowlands and foothills in or near permanent or late-season sources of deep water with dense, shrubby, or emergent riparian vegetation. During late summer or fall adults are known to use a variety of upland habitats with leaf litter or mammal burrows.	**Moderate:** Suitable upland and breeding habitat is present within and adjacent to the Project area. There are 48 CNDDB occurrences reported within 3.1 miles of the Project area and 11 occurrences within one mile of the Project area, the most recent dated 2017.
Spea hammondii Western spadefoot toad	-- / CSC / --	Grasslands with shallow temporary pools are optimal habitats for the western spadefoot. Occur primarily in grassland habitats but can be found in valley and foothill woodlands. Vernal pools are essential for breeding and egg laying.	**Moderate:** Potential ephemeral pool breeding habitat was observed in the Project area. The Project area is within the known range of this species.
REPTILES			
Anniella pulchra Northern California legless lizard	-- / CSC / --	Requires moist, warm habitats with loose soil for burrowing and prostrate plant cover, often forages in leaf litter at plant bases; may be found on beaches, sandy washes, and in woodland, chaparral, and riparian areas.	**Moderate:** The Project area is within the known range of this species. There are no CNDDB occurrences reported within 3.1 miles of the Project area. Suitable habitat may occur within sandy washes where shrubs and leaf litter are present.
Arizona elegans occidentalis California glossy snake	-- / CSC / --	Inhabits arid scrub, rocky washes, grasslands, chaparral. Appears to prefer microhabitats of open areas and areas with soil loose enough for easy burrowing.	**Moderate:** Suitable foraging and burrowing habitat is present within the Project area. The Project area is within the known range for this species. There are three CNDDB occurrences reported within 3.1 miles of the Project area, the most recent dated 1986.

Species	Status (USFWS/CDFW /CNPS)	General Habitat	Potential Occurrence within Project Area
Emys marmorata Western pond turtle	-- / CSC / --	Associated with permanent or nearly permanent water in a wide variety of habitats including streams, lakes, ponds, irrigation ditches, etc. Require basking sites such as partially submerged logs, rocks, mats of vegetation, or open banks.	**Present:** This species was observed in an intermittent channel just south of Mountain House Road. Other freshwater habitats such as ponds and irrigation ditches are present in the Project area and could provide habitat for this species.
Masticophis flagellum ruddocki San Joaquin whipsnake	-- / CSC / --	Variety of habitats-deserts, scrub land, juniper-grassland, woodland, thorn forest, and farmland. Generally avoid dense vegetation. Ranges from Arbuckle in the Sacramento southward to the Grapevine in the Kern County portion of the San Joaquin Valley and westward into the inner South Coast Ranges. An isolated population also occurs in the Sutter Buttes.	**Moderate:** Suitable habitat is present within the Project area. The Project area is within the known range of this species. There are eight CNDDB occurrences reported within 3.1 miles of the Project area, the most recent dated 2004.
Phrynosoma blainvillii Coast horned lizard	-- / CSC / --	Associated with open patches of sandy soils in washes, chaparral, scrub, and grasslands.	**Moderate:** Limited suitable habitat is present in the Project area. The Project area is within the known range for this species. There are four CNDDB occurrences reported within 3.1 miles of the Project area, the most recent dated 1992.
Thamnophis gigas Giant garter snake	FT / ST / --	Essential habitat components include adequate water during early spring through mid-fall, emergent, herbaceous wetland vegetation (e.g., cattail and bulrush), grassy banks and opening in waterside vegetation, and higher elevation upland for refuge from flood waters in the winter.	**Moderate:** Limited suitable aquatic foraging habitat was observed within the Project area. The Project area is within the known range of this species.

Species	Status (USFWS/CDFW /CNPS)	General Habitat	Potential Occurrence within Project Area
INVERTEBRATES			
Branchinecta longiantenna Longhorn fairy shrimp	FE / -- / --	Require ephemeral pools with no flow. Restricted distribution; Eastern edge of the Central Coast Mountains Region. Require ephemeral pools, typically associated with clear to turbid, clay and grass-bottomed pools.	**Moderate:** Limited ephemeral pool habitat was observed in the Project area. There is one CNDDB occurrence reported within 3.1 miles of the Project area.
Branchinecta lynchi Vernal pool fairy shrimp	FT / -- / --	Require ephemeral pools with no flow. Associated with vernal pool/grasslands from near Red Bluff (Shasta County), through the central valley, and into the South Coast Mountains Region. Require ephemeral pools with no flow.	**Moderate:** The Project area is within the known species range. Potential ephemeral pool, ditch and pond habitat was observed in the Project area.
Lepidurus packardi Vernal pool tadpole shrimp	FE / -- / --	Endemic to vernal pools in grasslands of the Central Valley, Central Coast mountains, and South Coast mountains.	**Moderate:** The Project area is within the known species range. Potential ephemeral pool, ditch, alkaline wetland, and pond habitat was observed in the Project area.
PLANTS			
Astragalus tener var. tener Alkali milk-vetch	-- / -- / 1B	Playas, valley and foothill grassland on adobe clay, and vernal pools on alkaline soils at elevations of approximately 3-200 feet. Annual herb in the Fabaceae family; blooms March-June.	**Moderate:** Suitable grassland and alkaline habitats are present within the Project area.
Atriplex cordulata var. cordulata Heartscale	-- / -- / 1B	Chenopod scrub, meadows and seeps, and (sandy) valley and foothill grassland on saline or alkaline soils, at elevations of approximately 0-1,840 feet. Annual herb in the Chenopodiaceae family; blooms April-October.	**Moderate:** Suitable grassland and alkaline habitats are present within the Project area.
Atriplex coronata var. vallicola Lost Hills crownscale	-- / -- / 1B	Chenopod scrub, valley and foothill grasslands, and vernal pools on alkaline soils at elevations of approximately 164-2,085 feet. Annual herb in the Chenopodiaceae family; blooms April-September.	**Moderate:** Suitable grassland and alkaline habitats are present within the Project area.

Species	Status (USFWS/CDFW /CNPS)	General Habitat	Potential Occurrence within Project Area
Atriplex depressa Brittlescale	-- / -- / 1B	Chenopod scrub, meadows and seeps, playas, valley and foothill grassland, and vernal pools on alkali scalds or clay soils at elevations of approximately 3-1,050 feet. Annual herb in the Chenopodiaceae family; blooms April-October.	**Moderate:** Suitable grassland and alkaline habitats are present within the Project area. The Project area is near the edge of the limited range of this species.
Atriplex minuscula Lesser saltscale	-- / -- / 1B	Chenopod scrub, playas, and valley and foothill grassland on alkali or sandy soils at elevations of approximately 50-660 feet. Annual herb in the Chenopodiaceae family; blooms May-October.	**Moderate:** Suitable grassland and alkaline habitats are present within the Project area. The Project area is near the edge of the limited range of this species.
Atriplex persistens Vernal pool smallscale	-- / -- / 1B	Usually occurs in wetlands and alkaline vernal pools up to approximately 380 feet in elevation, occasionally occurs in non-wetlands. Annual herb in the Chenopodiaceae family; blooms June-October.	**Moderate:** Suitable grassland and alkaline habitats are present within the Project area. The Project area is near the edge of the limited range of this species.
Atriplex subtilis Subtle orache	-- / -- / 1B	Valley, foothill grassland, and saline depressions up to approximately 230 feet in elevation. Annual herb in the Chenopodiaceae family; blooms June-October.	**Moderate:** Suitable grassland and alkaline habitats are present within the Project area. The Project area is near the edge of the limited range of this species.
Blepharizonia plumosa Big tarplant	-- / -- / 1B	Valley and foothill grassland at elevations of approximately 98-1,660 feet. Annual herb in the Asteraceae family; blooms July-October.	**Moderate:** Suitable grassland habitat is present within the Project area.
Caulanthus lemmonii Lemmon’s jewel flower	-- / -- / 1B	Open, grassy areas on hillside slopes and in fields, canyons, and arroyos. Soils include alkaline soils, shaley clay, sandstone talus, and decomposed serpentine. Predominantly found within valley and foothill grassland and occasionally in pinyon and juniper woodland at elevations of approximately 260-4,010 feet. Annual herb in the Brassicaceae family; blooms March-May.	**Moderate:** Suitable grassland and alkaline habitats are present within the Project area. There are no serpentine soils or talus slopes observed within the Project area.

Species	Status (USFWS/CDFW /CNPS)	General Habitat	Potential Occurrence within Project Area
Chloropyron molle ssp. hispidum Hispid salty bird's-beak	-- / -- / 1B	Meadows, seeps, playas, and valley and foothill grassland on alkaline soils at elevations of 1-155 meters. Annual hemiparasitic herb in the Orobanchaceae family; blooms June-September.	**Moderate:** The Project area is near the edge of the limited range of this species. Suitable grassland and alkaline habitats are present within the Project area.
Delphinium recurvatum Recurved larkspur	-- / -- / 1B	Chenopod scrub, cismontane woodlands, and valley and foothill grasslands on alkaline soils at elevations of approximately 3-2,500 feet. Perennial herb in the Ranunculaceae family; blooms March-June.	**Moderate:** The Project area is near the edge of the limited range of this species. Suitable grassland and alkaline habitats are present within the Project area.
Eryngium spinosepalum Spiny-sepaled button-celery	-- / -- / 1B	Valley and foothill grassland and vernal pools at elevations of approximately 260-3,200 feet. Annual/perennial herb in the Apiaceae family; blooms April-June.	**Moderate:** The Project area is near the edge of the limited range of this species. Suitable grassland habitats are present within the Project area.
Eschscholzia rhombipetala Diamond-petaled California poppy	-- / -- / 1B	Valley and foothill grassland on alkaline and clay soils at elevations of approximately 0-3,200 feet. Annual herb in the Papaveraceae family; blooms March-April.	**Moderate:** The Project area is near the edge of the limited range of this species. Suitable grassland and alkaline habitats are present within the Project area.
Extriplex joaquiniana San Joaquin spearscale	-- / -- / 1B	Meadows and seeps, playas, chenopod scrub, and valley and foothill grassland on alkaline soils at elevations of approximately 3-2,740 feet. Annual herb in the Chenopodiaceae family; blooms April-October.	**Moderate:** The Project area is near the edge of the limited range of this species. Suitable grassland and alkaline habitats are present within the Project area.
Hibiscus lasiocarpus var. occidentalis Wooly rose-mallow	-- / -- / 1B	Freshwater marshes, swamps at elevations of approximately 0-395 feet. Perennial rhizomatous herb in the Malvaceae family; blooms June-September.	**Moderate:** The Project area is near the southern edge of the known range of this species. Limited wetland habitats are present within the Project area.
Layia munzii Munz's tidy-tips	-- / -- / 1B	Chenopod scrub and valley and foothill grasslands on alkaline clay soils at elevations of approximately 490-2,300 feet. Annual herb in the Asteraceae family; blooms March-April.	**Moderate:** Suitable grassland and alkaline habitats are present within the Project area. There are two CNDDB occurrences reported within one mile of the Project area.

Species	Status (USFWS/CDFW /CNPS)	General Habitat	Potential Occurrence within Project Area
Lepidium jaredii ssp. album Panoche pepper-grass	-- / -- / 1B	Valley and foothill grassland in clay soils on steep slopes at elevations of approximately 610-905 feet. Annual herb in the Brassicaceae family; blooms February-June.	**Moderate:** The Project area is near the eastern edge of this species' known range. Suitable valley grassland habitat is present within the Project area.
Navarretia nigelliformis ssp. radians Shining navarretia	-- / -- / 1B	Cismontane woodland, valley and foothill grasslands, and vernal pools at elevations of approximately 250-3,280 feet. Annual herb in the Polemoniaceae family; blooms April-July.	**Moderate:** The Project area is near the edge of this species' known range. Suitable valley grassland habitat is present within the Project area.
Navarretia prostrata Prostrate vernal pool navarretia	-- / -- / 1B	Meadows, seeps, vernal pools, and mesic areas of coastal scrub and valley and foothill grassland at elevations of approximately 50-6,925 feet. Annual herb in the Polemoniaceae family; blooms April-July.	**Moderate:** The Project area is near the edge of this species' known range. Suitable valley grassland and wetland habitats are present within the Project area.
Puccinellia simplex California alkali grass	-- / -- / 1B	Valley and foothill grasslands, chenopod scrub, meadows and seeps, and vernal pools. Found in alkaline, vernally mesic, sinks, flats, and lake margins. Occurs at elevations of approximately 7-3,050 feet. Annual herb in the Poaceae family; blooms March-May.	**Moderate:** Suitable grassland and alkaline habitats are present within the Project area. There are two CNDDB occurrences reported within five kilometers of the Project area, the most recent dated 2006.
Sagittaria sanfordii Sanford's arrowhead	-- / -- / 1B	Freshwater wetlands and ponds up to approximately 985 feet in elevation. Perennial herb in the Alismataceae family; blooms May-October.	**Moderate:** Limited freshwater wetland habitat is present within the Project area. There is one CNDDB occurrence within one mile of the Project area, dated 1980.
Spergularia macrotheca var. longistyla long-styled sand-spurrey	-- / -- / 1B	Meadows, seeps, marshes, and swamps in alkaline soils at elevations approximately 0-840 feet. Perennial herb in the Caryophyllaceae family; blooms February-May.	**Moderate:** The Project area is near the eastern edge of this species' known range. Limited alkaline wetland habitat is present within the Project area.

Species	Status (USFWS/CDFW /CNPS)	General Habitat	Potential Occurrence within Project Area
Trichocoronis wrightii var. wrightii Wright's trichocoronis	-- / -- / 2B	Riparian, meadows, marsh, and vernal-pools habitats up to approximately 1,640 feet in elevation. Annual herb in the Asteraceae family; blooms May-September.	**Moderate:** The Project area is near the edge of this species' known range. Limited suitable wetland habitat is present within the Project area.
Tropidocarpum capparideum Caper-fruited tropidocarpum	-- / -- / 1B	Alkaline hills in valley and foothill grassland at elevations of 3-1,495 feet. Annual herb in the Brassicaceae family; blooms March-April.	**Moderate:** Limited suitable habitat is present within the Project area. There is one recent CNDDB occurrence within five kilometers of the Project area dated 2019.

Sources: California Native Plant Society (CNPS) 2022; Calflora 2022; CDFW 2022b; Jepson 2022

STATUS DEFINITIONS

Federal

FE = listed as Endangered under the federal Endangered Species Act
FT = listed as Threatened under the federal Endangered Species Act
FC = Candidate for listing under the federal Endangered Species Act
UR = Species that have been petitioned for listing under the ESA and for which a 90 day and/or 12 Month finding has not been published in the Federal Register, as well as species being reviewed through the candidate process but the CNOR has not yet been signed
-- = no listing

State

SE = listed as Endangered under the California Endangered Species Act
ST = listed as Threatened under the California Endangered Species Act
SC = Candidate for listing under California Endangered Species Act
SR = listed as Rare under the California Endangered Species Act
CFP = California Fully Protected Species
CSC = CDFW Species of Concern
-- = no listing
CNPS = California Native Plant Society
1B = California Rare Plant Rank 1B species; plants rare, threatened, or endangered in California and elsewhere
2B = California Rare Plant Rank 2B species; plants rare, threatened, or endangered in California, but more common elsewhere
-- = no listing

POTENTIAL TO OCCUR

Present = known occurrence of species within the Project area; presence of suitable habitat conditions; or observed during field surveys
High = known occurrence of species in the vicinity from the CNDDB or other documentation; presence of suitable habitat conditions
Moderate = known occurrence of species in the vicinity from the CNDDB or other documentation; presence of marginal habitat conditions within the Project area

M.2 Assessment Methodology

The impact analysis for biological resources was conducted by evaluating the potential for construction and/or operation of the Proposed Action to result in adverse effects on special-status species or sensitive habitats that would meet or exceed any of the significance criteria described below.

M.3 Significance Criteria

The significance criteria described below were developed in accordance with the CEQA Guidelines to determine the significance of potential impacts related to biological resources. Impacts would be significant if implementing the Proposed Action would:

- 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 CDFW, USFWS, or National Marine Fisheries Service (NMFS).
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community or critical habitat identified in local or regional plans, policies, or regulations or by the CDFW, USFWS, or NMFS.
- 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.
- 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.
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

M.4 Project Impacts and Mitigation Measures

M.4.1 No Action/No Project Alternative

Under the No Action/No Project Alternative (subsequently identified as the No Action Alternative), no construction activities would occur and impacts on biological resources would remain similar to those experienced under existing conditions. Operations and maintenance activities would be similar to or would slightly increase over existing conditions as a result of increased effort required to address issues that may arise due to aging infrastructure. The Bureau of Reclamation (Reclamation) would continue to maintain the facilities in compliance with USFWS biological opinion titled *Formal Endangered Species Consultation on the Operations and Maintenance Program Occurring on Bureau of Reclamation Lands within the South-Central California Area Office* that was issued on February 17, 2005 (herein referred as 2005 USFWS biological opinion) (USFWS 2005), the 2019 USFWS and National Marine Fisheries Service (NMFS) Biological Opinions (USFWS 2019; NMFS 2019), the 2020 Reinitiation of Consultation on Long-Term Water Transfers Record of Decision (Reclamation 2020), and all future applicable biological opinions. Operations and maintenance of the DMC, including minor construction and earth-moving activities, soil erosion control, and weed and pest control activities, would occur within the existing canal footprint and canal Right-of-Way (ROW) and would not result in significant impacts on biological resources.

Under the No Action Alternative, deficient bridges would be partially submerged when the canal is operated at the design flow. These deficient bridges provide potential roosting habitat for the three special-status bat species with the potential to occur in the Project area—pallid bat, Townsend's big-eared bat, and western mastiff bat. Reduction in roosting habitat would be localized and temporary, and any resultant adverse effects on these species would likely be short-term and minor**. Therefore, such impacts would be less than significant.**

M.4.2 Raise Deficient Structures Alternative (Proposed Action)

Under the Proposed Action, south-of-Delta exports are expected to increase compared to existing conditions, as operation of the DMC at design capacity would allow for the full use of Jones Pumping Plant. Increased south-of-Delta exports could impact biological resources through resultant changes to hydrodynamic conditions that could impact water quality conditions (e.g., salinity, temperature, total dissolved solids levels) in the central and southern Delta. However, south-of-Delta export rates that would occur as a consequence of the Proposed Action are within the range considered in the 2019 USFWS and NMFS Biological Opinions (USFWS 2019; NMFS 2019), and thus, are already addressed by the terms and conditions specified in these documents. Furthermore, operation and maintenance of the Proposed Action would be conducted in accordance with all relevant existing or future regulatory requirements and the terms and conditions specified in all applicable future biological opinions. Additionally, operation of the Proposed Action could affect the water elevation (i.e., storage levels) at Lake Oroville, Folsom Lake, Shasta Reservoir, and San Luis Reservoir, which could impact biological resources occurring at these locations. However, the expected percentage change in storage levels at these reservoirs relative to existing conditions would be less than five percent across all water year types, as summarized in Table M-3 through Table M-6, which is within the range attributable to noise associated with the model outputs. **As such, the Proposed Action would have less than significant operational impacts on biological resources.**

Table M-3. Averaged Modeled Difference in Total Annual Storage at Lake Oroville between Existing Conditions and the Proposed Action by Water Year Type (1,000 acre-feet)

Sacramento River Water Year Type	Total Average Existing Conditions	Proposed Action	Difference from Existing Conditions	Percent Change
Wet	33,906	33,877	-29	0%
Above Normal	30,073	29,969	-104	0%
Below Normal	26,324	26,153	-170	-1%
Dry	21,439	21,358	-81	0%
Critical	16,552	16,411	-141	-1%
All	26,774	26,682	-92	0%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.

Table M-4. Averaged Modeled Difference in Total Annual Storage at Folsom Lake between Existing Conditions and the Proposed Action by Water Year Type (1,000 acre-feet)

Sacramento River Water Year Type	Total Average Existing Conditions	Proposed Action	Difference from Existing Conditions	Percent Change
Wet	8,598	8,564	-34	0%
Above Normal	8,018	7,985	-33	0%
Below Normal	7,872	7,777	-95	-1%
Dry	6,999	6,893	-106	-2%
Critical	5,411	5,295	-116	-2%
All	7,572	7,500	-72	-1%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.

Table M-5. Averaged Modeled Difference in Total Annual Storage at Shasta Reservoir between Existing Conditions and the Proposed Action by Water Year Type (1,000 acre-feet)

Sacramento River Water Year Type	Total Average Existing Conditions	Proposed Action	Difference from Existing Conditions	Percent Change
Wet	44,377	44,294	-84	0%
Above Normal	42,620	42,467	-154	0%
Below Normal	41,840	41,513	-327	-1%
Dry	39,215	38,685	-530	-1%
Critical	31,417	30,608	-809	-3%
All	40,657	40,318	-340	-1%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.

Table M-6. Averaged Modeled Difference in Total Annual Storage at San Luis Reservoir between Existing Conditions and the Proposed Action by Water Year Type (1,000 acre-feet)

Sacramento River Water Year Type	Total Average Existing Conditions	Proposed Action	Difference from Existing Conditions	Percent Change
Wet	14,898	15,037	139	1%
Above Normal	11,555	11,534	-21	0%
Below Normal	12,569	12,708	139	1%
Dry	11,176	11,245	69	1%
Critical	10,118	10,261	142	1%
All	12,495	12,595	101	1%

Notes: Modeling Period 1922-2003, Data results from CalSim II modeling. CalSim II model output includes minor fluctuations of up to five percent because of model assumptions and approaches.

M.4.2.1 Impact BIO-1: 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 CDFW, USFWS, or NMFS.

The Proposed Action would have potentially significant direct and indirect impacts on sensitive species under the jurisdiction of CDFW and/or USFWS. As described in the discussion of impacts on specific biological resources provided below, these impacts include the potential for direct injury, mortality, stress, or behavioral effects from construction noise and activity and indirect impacts such as increased risk of predation, increased competition, and reproductive failure from disturbance or loss of habitat. Estimated temporary and permanent impacts on existing habitat types within the Project area are presented in Table M-7.

Table M-7. Estimated Habitat Impacts Under the Proposed Action

Habitat Type	Temporary Impact (Acres)	Permanent Impact (Acres)
Agriculture	283.7	0.4
Annual Grassland	765.8	4.1
Alkaline Emergent Wetland	7.2	0
Freshwater Emergent Wetland	21.2	0
Freshwater Forested Wetland	2.1	0
Intermittent Channel	10.3	0
Irrigation Canal	6.7	0.1
Maintained Agriculture Ditches and Drainage Features	108.6	0.7
Pond	1.4	0
Riparian Woodland	1.4	0
Ruderal/Developed	2,624.9	41.7
DMC - Riverine	1,526.7	0
DMC - Freshwater Emergent Wetland	54.5	0
Total	5,414.5	47

Mitigation measures (MMs) BIO-1 through BIO-15 include the following requirements to avoid or minimize impacts to the extent practicable: pre-construction surveys for special-status plants and animals to determine the presence of these species, implementation of a biological resources monitoring and management plan, environmental awareness training for construction personnel, implementation of general (e.g., litter control, marking construction areas, and appropriate erosion control materials) and species-specific measures (e.g., avoidance buffers, modifying timing of construction activities, biological monitoring, and preservation of habitats). **With implementation of MMs BIO-1 through BIO-15, impacts on special-status species would be less than significant**.

Special-Status Plants

As summarized in Table M-2, 24 special-status plant species have the potential to occupy portions of the Project area where suitable habitats, such as annual grassland, alkaline and freshwater wetlands, and ponds are present. These habitats occur primarily along the landward edge of the DMC ROW where ground-disturbing activities, including clearing/grubbing for construction access and materials staging as well as expansion of the existing canal embankment footprint along sections where the embankment would be raised could impact suitable habitat for special-status plant species, as well as existing plants. No special-status plants were observed during the surveys conducted in 2022, and existing habitats within the Project area generally represent marginal growing conditions for special-status plants due to ongoing and historical anthropogenic disturbance. However, if special-status plants are present in areas that would be subject to ground disturbance such plants could be harmed or killed through interactions with construction equipment or personnel or through habitat modification resulting in decreased habitat suitability. **With the implementation of MM BIO-1, construction-related impacts on special-status plants would be less than significant.**

Special-Status Animals

Multiple special-status animals were observed during the April 2022 surveys, as described in Section 4.3.1 of Attachment 1, and ground-disturbing activities associated with the Proposed Action could have significant temporary and permanent impacts on special-status animal species if they are present in or immediately adjacent to the areas subject to ground disturbance. MM BIO-2 includes general measures that are intended to avoid or minimize potential impacts on all special-status animal species. **With the implementation of these measures, in addition to the species-specific measures described in Section M.4.3, potential impacts on all special-status animal species would be less than significant.**

Pallid Bat, Townsend's Big-Eared Bat, and Western Mastiff Bat

No special-status bat species were observed during the April 2022 surveys, but suitable grassland and open agricultural foraging habitat is present along the outer edges of the canal ROW and potential roost sites provided by trees and canal infrastructure (e.g., bridges) occur throughout the Project area. Because individuals are generally expected to readily avoid active work sites, direct impacts on bats are not expected when bats are not using a roost site as a maternity colony (i.e., a breeding roost used to bear and rear young). Bats may form maternity colonies in trees, bridges, and tunnels within the Project area. If a tree or piece of canal infrastructure is removed that contains an active bat maternity colony, such actions could lead to bat mortality or injury. Additionally, indirect impacts may occur from construction-related noise if a maternity colony is present in or adjacent to the Project area. Substantial noise disturbance could result in adults temporarily or permanently leaving the maternity colony. To minimize potential impacts on special-status bat species MM BIO-3 would be incorporated into the Proposed Action. **With the implementation of these measures, impacts on bats would be less than significant**.

American Badger

The Project area and surrounding grassland, where present, may provide badgers with suitable foraging habitat, potential prey, and friable soils for denning. Although no badgers were observed during the April 2022 surveys, multiple suitable-sized dens were observed along the banks of the canal and in surrounding annual grassland habitat. Therefore, construction activities may lead to reproductive failure in badgers within or immediately adjacent to the Project area by disrupting foraging activities and precluding the formation of natal dens. Additionally, direct disturbance from construction activities, such as operation of vehicles and heavy equipment and earth-moving operations around dens could result in significant impacts due to stress, injury, or mortality to individual badgers and/or destruction of their dens. These impacts would negatively affect American badgers if any were to be present in or adjacent to the Project area, and such impacts would be significant. **However, with the implementation of MM BIO-4, impacts on the American badger would be less than significant**.

San Joaquin Kit Fox

San Joaquin kit foxes (SJKF) are known to occupy human-altered habitats, where denning opportunities and suitable prey are available, and the species frequently uses man-made features (e.g., culverts in roadbeds and pipes) in developed landscapes. SJKF presence in the western San Joaquin Valley is largely limited to a narrow belt of suitable habitat between Interstate 5 and the Coast Range foothills. As such, known occurrences of the species are largely concentrated west of the Project area. Although no SJKFs were observed during the April 2022 field surveys, the Project area and surrounding grassland, where present, provide suitable foraging habitat, potential prey, and existing ground squirrel burrows for denning. Therefore, construction activities implemented under the Proposed Action could cause the destruction of potential kit fox dens—potentially resulting in mortality if dens are occupied—and may temporarily displace kit foxes from preferred habitats, thereby increasing intraspecific competition for resources and making displaced individuals more susceptible to predation or vehicle strikes. Construction may also result in reproductive failure by disrupting foraging activities, increasing human disturbance, and precluding the formation of natal dens in the Project area. The loss of potential dens and temporarily reduced habitat access would negatively affect SJKFs if any were to be present in the vicinity during Project implementation, and such impacts would likely be significant. **However, with the implementation of MM BIO-5, impacts on the SJKF would be less than significant**.

Tricolored Blackbird and Yellow-Headed Blackbird

Tricolored Blackbirds and Yellow-Headed Blackbirds both breed near fresh water, preferably in emergent wetlands with tall, dense cattails or tules. Preferred foraging habitats for the tricolored blackbird include crops such as rice, alfalfa, irrigated pastures, and ripening or cut grain fields (e.g., oats, wheat, silage), as well as annual grasslands, cattle feedlots, and dairies (Beedy and Hamilton 1999). The Yellow-Headed Blackbird uses similar foraging habitat, preferring open fields and areas near water. Although neither species was observed during were observed during the April 2022 surveys, suitable habitat for both species within the Project area includes freshwater emergent wetlands, ponds, and maintained agricultural ditches and drainage features with perennial water and sufficient vegetation. Activities associated with the Proposed Action, such as vegetation clearance to facilitate construction access, could result in the loss or alteration of breeding habitat for these species and/or indirect (noise) disturbance to nest sites, which could result in nest abandonment, loss of young, or reduced health and vigor of eggs and/or nestlings. **However, with the implementation of MM BIO-6 impacts on the Tricolored Blackbird and the Yellow-Headed Blackbird would be less than significant**.

Burrowing Owl

This species was not observed during the April 2022 surveys. However, suitable habitat featuring friable soils, existing small mammal burrows, and grazed grassland is present within and adjacent to the Project area. Open developed areas, canal embankments, and fallow agricultural fields also have the potential to support Burrowing Owls. In addition, this species has potential to use canal infrastructure, such as culverts, for nesting. If Burrowing Owls are present during Project implementation, the Proposed Action could result in a temporary or permanent loss of Burrowing Owl habitat and displacement of owls where Project activities affect potential burrow sites. Direct disturbance from construction activities, such as operation of vehicles and heavy equipment and earth-moving operations around burrows could result in significant impacts due to stress, injury, or mortality to individual owls and/or destruction of their burrows. Potential impacts are considered to be largely temporary because small mammal burrows are expected to become reestablished along the earthen-lined segments of the DMC that would be modified under the Proposed Action once construction is complete. To minimize potential impacts on the Burrowing Owl, MM BIO-7 would be implemented. **With the implementation of these measures, impacts on Burrowing Owls would be less than significant**.

Golden Eagle, Swainson's Hawk, Northern Harrier, and White-Tailed Kite

Golden Eagle, Swainson's Hawk, and Northern Harrier were observed soaring over portions of the Project area during the April 2022 surveys. Although no White-Tailed Kites were observed, suitable foraging and nesting habitat for the species occurs throughout the Project area. Implementation of the Proposed Action could result in the temporary and permanent loss of foraging habitat (i.e., annual grassland and agricultural fields) through the staging of equipment, temporary construction access, and other construction activities that may occur along the outer edge of the canal ROW. Additionally, direct disturbance to nests and/or breeding adults may occur where Project activities occur near or involve the removal of suitable nesting trees for Swainson's Hawks and/or White-Tailed Kites or ground disturbance in or along suitable nesting habitat for Northern Harriers (i.e., tall grasses in wetlands or at wetland borders). Further, indirect disturbance due to construction activities, such as noise and vibration associated with the operation of vehicles and heavy equipment, could have significant impacts on these special-status raptor species in the form of stress, injury, or mortality to individuals where construction activities occur near active nests. To minimize potential impacts on golden eagles, Swainson's Hawks, Northern Harriers, and White-Tailed Kites, MM BIO-8 would be implemented. **With the implementation of these measures, impacts on these special-status raptor species would be less than significant.**

Other Migratory Birds and Raptors

Several species of migratory birds and raptors were observed during the April 2022 surveys. Construction activities may be scheduled during the avian breeding season (generally February 1 through August 31, depending on the species) and could disturb nesting birds in or adjacent to the Project area. Construction-related disturbance could result in the incidental loss of fertile eggs or nestlings or nest abandonment, which could potentially have significant impacts on local or regional populations of affected bird species. Impacts on nesting birds could result from:

- Tree and shrub removal, which may be necessary to accommodate modifications to canal infrastructure, that could decrease nesting sites for species such as the song sparrow and the loggerhead shrike.
- Ground-disturbing activities (e.g., grubbing and grading to facilitate construction access) that occur within annual grasslands, which could affect ground-nesting birds, such as the grasshopper sparrow and the short-eared owl.
- Noise from construction activities.

- Removal of bridges and other construction activities near the existing bridges that could disturb or remove active cliff swallow nests if they are present.

However, with the implementation of MM BIO-9, impacts on migratory birds and raptors would be less than significant.

California Tiger Salamander and California Red-legged Frog

Neither the California tiger salamander nor the California red-legged frog were observed during the April 2022 surveys. However, based on available information on the species' movement capabilities and known occurrence locations, both species may occur in the portion of the Project area from approximately Tracy northward. In addition to potential aquatic habitat (i.e., seasonal ponds, freshwater emergent or forested wetlands, or maintained agricultural ditches and drainage features that seasonally retain water), portions of the Project area and immediately adjacent areas provide suitable upland habitat for both species—consisting of contiguous areas of annual grassland with existing California ground squirrel burrows for the California tiger salamander and patches of riparian trees or forested shrub wetlands for the California red-legged frog. Therefore, both the California tiger salamander and the California red-legged frog have the potential to occur in the Project area north of Tracy, especially in areas where both suitable upland and aquatic breeding habitat are present. The Proposed Action could result in the temporary and/or permanent loss of aquatic breeding habitat and the displacement of individuals if the limits of work were to overlap suitable habitat for these species along the outer edge of the canal ROW. Direct disturbance from construction activities, such as the operation of vehicles and heavy equipment around upland and breeding habitat, could also result in significant impacts due to stress, injury, or mortality to individuals or destruction of upland refugia. **However, with the implementation of MM BIO-10, impacts on the California tiger salamander and California red-legged frog would be less than significant**.

Western Spadefoot Toad

Western spadefoot toads are largely fossorial and spend most of the year in underground burrows, which they may construct themselves or may inherit from small mammals. Breeding and egg laying occur almost exclusively in shallow, temporary pools formed by heavy winter rains. Although this species was not observed during the April 2022 surveys, annual grasslands featuring existing mammal burrows and friable soils providing habitat for the non-breeding season and ephemeral pools providing potential aquatic habitat occur intermittently throughout the Project area. As such, the implementation of the Proposed Action could result in the temporary and/or permanent loss of western spadefoot toad habitat and displacement of individual toads where Project activities affect potential aquatic breeding habitat and upland burrow sites. Direct disturbance from construction activities, such as operation of vehicles and heavy equipment and earth-moving operations, could result in significant impacts on individuals due to stress, injury, or mortality to individuals or destruction of their burrows. **However, with the implementation of MM BIO-11 impacts on the western spadefoot toad would be less than significant**.

Northern California Legless Lizard, California Glossy Snake, San Joaquin Coachwhip, and Coast Horned Lizard

Although these special-status reptile species were not observed during the April 2022 surveys, annual grassland, sandy intermittent channel, and dry wash habitats providing suitable foraging and/or burrowing habitat for these species occur intermittently throughout the Project area. The implementation of the Proposed Action could result in temporary and/or permanent habitat loss and the displacement of individuals where construction footprints overlap suitable habitat for these species. Direct disturbance from construction activities, such as operation of vehicles and heavy equipment and earth-moving operations, could result in significant impacts due to stress, injury, or mortality to individuals or destruction of their burrows. **However, with the implementation of MM BIO-12 impacts on the Northern California legless lizard, California glossy snake, San Joaquin coachwhip, and coast horned lizard would be less than significant**.

Giant Garter Snake

Although the giant garter snake was not observed during the April 2022 surveys, portions of the Project area provide suitable aquatic resources with emergent vegetation. The potential for giant garter snake to occur within the Project area is highest near where the DMC flows into Mendota Pool because of the presence of suitable habitat and known occurrence of the species in the vicinity. Other suitable aquatic habitat, such as emergent wetlands and vegetated agricultural ditches occurs within the Project area north of Mendota Pool; however, the potential for giant garter snake to occur in these areas is extremely low, owing to the lack of nearby known occurrences. As such, any Project-related impacts on the species are expected to be limited to areas near the Mendota Pool where individuals may be harmed directly through interactions with construction equipment and personnel as well. In addition, indirect impacts could occur from noise and vibration associated with construction work that may displace individuals from protective cover leading to an increased risk of predation or injury from vehicular or foot traffic. **However, with the implementation of MM BIO-13, impacts on the giant garter snake would be less than significant**.

Western Pond Turtle

The western pond turtle was observed during the April 2022 surveys in an intermittent creek immediately south of Mountain House Road, near the northernmost extent of the Project area. Additionally, this species has the potential to occur throughout the Project area where ponds, ditches, and other watercourses that retain water and have suitable adjacent herbaceous vegetation for nest construction and egg laying are present. Similar to the giant garter snake, western pond turtles may be subject to direct harm through interactions with construction equipment and personnel where the limits of ground disturbance overlaps suitable habitat for the species as well as indirectly through noise and vibration associated with construction work that may displace individuals from preferred areas. **However, with the implementation of MM BIO-14, impacts on the western pond turtle would be less than significant**.

Longhorn Fairy Shrimp, Vernal Pool Fairy Shrimp, and Vernal Pool Tadpole Shrimp

No vernal pool branchiopods were observed during the April 2022 surveys. However, the Project area provides freshwater emergent wetland, alkaline emergent wetland and pond habitat that may be suitable for these species, depending on the depth and longevity of inundation. Therefore, these species have the potential to occur in the Project area and to be subject to Project-related impacts. Vernal pool branchiopods could be adversely affected if construction activities were to result in the fill or excavation of vernal pools or alterations to the hydrology of vernal pool habitats. To minimize or avoid any potential impacts on vernal pool branchiopods MM BIO-15 would be implemented. **With the implementation of these measures, impacts on vernal pool branchiopods would be less than significant**.

M.4.2.2 Impact BIO-2: Have a substantial adverse effect on any riparian habitat or other sensitive natural community or critical habitat identified in local or regional plans, policies, or regulations or by the CDFW, USFWS, or NMFS.

The Proposed Action could have potentially significant impacts on sensitive natural communities. Sensitive natural communities are found throughout the Project area, as described in Section M.1. Under the Proposed Action, up to approximately 7.2 acres of alkaline emergent wetland, approximately 21.2 acres of freshwater emergent wetland, approximately 2.1 acres of freshwater forested wetland, approximately 10.3 acres of intermittent channel, approximately 108.6 acres of maintained agriculture ditches and drainage features, approximately 1.4 acres of pond habitat, and approximately 1.4 acres of riparian woodland would be temporarily impacted. Temporary impacts could result from removing vegetation to allow for construction equipment access and materials staging and/or through the process of excavating material from existing borrow sites along the canal ROW.

The Proposed Action would also result in the temporary loss of up to approximately 54.5 acres of emergent wetlands—consisting of narrow bands of emergent vegetation—along the banks of the southernmost 18 miles of the earthen-lined portion of the DMC where in-channel work involving excavation and the lowering of canal water levels would be required to stabilize the existing banks. This habitat loss is considered temporary as it is anticipated that similar wetland habitats would become established along the canal banks subsequent to Project completion. Additionally, the Proposed Action would result in a permanent loss of up to approximately 0.7 acre of maintained agriculture ditches as a result of the expansion of the canal embankment footprint in some areas. However, with the implementation of MM BIO-16, sensitive natural communities will be identified on construction drawings and protected during construction. **Therefore, with the implementation of MM BIO-16, impacts on sensitive natural communities would be less than significant**.

The portion of critical habitat for the California red-legged frog that overlaps the Project area consists of annual grassland and ruderal/developed habitat, and as such likely functions solely as marginal upland and/or dispersal habitat—defined as physical and biological features 3 and 4 in the critical habitat designation (USFWS 2010). However, given the potential for impacts on California red-legged frog critical habitat from construction activities, it is anticipated that formal consultation with USFWS will be required. No activities will be initiated that would affect a federally listed species or designated critical habitat without first completing the appropriate consultation(s) with USFWS and receiving formal notice that the action would not jeopardize the continued existence of the species. **Compliance with measures expected to be determined by USFWS through consultation, and the expected implementation of MM BIO-10 as well as MM BIO-16, would result in the Proposed Action having a less than significant impact on critical habitat for the California red-legged frog.**

Delta smelt critical habitat overlaps portions of the Project area between Mountain House Road and the Tracy Fish Facility. However, the Project area is located downstream of the Tracy Fish Facility, which prevents Delta smelt from entering the canal via the San Joaquin River Delta. Therefore, the Project area does not support any of the biological or physical habitat attributes that are essential to the Delta smelt's conservation (i.e., primary constituent elements). Furthermore, the portion of Delta smelt critical habitat that overlaps the Project area does not maintain factors constituting habitat for the species in surrounding areas. **As such, the Proposed Action would have no impact on critical habitat for Delta smelt.**

M.4.2.3 Impact BIO-3: 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.

According to the findings of the BSR, wetlands and other waters potentially under the jurisdiction of the U.S. Army Corps of Engineers (USACE) and the Regional Water Quality Control Board (RWQCB) occur at numerous locations along the length of the Project area, especially where the outer toe of the existing canal embankment meets the adjoining landscape. As previously noted, the Proposed Action would result in temporary impacts on up to approximately 7.2 acres of alkaline emergent wetland, approximately 21.2 acres of freshwater emergent wetland, approximately 2.1 acres of freshwater forested wetland, approximately 10.3 acres of intermittent channel, approximately 108.6 acres of maintained agriculture ditches and drainage features, approximately 1.4 acres of pond habitat and would result in permanent impacts on up to approximately 0.7 acre of maintained agriculture ditches and drainage features. However, these acreages are based on a reconnaissance-level mapping effort and the actual extent of jurisdictional waters of the U.S. can only be determined by USACE after completion and verification of a formal wetland delineation. Additional features including irrigation canals and the channel of the DMC itself contain some wetland characteristics and will need to be addressed during a formal wetland delineation. Given the nature of expected impacts to potential jurisdictional waters, any applicable permits/authorizations from RWQCB and USACE will be obtained prior to any temporary or permanent impacts on such resources, as described in MM BIO-17, and all terms and conditions of said permits/authorizations will be implemented. Further, where impacts on jurisdictional wetlands and other waters cannot be avoided, restoration and compensatory mitigation will be required to offset any temporary and permanent impacts as described in MM BIO-17. **Therefore, with the implementation of MM BIO-17, impacts on state or federally protected wetlands would be less than significant**.

M.4.2.4 Impact BIO-4: 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.

Implementation of the Proposed Action would have temporary impacts on forested wetlands and intermittent channels that may be used by wildlife as migratory corridors, and therefore could result in potentially significant impacts on the movement of native or resident migratory species. **However, with the implementation of MMs BIO-16 and BIO-17, impacts would be less than significant**.

M.4.2.5 Impact BIO-5: Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

Each county within which the Project area is located has adopted a general plan which addresses protection of biological resources:

- The Fresno County General Plan addresses biological resources in the Natural Resources section, which includes subsections D through F where goals are identified to conserve wetland and riparian areas, fish and wildlife habitat, and valuable vegetation resources in Fresno County (Fresno County 2000).
- The Merced County General Plan – 2030 Update addresses biological resources in the Natural Resources Element, which identifies its primary goal (Goal NR-1) as being to preserve and protect, through coordination with the public and private sectors, the biological resources of the County (Merced County 2013).

- The Stanislaus County General Plan addresses biological resources in the Conservation/Open Space Element, which identifies the protection of wildlife and species of the County as a goal (Goal Ten) (Stanislaus County 2016).
- The San Joaquin County General Plan addresses biological resources in the Natural and Cultural Resources Element, which includes Goal NCR-2. The goal of NCR-2 is to preserve and protect wildlife habitat areas for the maintenance and enhancement of biological diversity and ecological integrity (San Joaquin County 2016).
- The Contra Costa County General Plan addresses biological resources in the Conservation Element, in which three goals are identified that include components related to vegetation and wildlife: to protect ecologically significant lands, wetlands, plant and wildlife habitat (Goal 8-D); to protect rare, threatened and endangered species of fish, wildlife and plants, significant plant communities, and other resources which stand out as unique because of their scarcity, scientific value, aesthetic quality or cultural significance (Goal 8-E); and to encourage the preservation and restoration of the natural characteristics of the San Francisco Bay/Delta estuary and adjacent lands (Goal 8-F) (Contra Costa County 2005).

With implementation of MMs BIO-1 through BIO-17 to avoid or minimize impacts on biological resources, the Proposed Action would not conflict with the goals of these plans. **This impact would be less than significant**.

M.4.3 Mitigation Measures

MM BIO-1: Measures to Minimize Impacts on Special Status Plants.
A botanical survey shall be conducted prior to construction activities to determine the presence or absence of special-status plant species in the Project area. The surveys shall be conducted in general accordance with the *Protocols for Surveying and Evaluating Impacts to Special-Status Native Plant Populations and Natural Communities* (CDFW 2021) and shall be timed to appropriately coincide with the blooming period of special-status plant species with the potential to occur in the Project disturbance areas.

If more than five years lapse after the botanical survey is conducted prior to ground disturbance, two botanical surveys (early and late season) shall be conducted in all suitable habitat located within the Project disturbance areas to determine the presence or absence of special-status plants.

If special-status plant species are found during the botanical surveys, the locations of the special-status plants and a 50-foot buffer will be marked as avoidance areas both in the field using flagging, staking, fencing, or similar devices and on construction plans.

If non-listed, special-status plants are identified during botanical surveys and complete avoidance is not practicable, and the Project would directly or indirectly affect more than 25 percent of a local occurrence by either number of plants or square footage of occupied habitat, a qualified biologist will determine if implementation of a conservation plan is recommended. If federally listed plants are identified during botanical surveys and complete avoidance is not practicable, coordination with USFWS will be conducted as appropriate to develop the conservation plan. No take of federally listed species will occur without an Incidental Take Permit (ITP) from USFWS. If it is determined that the Project would be subject to compliance with the CESA and state-listed plant species are detected in areas where avoidance is impracticable, then CDFW will be consulted and any necessary permits will be obtained.

The special-status plant conservation plan may consist of, but would not necessarily be limited to, purchase of mitigation credits at a regional conservation bank; plant salvage and relocation; collection and subsequent planting of seed or incorporating seed from native nursery into seed mix used for revegetation efforts; stockpiling, storing, and replacing topsoil containing the local seed bank; or other measures determined practicable based on the species and site conditions. If on-site conservation measures are implemented, the objective is to restore the impacted special-status plant species community to pre-existing conditions by providing for the restoration of a self-sustaining population of special-status plants in the general area where the impact occurred at a minimum of a 1:1 ratio (e.g., number of plants, square footage occupied). For on-site conservation measures, the conservation plan will identify success criteria and provide for annual or other regular monitoring to evaluate whether the conservation effort has met the success criteria. The conservation plan will also include measures for remedial actions (e.g., additional plantings, supplemental irrigation, increased monitoring) if monitoring efforts indicate that success criteria are not being met.

For some species and site conditions, the biologist may determine that a conservation plan is not recommended. Some of these circumstances may include but are not limited to the following: (1) there are other nearby populations that will not be disturbed; (2) plant relocation, seeding, or revegetation would not have a reasonable probability of success; (3) implementation of measures could result in detrimental effects on existing special-status plant populations; or (4) incompatibility with required operations and maintenance activities. If the biologist determines, in coordination with USFWS (and/or CDFW if it is determined that the Project would be subject to compliance the CESA) that a conservation plan is not warranted, no additional measures are required.

MM BIO-2: General Measures to Minimize Impacts on Special-Status Animal Species

A Biological Resources Management and Monitoring Plan (BRMMP) shall be developed and implemented for the Project. The BRMMP shall provide for the following:

1. Overall implementation and monitoring of the MMs for biological resources and the terms and conditions of any agency permits/authorizations throughout the duration of Project construction and restoration/revegetation of riparian habitat per BIO-2c.
2. Designation of an overall Project biologist and the roles and responsibilities of the Project biologist and other monitoring biologists and the roles of Reclamation, San Luis & Delta-Mendota Water Authority (SLDMWA) and construction personnel in coordinating and implementing the BRMMP.
3. Adaptive management in scheduling worker environmental awareness training (WEAT) and conducting pre-construction surveys for special-status species. In some cases, additional biological surveys beyond those identified in the MMs may be warranted to proactively avoid biological constraints or conflicts with protective measures. For example, early monitoring for nesting birds or occupied mammal burrows may be needed to preserve opportunities for vegetation removal, removal of nesting starts before egg laying, and burrow monitoring and closure prior to the initiation of breeding or nesting activities.

4. The procedure and authorizations required to modify the MMs, if needed, to resolve conflicts with constructability requirements or other measures required by agency permits/authorizations or to provide for equivalent avoidance/minimization of adverse effects on sensitive biological resources under changing conditions over the life of Project construction. For example, nesting birds or other special-status species may initiate nesting or denning activities in proximity to construction areas while active construction activities are ongoing, including within the 'no-disturbance buffers.' In these cases, it may be that the animals are acclimated to the level of construction disturbance, and continuance of construction activities would not be expected to adversely affect the animals or their nesting/breeding activities (assuming that increased levels of disturbance or closer proximity of construction activities is not planned). The BRMMP will include provisions for how these and similar circumstances will be addressed and how determinations regarding additional biological monitoring or agency coordination will be addressed.
5. The procedure to record and document implementation of the MMs and other measures including any pre-construction survey reports, WEAT sign-in forms, routine biological monitoring forms, photographs, and other materials related to implementation of the BRMMP.
6. The procedure to comply with the terms and conditions and notification and reporting requirements of any agency permits/authorizations required for the Project, and the procedure for coordination/consultation with resource or permitting agencies as necessary.
7. The procedure to inform, document, and monitor restoration and revegetation activities associated with restoring temporary impacts on terrestrial and aquatic habitats and vegetation communities. This includes any post-construction monitoring/reporting and remedial measures that may be required.

Prior to the initiation of ground disturbance, a qualified biologist(s) will conduct a WEAT for all construction personnel. Training sessions will be repeated for all new personnel before they access the Project site. Sign-in sheets identifying attendees and the contractor/company they represent will be prepared for each training session, and records of attendance will be maintained by the Project. At a minimum, the WEAT will include a description of the protected species and biological resources that may occur in the Project area and their physical description, habitats, and natural history, as well as the measures that are being implemented to avoid or minimize Project-related impacts, penalties for non-compliance, and the boundaries of the work area. As appropriate, training will be conducted in languages other than English to ensure that employees and contractors understand their roles and responsibilities. A written summary of the training will be provided to all attendees, and an electronic copy will be provided so that the Project can make and distribute future copies. The WEAT will be conducted annually, at a minimum, for all construction personnel.

A litter control program will be instituted at each Project site. All workers will place their food scraps, paper wrappers, food containers, cans, bottles, and other trash in covered or closed trash containers. The trash containers shall be removed from the Project area at the end of each working day.

No firearms (except as possessed by federal, state, or local law enforcement officers) or pets will be permitted on construction sites.

To prevent inadvertent entrapment of wildlife during construction, all excavated steep-walled holes or trenches greater than 2 feet deep shall be covered or filled at the end of each working day or provided with one or more escape ramps no greater than 200 feet apart. Before such trenches or holes are filled, they must be thoroughly inspected for trapped animals. If protected species are found in any of the holes or trenches, work shall cease until an escape ramp is provided and the animal leaves on its own volition, or until the animal has been relocated by a USFWS-approved biologist, and/or in coordination with USFWS as appropriate.

All construction activity will be confined within the Project site, which may include temporary access roads, haul roads, and staging areas specifically designated and marked for these purposes.

Restoration and re-vegetation work associated with temporary impacts shall be done using California native plant material from on-site or local sources (i.e., local ecotype). Plant materials from non-local sources shall be allowed only with written authorization from USFWS. To the maximum extent practical (i.e., presence of natural lands), topsoil shall be removed, cached, and returned to the site according to successful restoration protocols. Loss of soil from run-off or erosion shall be prevented with straw bales, straw wattles, or similar means provided they do not entangle, block escape or dispersal routes of listed animal species.

The Project construction area shall be delineated with high visibility temporary fencing, flagging, or other barrier to prevent encroachment of construction personnel and equipment onto any sensitive areas during Project work activities. Such fencing shall be inspected and maintained daily until completion of the Project. The fencing will be removed only when all construction equipment is removed from the site. No Project activities will occur outside the delineated Project construction area.

Only USFWS-approved personnel holding valid permits issued pursuant to section 10(a)(l)(A) of the ESA will be allowed to trap or capture listed species. Any relocation plan will be approved by USFWS prior to release of any listed species.

Tightly woven fiber netting or similar material (no monofilament material) will be used for erosion control or other purposes at the Project site to ensure that animals do not become trapped.

MM BIO-3: Measures to Minimize Impacts on Bats

To the extent practicable, the removal of large trees with cavities or the modification of canal infrastructure with the potential to provide bat roosts will occur before maternity colonies form (i.e., prior to March 1) or after young are volant (able to fly) (i.e., after August 15).

If construction (including the removal of large trees and/or the modification of canal infrastructure) occurs during the non-volant season (March 1 to August 15), a qualified biologist will conduct a pre-construction survey of the Project area for maternity colonies. The pre-construction survey will be performed no more than 14 days prior to the implementation of construction activities (including staging and equipment access). If a lapse in construction activities for 14 days or longer occurs between those dates, another pre-construction survey will be performed. If any maternity colonies are detected, appropriate conservation measures (as determined by a qualified biologist) will be implemented. These measures may include but are not limited to establishing a construction-free buffer zone around the maternity colony site, biological monitoring of the maternity colony, and delaying construction activities in the vicinity of the maternity site.

MM BIO-4: Measures to Minimize Impacts on the American badger

Any American badger detected within the Project area during Project-related activities will be allowed to move out of the work area of its own volition.

Concurrent with other required surveys, during winter and spring months before new Project activities, and concurrent with other pre-construction surveys (e.g., San Joaquin kit fox (SJKF) and Burrowing Owl), a qualified biologist will perform a survey to identify the presence of active or inactive American badger dens. If this species is not found, no further mitigation will be required. If badger dens are identified within the construction footprint during the surveys or afterward, they will be inspected and closed using the following methodology:

- When unoccupied dens are encountered outside of work areas but within 100 feet of proposed activities, vacated dens will be inspected to ensure they are empty and temporarily covered using plywood sheets or similar materials.
- If badger occupancy is determined at a given site within the work area, work activities at that site shall be halted. Depending on the den type, reasonable and prudent measures to avoid harming badgers will be implemented and will include seasonal limitations on Project construction near the site (e.g., restricting the construction period to avoid spring-summer pupping season) or establishing a construction exclusion zone around the identified site or resurveying the den at a later time to determine species presence or absence.
- Badgers will be passively relocated using burrow exclusion (e.g., installing one-way doors on burrows) or similar CDFW-approved exclusion methods. In unique situations, it may be necessary to actively relocate badgers (using live traps) to protect individuals from potentially harmful situations. If necessary, such relocation would be performed with advance CDFW coordination and concurrence.

MM BIO-5: Measures to Minimize Impacts on San Joaquin Kit Fox

Determine the presence of SJKF dens:

a) Pre-construction monitoring will be performed no less than 14 days and no more than 30 days prior to construction to identify kit fox habitat features within the Project Area.

b) Areas within which pre-construction monitoring have been completed more than 30 days prior to construction will be re-inventoried not more than 30 days prior to construction.

c) Pre-construction monitoring for dens will be conducted by qualified biologists familiar with SJKF biology, natural history, and potential dens.

d) Pipes and culverts will be searched for SJKF immediately prior to being moved or sealed to ensure that an animal has not been trapped. If SJKF is observed, it will be gently encouraged to leave the area by a USFWS-approved biologist. (i.e., without using loud noise, physical force, or physical movement of the pipe or culvert such that the animal could be injured or startled while it is leaving the area).

Identify and document locations of potential or occupied dens (natal or non-natal) and their status (occupied or unoccupied). Definitions:

a) Known den: any existing natural den or manmade structure that is used or has been used at any time in the past by SJKF. Evidence of use may include historical records, past or current radiotelemetry or spotlighting data, kit fox sign such as tracks, scat, and/or prey remains, or other reasonable proof that a given den is being or has been used by a kit fox. USFWS discourages use of the terms "active" and "inactive" when referring to any kit fox den because a great percentage of occupied dens show no evidence of use, and because kit foxes change dens often, with the result that the status of a given den may change frequently and abruptly.

b) Potential den: any subterranean hole within the species' range that has entrances of appropriate dimensions (five to eight inches in diameter) for which available evidence is insufficient to conclude that it is being used or has been used by a kit fox. Potential dens shall include the following: (1) any suitable subterranean hole five to eight inches in diameter within the species' range; or (2) any den or burrow of another species (e.g., coyote, badger, red fox, or ground squirrel) that otherwise has appropriate characteristics for kit fox use.

c) Natal/pupping den: any den used by kit foxes to whelp and/or rear their pups. Natal/pupping dens may be larger with more numerous entrances than dens occupied exclusively by adults. These dens typically have more kit fox tracks, scat, and prey remains in the vicinity of the den, and may have a broader apron of matted dirt and/or vegetation at one or more entrances. A natal den, defined as a den in which kit fox pups are actually whelped but not necessarily reared, is a more restrictive version of the pupping den. In practice, however, it is difficult to distinguish between the two, therefore, for purposes of this definition either term applies.

d) Atypical den: any manmade structure which has been or is being occupied by SJKF. Atypical dens may include pipes, culverts, and diggings beneath concrete slabs and buildings.

Identify and execute appropriate action(s) regarding notification, buffers, excavation and fill, or seal off:

a) Occupied natal den: if an occupied natal den is visible or encountered within the Project limits or on publicly accessible land sufficiently close to the Project construction area such that it would be disturbed (based on qualified biologist opinion and monitoring), USFWS (and CDFW if it is determined that the Project would be subject to compliance with the CESA) will be contacted immediately and before any Project action occurs to determine permissible actions to permit resumption of work.

b) Unless determined necessary for safety or constructability by Reclamation, SLDMWA, or the Project contractor, the Project site will not be lighted between sunset and sunrise.

c) Pipes or culverts with a diameter greater than four inches will be capped or taped closed when it is ascertained that no SJKF are present. Any SJKF found in a pipe or culvert will be allowed to escape unimpeded.

If a natural den or burrow is determined to meet size criteria (i.e., greater than 4-inches in diameter) and cannot be avoided per the no-disturbance buffers recommended in the USFWS *Standardized Recommendations for Protection of the SJKF Prior to or During Ground Disturbance* (USFWS 2011) or must be destroyed, the following guidelines will be followed:

a) Prior to den destruction, areas scheduled for construction within the vicinity of potential kit fox dens shall be monitored by a qualified biologist to determine their status. Monitoring will begin with pedestrian surveys to identify locations of potential kit fox dens and observe for suitable surrounding habitat. Because it is logistically impractical to monitor all dens using remote cameras and tracking medium (or to hand excavate to confirm vacancy), baited camera traps may be used to assess presence or absence of SJKF activity. Prior to ground-disturbing activities in Project segments that require excavation, baited camera traps will be deployed in approximate 0.25-mile increments for four consecutive nights. Baited camera traps may be placed farther than 0.25-mile apart depending on the suitability of surrounding habitat and land uses that are observed during pedestrian surveys and in areas with lower densities of potential kit fox dens. If no kit foxes are detected by the camera traps during this time period, it can be assumed that kit foxes are not currently using the area, and ground-disturbing activities may commence in that area. If a kit fox is detected by a camera trap, then further investigation will be required as described below.

b) If a kit fox is detected by a baited camera trap or otherwise observed in an area, further pre-construction monitoring will be conducted to determine which den(s) are being used. Baited camera traps will be deployed in the area, and tracking medium will be placed at the entrances of suspected dens to monitor the area for four consecutive nights. If no SJKF activity is observed during this period, the den will be deemed unoccupied and destroyed immediately under the supervision of a USFWS-approved biologist to preclude subsequent use. If SJKF activity is observed at the den during this period, the den will be monitored for at least five consecutive days from the time of observation to allow any resident animal to move to another den during its normal activities. Use of the den can be discouraged during this period by partially plugging the entrance(s) with soil in such a manner that any resident animal can escape easily. Destruction of the den may begin when, in the judgment of a USFWS-approved biologist, the animal has vacated. The biologist will be trained and familiar with SJKF biology. If the animal is still present after five or more consecutive days of plugging and monitoring, the den may be excavated when, in the judgment of a USFWS-approved biologist, it is temporarily vacant, for example during the animal's normal foraging activities. All den destruction shall be conducted under the supervision of a USFWS-approved biologist.

c) All dens requiring excavation will be excavated under the supervision of a USFWS-approved biologist. In no event will an excavation that meets the definition of a confined space (i.e., a space large enough and so configured that a person can bodily enter but has limited or restricted means for entry or exit) be initiated. In this circumstance, discouragement (as described above) would be used.

d) The den will be fully excavated and then filled with dirt and compacted so that SJKF cannot reenter or use the den during the construction period. If at any point during excavation, an SJKF is discovered inside the den, the excavation activity will cease immediately, and monitoring of the den will be resumed. Destruction of the den may be resumed when in the judgment of a USFWS-approved biologist, the animal has escaped from the partially destroyed den.

Before and during construction:

- Project-related vehicles shall observe a daytime speed limit of 20-mph throughout the site in all Project areas, except on county roads and State and Federal highways; this is particularly important at night when kit foxes are most active. Night-time construction shall be minimized to the extent possible. However, if it does occur, then the speed limit shall be reduced to 10-mph. Off-road traffic outside of designated Project areas shall be prohibited.
- Kit foxes are attracted to den-like structures such as pipes and may enter stored pipes and become trapped or injured. All construction pipes, culverts, or similar structures with a diameter of 4-inches or greater that are stored at a construction site for one or more overnight periods shall be thoroughly inspected for kit foxes before the pipe is subsequently buried, capped, or otherwise used or moved in any way. If a kit fox is discovered inside a pipe, that section of pipe shall not be moved until USFWS has been consulted. If necessary, and under the direct supervision of the biologist, the pipe may be moved only once to remove it from the path of construction activity, until the fox has escaped.
- A representative shall be appointed by the Project proponent who will be the contact source for any employee or contractor who might inadvertently kill or injure a kit fox or who finds a dead, injured or entrapped kit fox. The representative will be identified during the employee education program and their name and telephone number shall be provided to USFWS.
- In the case of trapped animals, escape ramps or structures shall be installed immediately to allow the animal(s) to escape, or USFWS shall be contacted for guidance. If at any time a trapped or injured kit fox is discovered, USFWS and CDFW shall be contacted as noted below.
- Any contractor, employee, or military or agency personnel who are responsible for inadvertently killing or injuring a SJKF shall immediately report the incident to their representative. This representative shall contact USFWS immediately in the case of a dead, injured or entrapped kit fox.
- The Sacramento Fish and Wildlife Office (and CDFW if it is determined that the Project would be subject to compliance with the CESA) shall be notified in writing within three working days of the accidental death or injury to a SJKF during Project related activities. Notification must include the date, time, and location of the incident or of the finding of a dead or injured animal and any other pertinent information.
- New sightings of kit fox shall be reported to the CNDDB. A copy of the reporting form and a topographic map clearly marked with the location of where the kit fox was observed shall also be provided to USFWS.
- Because dusk and dawn are often the times when this species is most actively foraging, to the extent practicable, all construction activities will cease one half hour before sunset and will not begin prior to one half hour before sunrise. Except when necessary for driver or pedestrian safety, lighting of a Project site by artificial lighting during nighttime hours is prohibited.

MM BIO-6: Measures to Minimize Impacts on the Tricolored Blackbird and the Yellow-Headed Blackbird

Prior to construction, appropriately timed surveys for Tricolored Blackbirds and Yellow-Headed Blackbirds will be conducted in areas supporting potentially suitable habitat within 0.25-mile of construction areas. Habitat within 0.25-mile of Tricolored Blackbird or Yellow-Headed Blackbird colonies will be avoided during nesting season, which can begin as early as mid-March and extend through August. If it is determined that the Project would be subject to compliance with the CESA, CDFW will be consulted in cases where colonies cannot be avoided to potentially reduce buffer distances with active monitoring during construction by a qualified biologist.

MM BIO-7: Measures to Minimize Impacts on the Burrowing Owl

A minimum of one pre-construction survey for Burrowing Owls within a minimum of 500 feet of the Project area (where accessible) will be conducted by a qualified biologist within 15 days prior to the initiation of construction activities in a given area, regardless of the timing of construction. Pre-construction surveys each year of construction during the nonbreeding season (September 1 to January 31) will take place in order to determine the presence of Burrowing Owls before breeding activities begin. If any occupied burrows are identified, appropriate conservation measures (as determined by a qualified biologist) will be implemented. No disturbance will occur within 150 feet of occupied burrows during the nonbreeding season (September 1 to January 31) or within 250 feet during the breeding season (February 1 to August 31). These measures may also include establishing a construction-free buffer zone around the active nest site in coordination with the CDFW, biological monitoring of the active nest site, and delaying construction activities in the vicinity of the active nest site until the young have fledged.

If necessary, in situations where Burrowing Owls are detected within the Project area during the nonbreeding season and maintaining a 150-foot, no-disturbance buffer is not practicable, a qualified biologist will submit an exclusion and passive relocation plan to CDFW. The exclusion and passive relocation plan will generally follow the guidelines outlined in Appendix E of the *Staff Report on Burrowing Owl Mitigation* (CDFW 2012). The exclusion and passive relocation plan will consist of installing one-way doors in potential burrows, daily monitoring, and collapsing burrows once it is determined that the burrows are unoccupied. Exclusion may only take place during the nonbreeding season (September 1 to January 31) and may be an ongoing effort during this time period. This will allow the owls to exit burrows if they are present, but not return. The exclusion and passive relocation plan will also detail plans to replace collapsed burrows with artificial burrows at a minimum 1:1 ratio or describe why artificial burrows are not needed (e.g., numerous available natural burrows are available in nearby areas that will not be disturbed). Monitoring of collapsed burrows will be conducted as needed so that burrowing owls do not recolonize the area prior to construction disturbance.

If necessary, in situations where occupied burrows are detected during the breeding season and maintaining a 250-foot no-disturbance buffer is not practicable, CDFW will be consulted to determine alternative measures to minimize the potential for disturbance to occupied burrows and nesting activities. Measures may include but are not limited to continuous biological monitoring by a qualified biologist until it has been determined that the young have fledged and are no longer reliant on the nest or parental care for survival or construction is complete. No direct disturbance of burrows with eggs or young can be conducted without written authorization from the CDFW and USFWS.

MM BIO-8: Measures to Minimize Impacts on the Golden Eagle, Swainson's Hawk, Northern Harrier, or White-Tailed Kite.

For construction activities that occur between February 1 and August 31, a qualified biologist will conduct pre-construction surveys for Golden Eagles, Swainson's Hawks, Northern Harriers, and White-Tailed Kites. The pre-construction surveys will include the Project footprint and a minimum of a 0.5-mile radius where access is permitted around the construction area in suitable nesting habitat (i.e., large trees for Swainson's Hawk and White-Tailed Kite, cliff faces for Golden Eagle, and grasslands for Northern Harrier). The pre-construction surveys will be conducted no more than 10 days before ground disturbance in a given area and will be phased based on the construction schedule.

If nesting Golden Eagles, Swainson's Hawks, Northern Harriers, or White-Tailed Kites are detected, an appropriate no-disturbance buffer (minimum of 500 feet for Northern Harrier, 0.5 mile for Golden Eagle, Swainson's Hawk, and White-Tailed Kite) will be established and monitored daily by a qualified biologist. Buffers will be maintained until a qualified biologist has determined that the young have fledged and are no longer reliant on the nest or parental care for survival. A 0.5-mile no-disturbance buffer will also be maintained from any overwintering eagles if they are detected in the Project area or surrounding areas; the buffer will be maintained for the duration that the bird(s) are present. If any Bald Eagles or Golden Eagles are detected, Reclamation will coordinate with USFWS as necessary to comply with the Bald and Golden Eagle Protection Act.

If maintaining the minimum no-disturbance buffer around an active Golden Eagle or any overwintering eagles is not practicable, USFWS will be consulted to determine whether reduced minimum no-disturbance buffers are appropriate based on site-specific circumstances (e.g., visual barriers between nest and construction area, existing level of disturbance) or to identify alternative measures to minimize the potential for Project-related disturbance to the nest site that could result in nest abandonment or other forms of take. Similarly, if necessary, CDFW would be consulted to determine whether reduced minimum no-disturbance buffers could be implemented around active Swainson's Hawk, Northern Harrier, or White-Tailed Kite nests or to identify alternative measures to minimize the potential for Project-related disturbance to existing nest sites. Measures may include, but are not limited to, continuous biological monitoring by a qualified biologist until it has been determined that the young have fledged and are no longer reliant on the nest or parental care for survival or construction is complete. If the nesting pair shows signs of distress (i.e., adults leaving the nest when eggs or young chicks are present) as a result of Project-related activities, the monitoring biologist will have authority to stop work until it is determined that the adults have returned and are no longer showing signs of distress.

If trees suitable for nesting by Swainson's Hawk are scheduled to be removed during the non-nesting season, a qualified biologist will conduct a pre-construction survey during the nesting season prior to tree removal to determine whether Swainson's Hawks are using the trees for nesting. If the trees proposed for removal are being used by nesting Swainson's Hawk, and it is determined that the Project would be subject to compliance with the CESA, consultation with CDFW will take place prior to tree removal.

If CESA compliance is required, and consultation with CDFW results in a determination that take of an active Swainson's Hawk nest cannot be avoided, then take authorization pursuant to CESA will be obtained from CDFW prior to initiation of any activities that are likely to result in take.

If an active Golden Eagle or White-Tailed Kite nest may not be avoidable, then all activities that are likely to result in take will be delayed until a qualified biologist has determined that the young have fledged and are no longer reliant on the nest or parental care for survival.

MM BIO-9: Measures to Minimize Impacts on Nesting Migratory Birds

To the extent practicable, vegetation removal will be scheduled to avoid the breeding season for nesting raptors and other special-status birds (generally February 1 through August 31, depending on the species). Removal of vegetation outside of the nesting season is intended to minimize the potential for delays in vegetation removal due to active nests.

Regardless of when vegetation removal is scheduled, a qualified biologist will conduct a minimum of one pre-construction survey for nesting migratory birds and raptors within the Project area and a buffer (250 feet for migratory birds, 500 feet for raptors) around the Project area (where accessible) for all construction-related activities that will occur during the nesting season. The pre-construction survey will be conducted no more than 15 days prior to the initiation of construction in a given area and will be phased based on the construction schedule. Due to the ongoing, phased approach to construction, multiple pre-construction surveys per year may be required. If an active nest is found, a construction-free buffer zone (250 feet for migratory birds, 500 feet for raptors) will be established around the active nest site. If establishment of the construction-free buffer zone is not practicable, appropriate conservation measures (as determined by a qualified biologist) will be implemented. These measures may include, but are not limited to, consultation with CDFW to establish a different construction-free buffer zone around the active nest site, daily biological monitoring of the active nest site, and delaying construction activities in the vicinity of the active nest site until the young have fledged.

If removal of bridges or other bridge work is scheduled to occur during the swallow nesting season, exclusionary devices (e.g., netting) will be installed around the bridges prior to the initiation of the avian breeding season (before February 15) during the same year as the bridges are scheduled for removal and after a qualified biologist has determined no active nests (i.e., nests with eggs or young) are present. The exclusionary devices will remain in place until August 15 or until the bridge removal or other bridge work is completed. The exclusionary devices will be anchored such that swallows cannot attach their nests to the structure through gaps. Exclusionary devices will be regularly inspected as necessary to confirm that they are adequately preventing initiation of nest building. If swallows have breached the exclusionary devices and began building nests on the structure, nesting material (i.e., partially built nests) can be removed only if a qualified biologist has determined that eggs or young are not present. No removal of nests with eggs or young can be conducted without written authorization from CDFW and USFWS, or until a qualified biologist has determined that the nest is no longer active (e.g., the nest has failed, the young have fledged and are no longer dependent on the nest).

MM BIO-10: Measures to Minimize Impacts on the California Tiger Salamander (CTS) and the California Red-legged Frog (CRLF)

Before and during construction:

- Protocol presence/absence surveys shall be conducted by a USFWS-approved biologist in suitable habitat prior to construction. As the Project is multi-year, protocol presence/absence surveys can be conducted in portions of the Project area that have work scheduled the following year. Alternatively, presence can be assumed in suitable habitat and the measures below implemented.

- To the maximum extent practicable, the Project design and construction implementation will avoid impacts to suitable breeding habitat. Areas of avoidance shall be indicated on Project plan sets and shall be clearly delineated in the field. Signage indicating "Environmentally Sensitive Area: Keep Out" shall be posted.
- Protocol aquatic surveys shall be conducted by a USFWS-approved biologist in suitable breeding habitat within areas that will be disturbed by construction in the following year, and within 1.3 miles of those areas to detect occupied breeding resources (1 survey in March, April, and May each). Any occupied breeding resources will be prioritized for avoidance.
- Resources documented to support breeding populations of CTS/CRLF shall be avoided during construction with a buffer sufficient to ensure the continued functioning of that breeding resource. If adherence to this buffer is not feasible, USFWS shall be contacted to determine whether moving individuals prior to construction is authorized.
- A USFWS approved biologist shall survey the work sites where suitable habitat has been identified no more than 30 days before the onset of construction. Adult individuals detected during the surveys shall be relocated out of the area of disturbance by a USFWS-approved biologist.
- Work in occupied habitat shall only occur during the dry season.
- Areas beneath construction equipment and vehicles shall be inspected daily, prior to operation, for presence of CTS/CRLF under tracks/tires and within machinery by a USFWS approved biologist until the biologists determines a designated contractor is sufficiently trained to monitor. A USFWS approved biologist will ensure that this individual receives training consistent with USFWS requirements. A USFWS approved biologist will be on-call to come to the site if CTS/CRLF are found.
- CTS/CRLF one-way, exclusion fencing shall be installed between construction areas and occupied habitat. This fencing shall extend 1.3 miles from the boundary of the occupied habitat along the alignment of the Project area.
- Overnight staging of vehicles or equipment shall be prohibited within 100 feet of occupied or assumed-occupied breeding resources.
- Work in occupied breeding habitat shall only occur during the dry season.

After construction:

- Temporary disturbance of occupied habitat shall be mitigated by restoring the area to pre-Project contours and revegetation.

MM BIO-11: Measures to Minimize Impacts on the Western Spadefoot Toad

If a western spadefoot toad is encountered during construction activities, it will be allowed to move out of harm's way of its own volition, or a qualified biologist will relocate it to the nearest suitable habitat that is at least 100 feet outside of the construction impact area.

Prior to moving equipment or materials each day, construction personnel will inspect underneath and around equipment and other Project materials (e.g., stored pipes greater than two inches in diameter) where located within 200 feet of aquatic habitat for western spadefoot toads. If western spadefoot toads are found, they will be allowed to move out of the construction area under their own volition, or a qualified biologist will relocate individuals to the nearest suitable habitat that is at least 100 feet outside of the construction impact area.

MM BIO-12: Measures to Minimize Impacts on the Northern California Legless Lizard, California Glossy Snake, San Joaquin Coachwhip, and Coast Horned Lizard

Prior to moving equipment or materials each day, construction personnel will inspect underneath and around equipment for northern California legless lizard, California glossy snake, San Joaquin coachwhip, and coast horned lizard. If these species are encountered during construction activities, they will be allowed to move out of harm's way of their own volition or a qualified biologist will relocate the organism(s) the nearest suitable habitat that is at least 100 feet outside of the construction impact area.

MM BIO-13: Measures to Minimize Impacts on the Giant Garter Snake

Before and during construction:

- Protocol presence/absence surveys shall be conducted by a USFWS approved biologist in suitable habitat prior to construction. As the project is multi-year, protocol presence/absence surveys can be conducted in portions of the Project Area that have work scheduled the following year. Alternatively, presence can be assumed in suitable habitat and the measures below implemented.
- Avoid construction activities within 200 feet from the banks of occupied giant garter snake aquatic habitat. Confine movement of heavy equipment to existing roadways to minimize habitat disturbance.
- Construction activity within suitable habitat shall be conducted between May 1 and October 1. This is the active period for giant garter snakes and direct mortality is lessened, because snakes are expected to actively move and avoid danger. Impacts to winter hibernacula shall be avoided during the period of October 2 and April 30.
- The Project area shall be surveyed for giant garter snakes 24-hours prior to construction activities. Survey of the Project area shall be repeated if a lapse in construction activity of two weeks or greater has occurred. If a snake is encountered during construction, activities shall cease until appropriate corrective measures have been completed or it has been determined that the snake will not be harmed.
- Any dewatered habitat shall remain dry for at least 15 consecutive days after April 15 and prior to excavating or filling of the dewatered habitat.

MM BIO-14: Measures to Minimize Impacts on the Western Pond Turtle

Before construction activities begin, a qualified biologist will conduct western pond turtle surveys within creeks and in other ponded areas affected by the Project. Adjacent upland areas will be examined for evidence of nests and individual turtles. The Project biologist will be responsible for the survey and for the relocation of pond turtles, if found. Construction will not proceed until reasonable effort has been made to capture and relocate as many western pond turtles as possible to minimize take. However, some individuals may remain undetected or enter sites after surveys and could be subject to injury or mortality. If a nest is observed, a biologist with the appropriate permits and prior approval from CDFW will move eggs to a suitable location or facility for incubation and release hatchlings into the creek system the following autumn.

MM BIO-15: Measures to Minimize Impacts on the Longhorn Fairy Shrimp, Vernal Pool Fairy Shrimp, and Vernal Pool Tadpole Shrimp

Before and during construction:

- Protocol presence/absence surveys shall be conducted by a USFWS approved biologist in suitable habitat prior to construction. As the Project is multi-year, protocol presence/absence surveys can be conducted in portions of the Project area that have work scheduled the following year. Alternatively, presence can be assumed in suitable habitat.
- Work in occupied listed vernal pool branchiopod habitat shall only occur during the dry season.
- The authorized limits of branchiopod habitat (i.e., 250 feet from the pool edge) will be clearly staked in the field, to prevent construction personnel from causing impacts to areas outside of work limits.
- Where temporary impacts will occur to occupied or assumed-occupied listed vernal pool branchiopod habitat, the top 1 to 3 inches of soil shall be salvaged to preserve the cyst bank. Saved topsoil shall be covered to avoid erosion. Topsoil shall be replaced as soon as possible upon completion of work in the impacted habitat.
- Overnight staging of vehicles or equipment shall be prohibited within 100 feet of occupied or assumed-occupied fairy shrimp.

After construction:

- Temporary impacts to listed branchiopod habitat shall mitigated for by restoring the affected area to pre-Project contours, compaction levels, and revegetation.

MM BIO-16: Measures to Minimize Impacts on Sensitive Natural Communities

Temporary and permanent impacts on sensitive natural communities known to occur within the Project area will be minimized to the greatest extent practicable. Trees and other vegetation will not be removed if it can otherwise be reasonably avoided. In determining areas where vegetation must be removed to provide adequate access for construction or staging, consideration will be given to selecting areas that require the least amount of removal of mature trees and canopy cover in coordination with a qualified biologist.

Prior to the initiation of construction activities, exclusionary fencing will be installed along the boundaries of all environmentally sensitive areas to be avoided, which will include sensitive natural communities and aquatic resources adjacent to the areas of Project-related impacts, so that impacts on environmentally sensitive areas outside of the construction area are minimized. Locations of environmentally sensitive areas and exclusionary fencing will be identified on construction plans. The exclusionary fencing will be inspected and maintained on a regular basis throughout Project construction in the areas where the fencing is needed to avoid unintended disturbance.

A Post-Construction Revegetation and Monitoring Plan will be developed and implemented to provide for the restoration of temporarily impacted riparian habitats to pre-existing conditions. The plan will include provisions for the planting of native woody vegetation and native seed mix or otherwise provide for the reestablishment of self-sustaining native riparian vegetation similar to the existing native riparian vegetation community. Planting of native riparian vegetation will include but is not limited to replacement of any trees removed by the Project at a 3:1 ratio (replaced to removed) with appropriate native tree species. For the purposes of this requirement, a tree is defined as a native woody plant (i.e., tree or mature shrub) with at least one stem measuring two inches or greater diameter at breast height. The plan will also identify success criteria and provide for annual or other regular monitoring to evaluate whether the revegetation effort has met the success criteria. The plan will include measures for remedial actions (e.g., additional plantings, supplemental irrigation, increased monitoring) if monitoring efforts indicate that success criteria are not being met.

MM BIO-17: Measures to Minimize Impacts on Wetlands

Prior to any temporary or permanent impacts on aquatic resources, any required permits/authorizations from RWQCB and USACE will be obtained. All terms and conditions of the required permits/authorizations will be implemented.

Where jurisdictional wetlands and other waters cannot be avoided, to offset temporary and permanent impacts that would occur as a result of the Project, restoration and compensatory mitigation to ensure no net loss will be provided as described below.

A wetland mitigation and monitoring plan will be developed in coordination with CDFW, USACE, or RWQCB to detail mitigation and monitoring obligations for temporary and permanent impacts to wetlands and other waters due to construction activities and for other CDFW jurisdictional areas. The plan will quantify the total acreage affected; provide for mitigation, as described below, to wetland or riparian habitat; specify annual success criteria for mitigation sites; specify monitoring and reporting requirements; and prescribe site-specific plans to compensate for wetland losses resulting from the Project consistent with the USACE's no net loss policy.

Prior to construction, the aquatic structure of wetland and riparian areas to be disturbed will be photo-documented and measurements of width, length, and depth will be recorded. Recontouring and revegetation of the disturbed portions of jurisdictional areas in areas temporarily affected by construction prior to demobilization by the construction contractor will be completed at the end of Project construction. Creek banks will be recontoured to a more stable condition if necessary.

Revegetation will include a palette of species native to the watershed area according to a revegetation plan to be developed by Reclamation and submitted to USACE, CDFW, and RWQCB for approval. Following removal, woody trees habitat acreage would be replanted at a minimum 1:1 ratio, or as determined and agreed upon by the permitting agencies. Interim vegetation or other measures will be implemented as necessary to control erosion in disturbed areas prior to final revegetation.

Wetland and other waters impact in the construction and inundation area will be compensated at a ratio of 2:1 or at a ratio agreed upon by the wetland permitting agencies. Compensatory mitigation will be conducted by creating or restoring wetland and aquatic habitat at an agency-approved location on nearby lands or through purchasing mitigation credits at a USACE- or CDFW-approved mitigation bank (depending on the resource). If mitigation is conducted on- or off-site, a five-year wetland mitigation and monitoring program for on- and off-site mitigation will be developed. Appropriate performance standards may include a 75-percent survival rate of restoration plantings; absence of invasive plant species; and a viable, self-sustaining creek or wetland system at the end of five years.

A weed control plan for the Project to limit the spread of noxious or invasive weeds will be developed. This plan would be consistent with current integrated pest management plans already in practice on lands surrounding the reservoir. Noxious or invasive weeds include those rated as 'high' in invasiveness by the California Invasive Plant Council. The plan will include a baseline survey to identify the location and extent of invasive weeds in the Project area prior to ground-disturbing activity, a plan to destroy existing invasive weeds in the construction area prior to initiation of ground-disturbing activity, weed-containment measures while the Project is in progress, and monitoring and control of weeds following completion of construction.

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