B.F. Sisk Dam Raise and Reservoir Expansion Project Feasibility Report

FINAL

SAN LUIS & DELTA-MENDOTA WATER AUTHORITY

BUREAU OF RECLAMATION

December 2020

B.F. Sisk Dam Raise and Reservoir Expansion Project

Final Feasibility Report

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Contents

Page

Chapter 1 Introduction 1-1
1.1 Feasibility Report Purpose and Organization 1-1
1.2 Project Background and History 1-2
1.2.1 Reclamation Safety of Dams (SOD) Act 1-4
1.2.2 Water Infrastructure Improvements for the Nation (WIIN) Act 1-4
1.3 Purpose, Needs, Opportunities, and Planning Objectives 1-5
1.3.1 Water and Related Resource Purpose, Needs, and Opportunities 1-5
1.3.2 Project Objectives 1-6
1.4 Study Area 1-6
1.5 Related Studies, Projects, and Programs 1-7
1.5.1 Activities of the State of California 1-7
1.5.2 Activities of Federal Agencies 1-9
1.5.3 Joint Activities of Federal and California State Agencies 1-13
1.5.4 Activities of Regional and Local Entities/Agencies 1-14

Chapter 2 Water Resources and Related Conditions 2-1
2.1 Existing and Likely Future Resource Conditions in Study Area 2-1
2.1.1 Existing Conditions Summary 2-1
2.1.2 Summary of Likely "Future Without Project" Conditions 2-13

Chapter 3 Plan Formulation 3-1
3.1 Alternatives Development Report 3-1
3.1.1 Measure Development 3-1
3.1.2 Measure Screening 3-2
3.1.3 Measure Screening Results 3-3
3.2 Feasibility Report 3-4
3.2.1 Initial Alternative Formulation and Screening 3-4
3.2.2 Alternative Refinement and Evaluation 3-5

Chapter 4 Descriptions of Alternatives 4-1
4.1 No Project/No Action Alternative 4-1
4.2 Non-Structural Alternative 4-1
4.3 Dam Raise Alternative Plan 4-2
4.3.1 Project Facilities 4-5
4.3.2 Construction Methods 4-8
4.3.3 Equipment and Staging 4-11
4.3.4 Construction Schedule 4-12
4.3.5 Operation of the Dam Raise Alternative 4-13
4.3.6 Costs 4-15

Chapter 5 Plan Evaluation and Comparison 5-1

5.1 Alternative Plan Evaluation 5-1
5.1.1 National Economic Development Account 5-1
5.1.2 Regional Economic Development Account 5-18
5.1.3 Environmental Quality Account 5-19
5.1.4 Other Social Effects Account 5-23
5.2 Comparison of Final Alternatives 5-24
5.2.1 Completeness 5-25
5.2.2 Effectiveness 5-26
5.2.3 Acceptability 5-27
5.2.4 Efficiency 5-29
5.3 Summary of Comparisons 5-29
5.4 Consistency of Alternative Plans with Other Programs 5-34

Chapter 6 Plan Selection, Implementation, and Uncertainty 6-1
6.1 Rationale for Plan Selection 6-1
6.2 Recommended Plan 6-2
6.2.1 Major Components 6-2
6.2.2 Operations 6-3
6.2.3 Major Accomplishments 6-3
6.2.4 Benefits 6-4
6.3 Feasibility Evaluation 6-4
6.3.1 Technical Feasibility 6-5
6.3.2 Environmental Feasibility 6-5
6.3.3 Economic Feasibility 6-5
6.3.4 Financial Feasibility 6-5
6.4 Implementation Requirements 6-11
6.4.1 Agreement on Up-Front Cost-Share with Non-Federal Partner 6-11
6.4.2 Project Funding 6-11
6.4.3 Water Rights 6-11
6.4.4 Operational Agreements and Plans 6-12
6.4.5 Regulatory and Related Requirements for Environmental Compliance 6-13
6.4.6 Preconstruction Activities 6-13
6.4.7 Federal and Non-Federal Responsibilities 6-13
6.5 Risk and Uncertainty 6-14
6.5.1 Effects of Hydrology and Climate Variability 6-14
6.5.2 Effects of Regulatory Conditions and New Infrastructure 6-14
6.5.3 System Operations 6-15
6.5.4 Cost Estimates 6-15
6.5.5 Activities Needed to Secure Construction Funding 6-16
6.5.6 Non-Federal Cost Share 6-16
6.5.7 Economics and Benefit Monetization 6-16
6.6 Timeline and Status of Feasibility Study 6-16

Chapter 7 Coordination and Public Involvement 7-1
7.1 Stakeholder and Public Outreach 7-1
7.2 Agency Coordination 7-1
7.2.1 U.S. Fish and Wildlife Service 7-2
7.2.2 U.S. Army Corps of Engineers 7-2

7.2.3 U.S. Environmental Protection Agency 7-2
7.2.4 California Department of Parks and Recreation 7-2
7.2.5 State Historic Preservation Officer 7-2
7.2.6 Central Valley Regional Water Quality Control Board 7-2
7.2.7 State Water Resources Control Board 7-2
7.2.8 San Joaquin Air Pollution Control District 7-2
7.2.9 California Department of Fish and Wildlife 7-3
7.2.10 California Department of Water Resources 7-3
7.2.11 California Department of Transportation 7-3
7.2.12 Native American Heritage Commission 7-3
7.2.13 Local Governments 7-3
7.3 Public and Agency Review and Comment 7-3
7.3.1 Alternative Formulation 7-3

Chapter 8 Findings and Considerations 8-1
8.1 Summary of the NED Plan 8-1
8.1.1 Costs and Benefits 8-1
8.1.2 Feasibility 8-1
8.1.3 Risk and Uncertainty 8-4
8.1.4 Federal Interest 8-4
8.1.5 Environmental Review and Regulatory Requirements 8-5

Chapter 9 Recommendations 9-1
9.1 Summary of the Dam Raise Alternative Plan 9-1
9.1.1 Costs and Benefits 9-2
9.1.2 Cost Allocation and Assignment 9-2
9.1.3 Non-Federal Cost-Share Partner 9-3
9.1.4 Funding 9-3
9.1.5 Approval 9-3
9.2 Federal Role 9-4
9.3 Non-Federal Role 9-4
9.4 Recommendations 9-5

Chapter 10 References 10-1

Tables

Table ES-1. Most Probable Cost Estimates for the Alternatives, January 2020 dollars..... ES-5
Table ES-2. Probable Low Cost Estimates for the Alternatives, January 2020 dollars..... ES-6
Table ES-3. NED Benefit-Cost Summary for Most Probable Construction Cost, Dam Raise Alternative Plan Subalternatives, Annual Values, 2020 dollars ES-8
Table ES-4. NED Benefit-Cost Summary for Probable Low Cost Construction Cost, Dam Raise Alternative Plan Subalternatives, Annual Values, 2020 dollars ES-9
Table ES-5. Initial Construction Cost Assignment for the Dam Raise Alternative Plan, Investor-Directed Storage Subalternative D, by Project Purpose – Most Probable Costs (million $) ES-11
Table ES-6. Initial OM&R Cost Assignment for the Dam Raise Alternative Plan, Investor-Directed Storage Subalternative D, by Project Purpose (million $/year)[1] ES-12
Table 2-1. Attainment Status for SJVAB (Merced County) 2-6
Table 2-2. Federal and State Threatened, Endangered, and Special-Status Species and Species of Note 2-9
Table 3-1. Measure Descriptions 3-1
Table 3-2. Screening Results Summary 3-3
Table 3-3. Initial Alternatives and Included Measures 3-4
Table 4-1. Dam Raise Alternative Plan – Most Probable Costs 4-15
Table 4-2. Dam Raise Alternative Plan – Probable Low Costs 4-15
Table 5-1. Estimated Change in Municipal and Industrial Water Supply Reliability Provided by the Non-Structural Alternative and the Dam Raise Subalternatives (TAF/year) 5-3
Table 5-2. Average Annual M&I Water Supply Economic Benefits Provided by the Non-Structural Alternative and the Dam Raise Subalternatives 5-4
Table 5-3. Estimated Change in Annual Average Irrigation Water Supply Provided by the Non-Structural Alternative and the Dam Raise Subalternatives (TAF/year) 5-5
Table 5-4. Estimated Irrigation Water Supply Reliability NED Benefits Provided by the Non-Structural Alternative and the Dam Raise Subalternatives 5-6
Table 5-5. Estimated Change in Annual Average Emergency M&I Water Supply Provided by the Non-Structural Alternative and the Dam Raise Subalternatives (TAF/year) 5-7
Table 5-6. Estimated NED Benefits for Enhanced M&I Emergency Water Supply 5-7
Table 5-7. Estimated Public Safety Benefits for Modification to State Route 152 – Approach 1 5-9
Table 5-8. Estimated Public Safety Benefits for Modification to State Route 152 – Approach 2 5-10
Table 5-9. Estimated Change in Annual Average Refuge Water Supply Provided by the Non-Structural Alternative and the Dam Raise Subalternatives (TAF/year) 5-11
Table 5-10. Average Annual Refuge Water Supply Economic Benefits Relative to No Action Alternative 5-12
Table 5-11. Summary of Estimated Economic Benefits by the Non-Structural Alternative and the Dam Raise Subalternatives, Adjusted for Delivery of Emergency Supplies (million $) 5-13
Table 5-12. Definition of National Economic Development Cost Components 5-14

Table 5-13. Most Probable Cost Estimates for the Alternatives (million $) 5-15
Table 5-14. Probable Low Cost Estimates for the Alternatives (million $) 5-15
Table 5-15. NED Benefit-Cost Summary for Most Probable Construction Cost, Annual Values, 2020 Dollars 5-16
Table 5-16. NED Benefit-Cost Summary for Probable Low Cost Construction Cost, Annual Values, 2020 Dollars 5-17
Table 5-17. Direct, Indirect, Induced Employment and Output Effects of Construction Expenditures Under the Dam Raise Alternative – Most Probable Construction Cost 5-18
Table 5-18. Direct, Indirect, Induced Employment and Output Effects of Construction Expenditures Under the Dam Raise Alternative – Probable Low Cost Construction Cost 5-19
Table 5-19. Summary of EQ Effects 5-20
Table 5-20. OSE Account Evaluation 5-23
Table 5-21. Overall Completeness Ranking for Final Alternatives 5-26
Table 5-22. Overall Effectiveness Ranking for Final Alternatives 5-27
Table 5-23. Overall Acceptability Ranking for Final Alternatives 5-28
Table 5-24. Summary Comparison of Final Alternatives 5-30
Table 6-2. Existing Authorities for Federal Financial Participation for Monetized Benefit Categories 6-6
Table 6-3. Dam Raise Alternative Plan Costs to be Allocated – Most Probable Costs (million $) 6-8
Table 6-4. Initial SCRB Analysis and Annual Construction and OM&R Cost Allocation Summary for the NED Plan (million $/year) 6-9
Table 6-5. Initial Cost Assignment Percentages 6-9
Table 6-6. Initial Construction Cost Assignment for the Dam Raise Alternative Plan by Project Purpose – Most Probable Construction Costs (million $) 6-10
Table 6-7. Initial OM&R Cost Assignment for the Dam Raise Alternative Plan by Project Purpose (million $/year) 6-10
Table 6-8. Summary and Status of the Feasibility Investigation 6-17
Table 8-1. Dam Raise Alternative for Most Probable Construction Cost (Investor-Directed Storage Subalternative D) Annual Benefit-Cost Summary 8-2
Table 8-2. Dam Raise Alternative Probable Low Cost Construction Cost (Investor-Directed Storage Subalternative D) Annual Benefit-Cost Summary 8-3
Table 9-1. Initial Construction Cost Assignment for the NED Plan by Project Purpose – Most Probable Costs (million $) 9-2
Table 9-2. Initial OM&R Cost Assignment for the NED Plan by Project Purpose (million $/year) 9-3

Figures

Figure ES-1. Planning Process ES-3
Figure 1-1. Planning process 1-1
Figure 1-2. San Luis Reservoir and Associated Facilities 1-3
Figure 1-3. Study Area 1-6
Figure 4-1. Dam Raise Typical Cross Section, Embankment Materials, and Zones 4-3
Figure 4-2. Dam Raise Embankment Profiles 4-4
Figure 4-3. State Route 152 Embankment Modification Profiles 4-5
Figure 4-4. Reservoir Expansion Actions along State Route 152 and at Pacheco Pumping Plant 4-7
Figure 4-5. Proposed Action Construction and Staging Areas 4-9

Appendices

Appendix A1. Modeling Technical Report
Appendix A2 Statewide Agricultural Production Model
Appendix B1. B.F. Sisk Dam Raise Feasibility Design Report
Appendix B2. State Route 152 Modifications Feasibility Design Report
Appendix C. Economic Benefits Evaluation
Appendix D. Preliminary Cost Allocation

List of Acronyms

ACHP	Advisory Council on Historic Preservation
Act	Water Supply, Reliability, and Environmental Improvement Act
AF	acre-feet
APE	area of potential effects
BEPA	Bald Eagle Protection Act
BDCP	Bay Delta Conservation Plan
BOs	Biological Opinions
BON	basis of negotiation
CAAQS	California Ambient Air Quality Standards
CALFED	CALFED Bay-Delta Program
CARB	California Air Resources Board
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
CFP	California fully protected species
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGS	California Geological Survey
COA	Coordinated Operations Agreement
CSC	California Species of Concern
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
DAF	Dissolved Air Floatation
Delta	Sacramento-San Joaquin Delta
DFG	Department of Fish and Game
DMC	Delta-Mendota Canal
DOC	Department of Conservation
DPS	Distinct Population Segment
DRMS	Delta Risk Management Strategy
DSOD	Division of Safety of Dams
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EIS	Environmental Impact Statement

ESA	Endangered Species Act
ESU	evolutionary significant unit
EQ	Environmental Quality
FC	Candidate for Federal listing
FD	Federal Delisted
FE	Federally Endangered
FT	Federally Threatened
FPE	Proposed for Listing as Endangered
FPT	Proposed for Listing as Threatened
hp	horsepower
I	Interstate
IDC	interest during construction
IL4	Incremental Level 4
IMPLAN	IMpact analysis for PLANning
kV	kilovolt
M&I	municipal and industrial
MAF	million acre-feet
MIG	Minnesota IMPLAN Group
MSL	mean sea level
MVA	megavolt amp
NAAQS	National Ambient Air Quality Standards
NED	National Economic Development
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
O&M	operations and maintenance
O_3	ozone
OM&R	operations, maintenance, and replacement
OSE	Other Social Effects
P&Gs	Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies
P.L.	Public Law
$PM_{2.5}$	fine particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM_{10}	inhalable particulate matter with an aerodynamic diameter less than or equal to 10 microns
Reclamation	United States Department of the Interior, Bureau of Reclamation
RED	Regional Economic Development
ROD	Record of Decision
RPAs	Reasonable and Prudent Alternatives

RWQCB	Regional Water Quality Control Boards
SBA	South Bay Aqueduct
SBCWD	San Benito County Water District
SC	Candidate for State listing
SCRB	Separable Cost-Remaining Benefits
SE	State Endangered
SEIS	Supplemental Environmental Impact Statement
SGMA	Sustainable Groundwater Management Act
SHPO	State Historic Preservation Officer
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District
SLDMWA	San Luis & Delta-Mendota Water Authority
SOD	Safety of Dams
SP	State Park
SR	State Route
SR	Listed as Rare by the State of California (plants only)
SRA	State Recreation Area
ST	State Threatened
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
WRC	Water Resources Council
U.S.	United States
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
Valley Water	Santa Clara Valley Water District
WEF	Water Education Foundation
WIIN	Water Infrastructure for Improvements to the Nation
WTP	water treatment plant
YR	year

Executive Summary

The B.F. Sisk Dam Raise and Reservoir Expansion Feasibility Report is a joint study by the United States (U.S.) Department of the Interior Bureau of Reclamation (Reclamation), in cooperation with the San Luis & Delta-Mendota Water Authority (SLDMWA). The purpose of the feasibility report is to determine the type and extent of federal and regional interest in a potential project to increase water supply reliability, quantity, and certainty of access for South-of-Delta contractors dependent on San Luis Reservoir. The B.F. Sisk Dam Raise and Reservoir Expansion alternatives analyzed in this Feasibility Report would help to maintain a high-quality, reliable, and cost-effective water supply for South-of-Delta Central Valley Project (CVP) water users.

ES.1 Background

B.F. Sisk Dam was constructed to create the offstream San Luis Reservoir, which provides supplemental storage capacity for the CVP and SWP. Currently, San Luis Reservoir provides 2,027,840 acre-feet of water storage for the CVP and SWP. The water stored in the reservoir is managed for federal (approximately 45%) and state (approximately 55%) uses as part of the CVP and SWP, respectively. Typically, during the winter and early spring, water conveyed from the Sacramento-San Joaquin River Delta (Delta) by the Delta-Mendota Canal (DMC) (a CVP facility) and California Aqueduct (a SWP facility) is lifted from O'Neill Forebay into San Luis Reservoir for storage using the pump-turbines in Gianelli Pumping-Generating Plant. Later in the year, when CVP and SWP demand increases, water is released from San Luis Reservoir through O'Neill Forebay and conveyed via the DMC or the San Luis Canal (a joint-use CVP and SWP facility) and California Aqueduct for use by water contractors (Reclamation 2019). As water is released back through Gianelli Pumping-Generating Plant, the plant generates hydropower, which is used to offset the energy demand of the project operations. Water is also diverted from the west side of San Luis Reservoir at the Pacheco Pumping Plant to supply water to two CVP contractors—the Santa Clara Valley Water District (Valley Water) and the San Benito County Water District (Reclamation 2019). In addition to storing and supplying water, San Luis Reservoir provides recreational opportunities.

The B.F. Sisk Dam SOD Modification Project is a federal project that has the potential to influence water supply conditions in San Luis Reservoir. In 2006, Reclamation completed a risk analysis of B.F. Sisk Dam that concluded there is justification to take action to reduce risk to the downstream public from a potential severe earthquake (Reclamation 2006). Consequently, Reclamation, in coordination with the California Department of Water Resources (DWR), completed the B.F. Sisk Dam SOD Modification Project EIS/EIR in December 2019.[1] The Crest Raise Alternative, one of the alternatives evaluated in the study that would reduce the dam safety risk, was selected to be implemented. Raising the crest elevation 12 feet would increase the distance between the water

[1] The B.F. Sisk Dam SOD Modification Project Final EIS/EIR is available for review at: https://www.usbr.gov/mp/nepa/nepa_project_details.php?Project_ID=34281

surface and the dam crest (freeboard) to prevent reservoir overtopping and failure in the event of dam deformation from a seismic event.

As a connected action to the B.F. Sisk Dam SOD Modification Project, Reclamation and SLDMWA seeks to evaluate an increase in storage capacity for San Luis Reservoir. The increased storage capacity would be achieved by raising the B.F. Sisk Dam embankment (across the entire dam crest) an additional 10 feet above the level proposed for dam safety purposes. This additional 10 feet of dam embankment could add approximately 130,000 AF of water storage to San Luis Reservoir. SLDMWA, in coordination with Reclamation, is conducting a feasibility study to evaluate the project and a potential cost-sharing agreement in accordance with the amended Safety of Dams Act and the Water Infrastructure Improvements for the Nation (WIIN) Act (P.L. 114-322) §4007.

ES.2 Purpose, Needs, Opportunities, and Project Objectives

ES.2.1 Project Purpose and Need

As a potential funding source for the Proposed Action under the WIIN Act, and in accordance with the amended Safety of Dams Act, Reclamation's preliminary purpose and need is to evaluate the feasibility report and determine if SLDMWA's request to increase water storage supply provides an additional benefit (in conjunction with the current B.F. Sisk Dam SOD Modification Project) that is consistent with Reclamation Law, can support a Secretary of the Interior's finding of feasibility, has federal benefits pursuant to the WIIN Act, and can be accomplished without negatively impacting the B.F. Sisk Dam SOD Modification Project.

ES.2.2 Project Objectives

Hydrologic variability and regulatory requirements in the Delta continue to restrict the amount of water that Reclamation and DWR can pump. These limitations cause water supply reliability concerns for CVP and SWP contractors that receive water supplies through Delta conveyance. Regulatory changes, project operations, and overall growth in surface water demand are expected to increase reliance on San Luis Reservoir supplies in the future. These conditions all contribute to a need for actions to improve water supply reliability and operational flexibility south of the Delta.

SLDMWA has developed additional objectives to optimize the water supply benefits of San Luis Reservoir while reducing additional risks to South-of-Delta contractors by:

- Increasing long-term reliability and quantity of yearly allocations to South-of-Delta contractors dependent on San Luis Reservoir.
- Increasing the certainty of access to supplies stored by South-of-Delta contractors in San Luis Reservoir in subsequent water years.

ES.2.3 Project Opportunities

ES.2.1.1 Operational Flexibility

Operational flexibility allows water agencies to manage water supplies efficiently by increasing supply and storage management options. Implementing the B. F. Sisk Dam Raise and Reservoir Expansion Project would provide increased storage options to CVP contractors to store non-Project water.

ES.2.1.2 Water Supply Reliability

During the years when CVP contractors choose to conserve portions of their allocation for use in a subsequent dry year, those contractors can choose to leave that unused supply in San Luis Reservoir as carried-over water. The contractors, in storing this carried-over supply in San Luis Reservoir, take on a risk of potentially losing it if San Luis Reservoir fills the next year and that supply is "spilled" (converted to CVP supplies for following year's allocation). The CVP contractors also store their supplemental supply (non-Project water), such as transfer water or conserved water, into a subsequent year. The contractors also risk losing this water if San Luis Reservoir fills. Implementing the B.F. Sisk Dam Raise and Reservoir Expansion Project could increase storage capacity and reduce the likelihood of carried-over supply and other water being lost to CVP contractors. Additionally, Reclamation could also capture more project water if excess flows become available.

ES.3 Plan Formulation Process

Reclamation and SLDMWA implemented a plan formulation (Figure ES-1) and screening process to identify, evaluate, and develop alternatives.

Figure ES-1. Planning Process

The evaluation identified and screened 17 measures, resulting in the development of two initial alternatives. Reclamation and SLDMWA developed an Alternatives Development Report to document the plan formulation process.

ES.4 Alternatives Evaluated in Feasibility Investigation

After completion of the plan formulation process, the following alternatives were carried forward to the feasibility investigation.

ES.4.1 No Project/No Action Alternative

The No Project/No Action Alternative presents the reasonably foreseeable future conditions in the absence of the alternative plan. The purpose of the No Action/No Project Alternative is to allow decision makers to compare the impacts of approving the project to the impacts of not approving the project. The No Action/No Project Alternative reflects the implementation of the crest raise actions evaluated in the B.F. Sisk Dam SOD Modification Project EIS/EIR. The crest raise action includes increasing the dam crest by 12 feet to reduce safety concerns for the downstream public by reducing the likelihood of overtopping if slumping were to occur during a seismic event (Reclamation 2019). The No Project/No Action Alternative was analyzed and deemed consistent with existing regulatory requirements, including the Reinitiation of Consultation on the Coordinated Long-Term Operations of CVP and SWP (ROC on LTO) Record of Decision (ROD) and the 2018 Addendum to the Coordinated Operation Agreement CVP/SWP and implementation of the B.F. Sisk Dam SOD Modification Project.

ES.4.2 Non-Structural Alternative Plan

Under the Non-Structural Alternative, operational measures would be used to contribute to the purpose and need/project objective. Reclamation would change its annual allocation process to reserve up to 310 thousand-acre-feet (TAF) of stored CVP supply in San Luis Reservoir at the end of wetter[2] years. This water would be reserved in San Luis Reservoir for allocation in subsequent drier years to South-of-Delta CVP contractors. In these drier years, the 310 TAF in reserved supply would be allocated to South-of-Delta CVP water contractors, consistent with the CVP's current allocation of water supply stored in San Luis Reservoir. Under this new operational configuration, allocated water supply not used by CVP contractors would not be carried over for use in a subsequent year. The Non-Structural Alternative would not require any additional construction or maintenance actions.

The Non-Structural Alternative is an action connected to the approved B.F. Sisk Dam SOD Modification Project included under the No Project/No Action Alternative.

ES.4.3 Dam Raise Alternative Plan

The Dam Raise Alternative would place additional fill material on the dam embankment to raise the dam crest an additional 10 feet above the 12-foot embankment raise under development by the B.F. Sisk Dam SOD Modification Project. The 10-foot embankment raise would support an increase in reservoir storage capacity of 130 TAF. Under this alternative, there are three subalternatives that evaluate different operational configurations of this expanded storage capacity.

The Dam Raise Alternative is an action connected to the approved B.F. Sisk Dam SOD Modification Project included under the No Project/No Action Alternative.

ES.4.4 Alternative Plan Cost Estimates

Table ES-1 summarizes the most probable construction, replacement, interest during construction, and operations and maintenance (O&M) cost estimates for the alternatives. The total cost was amortized over the alternatives' assumed 100-year project life at the 2020 federal discount rates of 2.75 percent and January 2020 price level. Table ES-2 presents the probable low costs for the alternatives that were developed to support sensitivity evaluations presented in this feasibility report. Additional detail on these probable low cost estimates are presented in Appendix B-1 and Appendix B-2.

[2] Wetter years under the Non-Structural Alternative are defined as years with South-of-Delta CVP allocations of 55 percent or higher. These allocations usually correlate with wet or above-normal year types.

Table ES-1. Most Probable Cost Estimates for the Alternatives, January 2020 dollars

		Dam Raise Alternative					
	Non-Structural Alternative	CVP-Only	CVP/SWP Split	Investor-Directed Storage (Subalternative A)	Investor-Directed Storage (Subalternative B)	Investor-Directed Storage (Subalternative C)	Investor-Directed Storage (Subalternative D)
Total Construction Cost (million $)	$0.0	$922.1	$922.1	$922.1	$922.1	$922.1	$922.1
Interest and Amortization for Construction Costs, 2.75%, 100 yr (million $)	N/A	$27.2	$27.2	$27.2	$27.2	$27.2	$27.2
Interest and Amortization for Replacement Costs, 2.75%,100 yr (million $)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Interest and Amortization for IDC, 2.75%, 100 yr (million $)	N/A	$2.8	$2.8	$2.8	$2.8	$2.8	$2.8
Average Annual O&M Cost (million $)	$0.0	$1.7	$1.9	$2.5	$2.0	$0.7	$0.7
Total Annual Cost (million $)	$0.0	$31.7	$31.9	$32.5	$32.0	$30.7	$30.7

Notes:

General: January 2020 price levels. Interest During Construction (IDC) calculated with a 2.75 percent rate. Interest and amortization based on a 2.75 federal discount rate over a 100-year period analysis.

Key: IDC = interest during construction; N/A = not applicable; OM&R = operations, maintenance, and replacement; yr = year

Table ES-2. Probable Low Cost Estimates for the Alternatives, January 2020 dollars

		Dam Raise Alternative					
	Non-Structural Alternative	CVP-Only	CVP/SWP Split	Investor-Directed Storage (Subalternative A)	Investor-Directed Storage (Subalternative B)	Investor-Directed Storage (Subalternative C)	Investor-Directed Storage (Subalternative D)
Total Construction Cost (million $)	$0.0	$720.5	$720.5	$720.5	$720.5	$720.5	$720.5
Interest and Amortization for Construction Costs, 2.75%, 100 yr (million $)	N/A	$21.2	$21.2	$21.2	$21.2	$21.2	$21.2
Interest and Amortization for Replacement Costs, 2.75%,100 yr (million $)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Interest and Amortization for IDC, 2.75%, 100 yr (million $)	N/A	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2
Average Annual O&M Cost (million $)	$0.0	$1.7	$1.9	$2.5	$2.0	$0.7	$0.7
Total Annual Cost (million $)	$0.0	$25.1	$25.3	$26.0	$25.5	$24.1	$24.1

Notes:

General: January 2020 price levels. Interest During Construction (IDC) calculated with a 2.75 percent rate. Interest and amortization based on a 2.75 federal discount rate over a 100-year period analysis.

Key: IDC = interest during construction; N/A = not applicable; OM&R = operations, maintenance, and replacement; yr = year

ES.5 National Economic Development Evaluation

The objective of National Economic Development (NED) analysis is to determine the change in net value of the nation's output of goods and services that would result from implementing each project alternative. Beneficial and adverse effects are evaluated in monetary terms and measured in terms of changes in national income among the No Action and various action alternatives. Benefits evaluated for the alternatives included M&I water supply reliability, irrigation water supply reliability, enhanced M&I emergency water storage, transportation safety and reliability, and refuge water supply.

Table ES-3 and Table ES-4 summarize the annual economic benefits and most probable and low probable costs of the alternatives. The tables also present net annual benefits or costs and a benefit-cost ratio for each alternative. Based on this economic evaluation, the Dam Raise Alternative Plan, Investor-Directed Storage Subalternative D, would have the highest net benefits among the alternatives. The Dam Raise Alternative Plan, Investor-Directed Storage Subalternative D would have a benefit-cost ratio range of 1.2 to 1.9 based on the most probable and low probable feasibility level cost estimates and benefits evaluation.

ES.6 Summary of NED Plan

The Dam Raise Alternative, Investor-Directed Storage Subalternative D, was identified as the NED Plan as it would achieve the highest net NED benefits. However, there is more than one operational subalternative under the dam Raise Alternative Plan that is considered economically feasible with NED benefits exceeding NED costs and a positive benefit-cost ratio. The Dam Raise Alternative Plan itself is considered to be technically and financially feasible. All operational subalternatives have been evaluated for environmental feasibility under the EIR/SEIS. This section presents a summary of the Dam Raise Alternative Plan including information relevant to the Investor-Directed Storage Subalternative D given this configuration's identification as the NED Plan.

ES.6.1 Costs and Benefits

The total most probable construction cost of the Dam Raise Alternative is estimated to be $922.1 million. Total annual costs including capital, interest during construction, and O&M would be $30.7 million over a 100-year period and at a 2.75 percent discount rate and January 2020 price level. The total probable low cost construction cost of the Dam Raise Alternative is estimated to be $720.5 million. Total annual probable low costs including capital, interest during construction, and O&M would be $24.1 million over a 100-year period and at a 2.75 percent discount rate and January 2020 price level.

Table ES-3. NED Benefit-Cost Summary for Most Probable Construction Cost, Dam Raise Alternative Plan Subalternatives, Annual Values, 2020 dollars

		Dam Raise Alternative					
	Non-Structural Alternative	**CVP-Only**	**CVP/SWP Split**	**Investor-Directed Storage (Subalternative A)**	**Investor-Directed Storage (Subalternative B)**	**Investor-Directed Storage (Subalternative C)**	**Investor-Directed Storage (Subalternative D)**
Annual M&I Water Supply Reliability Benefits (million $)[1,2]	$0.7	$1.5	–$1.8	$1.6	$16.0	$1.1	$9.4
Annual Agricultural Water Supply Reliability Benefits (million $)[1,2]	–$5.7	$7.4	$4.4	$5.8	$0.9	$3.0	$0.5
Annual Refuge Water Supply Reliability Benefits (million $)[1,2]	–	$0	$0	$1.8	$0	$1.1	$0
Transportation Benefit – Approach 1	–	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
Transportation Benefit – Approach 2	–	$7.6	$7.6	$7.6	$7.6	$7.6	$7.6
Emergency Water Supply Benefit	–	$12.5	$4.4	$14.7	$14.7	$27.8	$27.8
Total Annual Benefits (million $)[1,3]	**–$5.0**	**$21.7/$28.9**	**$7.3/$14.5**	**$24.3/$31.6**	**$31.9/$39.2**	**$33.3/$40.6**	**$38.0/$45.3**
Total Construction Cost (million $)	–	$27.2	$27.2	$27.2	$27.2	$27.2	$27.2
Total Interest During Construction (million $)	–	$2.8	$2.8	$2.8	$2.8	$2.8	$2.8
Annual O&M Costs (million $)[4]	–	$1.7	$1.9	$2.5	$2.0	$0.7	$0.7
Total Annual Costs (million $)[5]	**–**	**$31.7**	**$31.9**	**$32.5**	**$32.0**	**$30.7**	**$30.7**
Net Annual Benefits or Costs (million $)[3]	**N/A**	**-$10.0/-$2.7**	**-$24.6/-$17.3**	**-$8.2/-$0.9**	**-$0.1/$7.2**	**$2.6/$9.9**	**$7.3/$14.6**
Benefit-Cost Ratio[3]	**N/A**	**0.7/0.9**	**0.2/0.5**	**0.7/1.0**	**1.0/1.2**	**1.1/1.3**	**1.2/1.5**

Key: N/A = Not applicable, NED = National Economic Development, CVP= Central Valley Project, SWP= State Water Project, M&I = municipal and industrial, O&M = operations and maintenance

Notes: Based on January 2020 price levels.

[1] Benefits represent annual benefits estimated in the year 2030.

[2] M&I, Agricultural, and Refuge water supply benefits have been adjusted for the structural alternatives as detailed in Appendix C to account for a water supply emergency's limits on the availability of this supply.

[3] The first value includes Transportation Benefit – Approach 1 i.e. the Value of Lost Time Approach. The second value includes Transportation Benefit – Approach 2 i.e. the least-cost most likely alternative approach.

[4] Annual costs include construction cost amortized over 100 years at 2.75 percent discount rate, interest during construction annualized over 100 years at 2.75 percent discount rate, annual operations and maintenance costs.

[5] Total annual costs include construction costs and interest during construction. As noted in Appendix D, costs for long-term O&M are allocated 100 percent to the non-federal sponsor.

Table ES-4. NED Benefit-Cost Summary for Probable Low Cost Construction Cost, Dam Raise Alternative Plan Subalternatives, Annual Values, 2020 dollars

		Dam Raise Alternative					
	Non-Structural Alternative	**CVP-Only**	**CVP/SWP Split**	**Investor-Directed Storage (Subalternative A)**	**Investor-Directed Storage (Subalternative B)**	**Investor-Directed Storage (Subalternative C)**	**Investor-Directed Storage (Subalternative D)**
Annual M&I Water Supply Reliability Benefits (million $)[1,2]	$0.7	$1.5	–$1.8	$1.6	$16.0	$1.1	$9.4
Annual Agricultural Water Supply Reliability Benefits (million $)[1,2]	–$5.7	$7.4	$4.4	$5.8	$0.9	$3.0	$0.5
Annual Refuge Water Supply Reliability Benefits (million $)[1,2]	–	$0	$0	$1.8	$0	$1.1	$0
Transportation Benefit – Approach 1	–	$7.6	$7.6	$7.6	$7.6	$7.6	$0.6
Transportation Benefit – Approach 2	–	$0.3	$0.3	$0.3	$0.3	$0.3	$7.5
Emergency Water Supply Benefit	–	$12.5	$4.4	$14.7	$14.7	$27.8	$27.8
Total Annual Benefits (million $)[1,3]	**–$5.0**	**$21.7/$29.0**	**$7.3/$14.6**	**$24.3/$31.6**	**$31.9/$39.2**	**$33.3/$40.6**	**$38.0/$45.2**
Total Construction Cost (million $)	–	$21.2	$21.2	$21.2	$21.2	$21.2	$21.2
Total Interest During Construction (million $)	–	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2
Annual O&M Costs (million $)[4]	–	$1.7	$1.9	$2.5	$2.0	$0.7	$0.7
Total Annual Costs (million $)[5]	**–**	**$25.1**	**$25.3**	**$25.9**	**$25.4**	**$24.1**	**$24.1**
Net Annual Benefits or Costs (million $)[3]	**N/A**	**-$3.4/$3.9**	**-$18.0/-$10.7**	**-$1.6/$5.7**	**$6.5/$13.8**	**$9.2/$16.5**	**$13.9/$21.2**
Benefit-Cost Ratio[3]	**N/A**	**0.9/1.2**	**0.3/0.6**	**0.9/1.2**	**1.3/1.5**	**1.4/1.7**	**1.6/1.9**

Key: N/A = Not applicable, NED = National Economic Development, CVP= Central Valley Project, SWP= State Water Project, M&I = municipal and industrial, O&M = operations and maintenance

Notes: Based on January 2020 price levels.

[1] Benefits represent annual benefits estimated in the year 2030.

[2] M&I, Agricultural, and Refuge water supply benefits have been adjusted for the structural alternatives as detailed in Appendix C to account for a water supply emergency's limits on the availability of this supply.

[3] The first value includes Transportation Benefit – Approach 1 i.e. the Value of Lost Time Approach. The second value includes Transportation Benefit – Approach 2 i.e. the least-cost most likely alternative approach.

[4] Annual costs include construction cost amortized over 100 years at 2.75 percent discount rate, interest during construction annualized over 100 years at 2.75 percent discount rate, annual operations and maintenance costs.

[5] Total annual costs include construction costs and interest during construction. As noted in Appendix D, costs for long-term O&M are allocated 100 percent to the non-federal sponsor.

The NED Plan would provide increased water supplies to M&I users, irrigation water users, improve transportation safety, and would provide emergency water supplies. Water supplies provided would vary by year type.

- **Municipal and industrial supplies** provided to South-of-Delta CVP user deliveries would increase on average by approximately 18,100 AF.
- **Irrigation water supplies** provided to South-of-Delta CVP user deliveries would increase on average by approximately 2,930 AF.
- **Emergency water storage**, estimated at 63,000 AF (long-term average), would be available in the event of a regional water supply disruption.

The estimated range of the annual monetary benefit of the NED Plan is $38.0 million to $45.2 million. The low end of the net annual economic benefit using the most probable cost and the value of lost time approach for transportation benefits is approximately $7.3 million. The high end of the net annual economic benefit using the low probable cost and least-cost most likely alternative approach for transportation benefits is approximately $21.1 million. As noted in Table ES-3 and Table ES-4, the array of subalternatives have a range of benefits. The main difference between the Investor-Directed Storage Subalternative D and the other subalternatives is the amount of benefits the alternative delivers to the primary objective of improving water supply reliability and quantity by increasing CVP M&I deliveries and developing emergency water supply

ES.6.2 Feasibility

The Dam Raise Alternative Plan, and; therefore, the NED Plan is determined to be technically, environmentally, economically, and financially feasible at the feasibility level of detail.

ES.6.2.1 Technical Feasibility

The Dam Raise Alternative Plan is projected to be technically feasible, constructible, operable, and maintainable. The Reclamation design, estimating, and construction review was performed in June 2020. Preliminary results concur that the project designs, drawings, and geotechnical analysis are at a feasibility level of detail.

ES.6.2.2 Environmental Feasibility

The Dam Raise Alternative Plan will be considered environmentally feasible upon the signing of a ROD and once permits and approvals are secured for construction. The EIR/SEIS evaluates environmental effects and identifies mitigation measures. Once constructed, the expanded San Luis Reservoir would support an increase in reservoir storage capacity of 130 TAF and provide water supply benefits. The Dam Raise Alternative Plan will be considered environmentally feasible once the ROD is signed and the permits and approvals are secured for construction.

ES.6.2.3 Economic Feasibility

The Dam Raise Alternative Plan, Investor-Directed Storage Subalternative D, is projected to be economically feasible because the estimated benefits exceed the estimated costs, resulting in a positive total net benefits range of $7.3 million to $21.2 million annually with a benefit-cost ratio range of 1.2 to 1.9 based on the most probable and low probable cost estimates. Other operational subalternatives that are considered economically feasible are described further in Chapter 5.

ES.6.2.4 Financial Feasibility

Financial feasibility was determined by comparing the plan beneficiaries' payment capacity with the annualized costs. The estimated average M&I and agricultural water users annual ability to pay is large in comparison to the estimated total annual water supply cost provided by the Dam Raise Alternative, which indicates that the potential water users that would benefit from the Dam Raise Alternative Plan will be able to repay their allocated annualized costs. Under the WIIN Act, an agreement must be secured providing the upfront funding necessary to pay the non-federal share of the capital costs before the commencement of construction. This upfront funding further demonstrates the financial feasibility of the Dam Raise Alternative Plan.

ES.6.3 Cost Allocation and Assignment

Costs allocated to each purpose are assigned to federal taxpayers and project beneficiaries (reimbursable) based on the specific project authorization, existing federal law, existing cost-sharing requirements, and laws and objectives of non-federal entities, including states, counties, and nonprofit organizations. Table ES-5 shows an estimate of construction costs assigned to beneficiaries for each project purpose for the Dam Raise Alternative Plan, Investor-Directed Storage Subalternative D. This initial cost allocation is presented as an example for the Dam Raise Alternative Plan includes results from the most probable cost estimate for the NED Plan. Appendix D – Cost Allocation, further describes the initial cost allocation and presents initial cost allocations for the most probable cost estimate and probable low cost estimate for all configurations of the Dam Raise Alternative Plan with NED benefits that exceeded the NED costs.

Table ES-5. Initial Construction Cost Assignment for the Dam Raise Alternative Plan, Investor-Directed Storage Subalternative D, by Project Purpose – Most Probable Costs (million $)

Purpose/Action	Non-federal Assigned Percentage	Cost	Federal Assigned Percentage	Cost	Total Cost
Emergency Water Supply	100%	$420.7	0%	$0.0	$420.7
M&I Water Supply	17%	$38.3	83%	$191.8	$230.2
Agricultural Water Supply	17%	$2.0	83%	$10.2	$12.2
Transportation Safety and Reliability	0%	$0.0	100%	$259.0	$259.0
Total	**50%**	**$461.1**	**50%**	**$461.1**	**$922.1**

Notes:
General: January 2020 price levels. Federal funding for the NED Plan will be provided via the WIIN Act, which limits federal funding participation at 50 percent of the total project cost.
Key:
M&I = municipal and industrial
NED = National Economic Development
WIIN = Water Infrastructure Improvements for the Nation

Table ES-6 presents as an example for the Dam Raise Alternative Plan an estimate of the annual operations, maintenance, and replacement (OM&R) costs assigned to beneficiaries for each project purpose for the Dam Raise Alternative Plan, Investor-Directed Storage Subalternative D.

Table ES-6. Initial OM&R Cost Assignment for the Dam Raise Alternative Plan, Investor-Directed Storage Subalternative D, by Project Purpose (million $/year)[1]

Purpose/Action	Non-federal Assigned Percentage	Cost	Federal Assigned Percentage	Cost	Total Cost
Emergency Water Supply	100%	$0.44	0%	$0.00	$0.44
M&I Water Supply	100%	$0.24	0%	$0.00	$0.24
Agricultural Water Supply	100%	$0.01	0%	$0.00	$0.01
Transportation Safety and Reliability	100%	$0.00	0%	$0.00	$0.00
Total	100%	$0.70	0%	$0.00	$0.70

Notes:
[1] Cost assignment for joint OM&R associated with NED Plan facilities was assigned as 100-percent non-federal. For this alternative, no replacement costs are assumed to be incurred over the 100-year period of record. All values are rounded for display purposes; as a result, not all totals may sum.
Key: M&I = municipal and industrial
OM&R = operations, maintenance, and replacement (no replacement costs are included)
NED = National Economic Development

ES.6.3 Risk and Uncertainty

Certain assumptions were made for the feasibility investigation based on engineering, economic, and scientific judgment and the availability of data and information. While this is effective in estimating relative outcomes, various risks and uncertainties could affect implementation of an authorized project. These risks and uncertainties are described in Chapter 6 and summarized below.

- Potential climate trends could produce conditions that differ from today, affecting future CVP and SWP operations.
- Future water system operations and facilities may change, in addition to changing operational constraints, hydrology, demands, and regulatory conditions in California.
- Construction cost estimates, at a feasibility level, have inherent risks and uncertainties due to unknown future labor, market, and field conditions.
- Timing, source, and availability of funding will affect the construction schedule and cost estimates included in the Feasibility Report.
- Prior to award of any construction contract or beginning construction activities, a ROD must be executed along with the necessary associated activities to support initiation of consultation.
- Estimation of the economic (monetized) benefits of potential project accomplishments is subject to uncertainties associated with valuation methods and assumptions.

ES.7 Recommendations

The overall recommendation of this Feasibility Report is that the Secretary of the Interior, acting through Reclamation, participate in funding and implementing the Dam Raise Alternative, including the environmental commitments and mitigation measures identified in the planned Final 2020 EIR/SEIS. The WIIN Act, Section 4007, provides authority for the Secretary of the Interior to (1)

negotiate and enter into an agreement on behalf of the United States for the design, study, and construction or expansion of any federally owned storage project and (2) provide financial assistance up to an amount equal to not more than 50 percent of the total cost. The amended Safety of Dam Act, Section 5.B, provides authority for the Secretary of Interior to (1) determine additional project benefits are necessary and in the interest of the United States, (2) determine the project is consistent with the SOD Act, and (3) determine the project is feasible. This Feasibility Report documents the necessary information required for the Secretary of the Interior to render a determination of feasibility in accordance with the amended Safety of Dam Act and the WIIN Act, Section 4007, for pursing construction and funding the B.F. Sisk Dam Raise and Reservoir Expansion Project.

The following actions are recommended for the Secretary of the Interior:

- Approve the Dam Raise Alternative Plan, as outlined in this report, and submit the following determinations to Congress, per Section 4007(b)(3) of WIIN:
  - Project is feasible and in accordance with the reclamation laws
  - Proportional share of the project's benefits are federal benefits
- Request that Congress fund up to 50 percent of the total project cost.
  - Request that Congress authorize Reclamation to increase the construction cost to allow for escalation from stated price levels (January 2020) to the notice to proceed for each contract or work package, based upon Reclamation's Construction Cost Trends publication or similar source.
- Authorize the Commissioner of the Bureau of Reclamation to enter into a cost-sharing agreement for the construction of the Dam Raise Alternative Plan.
- Request that Congress annually appropriate funds such that construction is completed within 8 years of construction authorization to avoid cost overruns and ensure timely completion.

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Chapter 1 Introduction

The B.F. Sisk Dam Raise and Reservoir Expansion Project (Project) Feasibility Report is a joint study by San Luis & Delta-Mendota Water Authority (SLDMWA) and the U.S. Department of the Interior (DOI) Bureau of Reclamation (Reclamation). The purpose of the feasibility report is to determine the potential type and extent of federal and regional interest in a potential project to facilitate and approve the capacity expansion of the San Luis Reservoir. The Project alternatives analyzed in this Feasibility Report would help to secure a more reliable long-term water supply for SLDMWA and its member agencies and address water supply reliability problems across the federal Central Valley Project (CVP) and State Water Project (SWP) service areas.

The Reclamation Safety of Dams Act of November 2, 1978 (SOD Act) (43 United States Code [U.S.C.] §506 et seq.), was amended by Public Law (P.L.) 114-113 to include authority for Reclamation to develop additional project benefits in conjunction with a B.F. Sisk Dam Safety of Dams (SOD) Modification Project. Reclamation is evaluating this project as a connected action to the B. F. Sisk Dam SOD Modification Project to create additional project benefits by increasing storage within San Luis Reservoir. Reclamation and the California Department of Water Resources (DWR) evaluated the feasibility and environmental impacts of the B.F. Sisk Dam SOD Modification Project in 2019 and the documents are available here: https://www.usbr.gov/mp/sod/projects/sisk/.

1.1 Feasibility Report Purpose and Organization

The purpose of this Feasibility Report is to document the development, evaluation, and comparison of the alternatives established during the federal planning process for the Project and identify the National Economic Development (NED) Plan. Figure 1-1 shows the federal planning process. The Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) is a companion document to this report and assesses the environmental effects of a range of alternatives, including the No Project/No Action Alternative.

Figure 1-1. Planning process

This Feasibility Report is the result of a multistep, iterative screening process that further developed the measures initially identified in the Alternatives Development Report. The scope of this report includes specifying problems and opportunities, inventory and forecast of conditions, formulation of alternative plans, evaluation of effects of alternative plans, comparison of alternative plans, and identification of the NED Plan.

This Feasibility Report includes the following topics:

- Chapter 1 describes the study authorization; project background; problems, needs, and opportunities; and study planning objectives. The chapter also describes the study area and pertinent prior studies, projects, and programs.
- Chapter 2 describes the existing and likely future water resources and related conditions in the study area.
- Chapter 3 describes the plan formulation process, including the Alternatives Development Report, project modifications, and plan reformulation.
- Chapter 4 presents the No Project/No Action Alternative and alternative plans, including features and operations.
- Chapter 5 provides the evaluation and comparison of alternatives.
- Chapter 6 describes the Recommended Plan, including its major components and benefits, and determination of feasibility, risks, and uncertainties.
- Chapter 7 provides an overview of coordination and public involvement for the study, including stakeholder outreach, public involvement, and agency coordination and consultation.
- Chapter 8 summarizes findings of this Feasibility Report.
- Chapter 9 includes the next steps.
- Chapter 10 contains the sources used to prepare this Feasibility Report.

1.2 Project Background and History

B.F. Sisk Dam was constructed to create the offstream San Luis Reservoir, which provides supplemental storage capacity for the CVP and SWP. Currently, San Luis Reservoir provides 2,027,840 acre-feet (AF) of water storage for the CVP and SWP. The water stored in the reservoir is managed for federal (45%) and state (55%) uses as part of the CVP and SWP, respectively. Typically, during the winter and early spring, water conveyed from the Sacramento-San Joaquin River Delta (Delta) in the Delta-Mendota Canal (DMC) (a CVP facility) and California Aqueduct (a SWP facility) is lifted from O'Neill Forebay into San Luis Reservoir for storage using the pump-turbines in the Gianelli Pumping-Generating Plant (see Figure 1-2). Later in the year, when CVP and SWP demand increases, water is released from San Luis Reservoir through O'Neill Forebay and conveyed via the DMC or the San Luis Canal and California Aqueduct for use by water contractors (Reclamation 2019). As water is released back through the Gianelli Pumping-Generating Plant, the plant generates hydropower, which is used to offset the energy demand of the project operations. Water is also diverted from the west side of San Luis Reservoir at the Pacheco Pumping Plant to supply water to two CVP contractors, the Santa Clara Valley Water District (Valley Water), and the

San Benito County Water District (Reclamation 2019). In addition to storing and supplying water, San Luis Reservoir provides recreation opportunities.

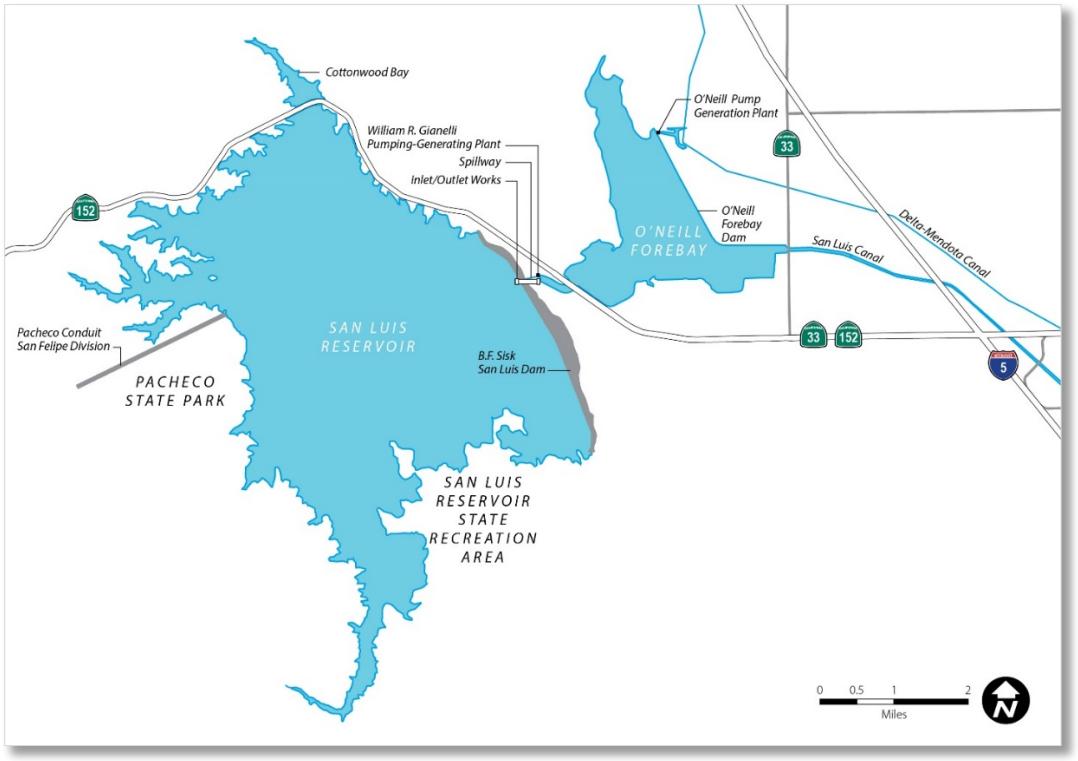

Figure 1-2. San Luis Reservoir and Associated Facilities

The B.F. Sisk Dam SOD Modification Project is a federal project that has the potential to influence water supply conditions in San Luis Reservoir. In 2006, Reclamation completed a risk analysis of B.F. Sisk Dam that concluded there is justification to take action to reduce risk to the downstream public from a potential severe earthquake (Reclamation 2006). Consequently, Reclamation, in coordination with DWR, completed a corrective action study in December 2019[3]. The Crest Raise Alternative, one of the alternatives evaluated in the study that would reduce the dam safety risk, was selected to be implemented. Raising the crest elevation 12 feet would increase the distance between the water surface and the dam crest (freeboard) to prevent reservoir overtopping and failure in the event of dam deformation from a seismic event. The Crest Raise Alternative does not provide for any additional storage.

As a connected action to the B.F. Sisk Dam SOD Modification Project, Reclamation and SLDMWA seek to evaluate an increase in storage capacity of San Luis Reservoir. The increased storage capacity would be achieved by an additional 10-foot raise of the B.F. Sisk Dam embankment across the entire dam crest above the level proposed for dam safety purposes. This additional 10 feet of dam embankment could add approximately 130,000 AF of water storage to San Luis Reservoir.

[3] The B.F. Sisk Dam SOD Modification Project Final EIS/EIR is available for review at the following hyperlink: https://www.usbr.gov/mp/nepa/nepa_project_details.php?Project_ID=34281

SLDMWA, in coordination with Reclamation, is conducting a feasibility study to evaluate the Project and a potential cost-share in accordance with the Reclamation SOD Act and the Water Infrastructure Improvements for the Nation (WIIN) Act (P.L. 114-322) §4007.

1.2.1 Reclamation Safety of Dams (SOD) Act

The SOD Act (43 United States Code [U.S.C.] §506 et seq.), was amended by P.L. 114-113 to include authority for Reclamation to develop additional project benefits in conjunction with a B.F. Sisk Dam SOD Modification Project. Pursuant to Section 5.B. of the SOD Act, as amended, Reclamation must determine that additional project benefits are necessary and in the interest of the United States prior to developing any additional project benefits, consistent with Reclamation law. Furthermore, it must be determined that the development of additional project benefits will not negatively impact the B.F. Sisk Dam SOD Modification Project.

1.2.2 Water Infrastructure Improvements for the Nation (WIIN) Act

The Project is a federally owned storage project, and according to P.L. 114-322, Title III, Subtitle J, Section 4007, Subsection (a)(1):

> *The Term "federally owned storage project" means any project involving a surface water storage facility in a Reclamation State-*
>
> *(A) to which the United States holds title; and*
>
> *(B) that was authorized to be constructed, operated, and maintained pursuant to the reclamation laws.*

Further guidance is provided in P.L. 114-322, Section 4007 (b):

> *(1) Agreements- On the request of any state, any department, agency, or subdivision of a state, or any public agency organized pursuant to state law, the Secretary of the Interior may negotiate and enter into an agreement on behalf of the United States for the design, study, and construction or expansion of any federally owned storage project in accordance with this section.*
>
> *(2) Federal Cost Share- Subject to the requirements of this subsection, the Secretary of the Interior may participate in a federally owned storage project in an amount equal to not more than 50 percent of the total cost of the federally owned storage project.*
>
> *(3) Commencement- The construction of a federally owned storage project that is the subject of an agreement under this subsection shall not commence until the Secretary of the Interior-*
>
> *(A) determinates that the proposed federally owned storage project is feasible in accordance with the reclamation laws:*
>
> *(B) secures an agreement providing upfront funding as is necessary to pay the non-Federal share of the capital costs; and*
>
> *(C) determines that, in return for the Federal cost-share investment in the federally owned storage project, at least a proportionate share of the project benefits are Federal benefits, including water supplies dedicated to specific purposed such as environmental enhancement and wildlife refuges.*

(4) Environmental Laws- In participating in a federally owned storage project under this subsection, the Secretary of the Interior shall comply with all applicable environmental laws, including the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.).

Therefore, section 4007(b) allows the Secretary of the Interior to negotiate and enter into an agreement on behalf of the United States for the design, study, and construction or expansion of any federally owned storage project. The Secretary of the Interior can participate up to "an amount equal to not more than 50 percent of the total cost." Section 4007(b)(3)(c) also states that "at least a proportional share of the project benefits must be federal benefits, including water supplies dedicated to specific purposes such as environmental enhancement and wildlife refuges." Section 4007(i) states "this section shall apply only to federally owned storage projects and state-led storage projects that the Secretary of the Interior determines to be feasible before January 1, 2021."

1.3 Purpose, Needs, Opportunities, and Planning Objectives

1.3.1 Water and Related Resource Purpose, Needs, and Opportunities

1.3.1.1 Project Purpose and Need

As a potential funding source for the Project under the WIIN Act, and in accordance with the amended SOD Act, Reclamation's preliminary purpose and need is to evaluate the feasibility report and determine if SLDMWA's request to increase storage capacity, resulting in a corresponding increase in water supply reliability across the CVP and SWP service areas, provides an additional benefit in conjunction with the current B.F. Sisk Dam SOD Modification Project, is consistent with Reclamation Law, can support a Secretary of Interior's finding of feasibility, has federal benefits pursuant to the WIIN Act, and can be accomplished without negatively impacting the B.F. Sisk Dam SOD Modification Project.

1.3.1.2 Opportunities

Operational Flexibility: Operational flexibility allows water agencies to manage water supplies efficiently by increasing supply and storage management options.

Water Supply Reliability: In years when CVP contractors choose to conserve portions of their allocation for use in a subsequent dry year, those contractors can choose to leave that unused supply in San Luis Reservoir as carried-over water. The contractors, in storing this carried-over supply in San Luis Reservoir, take on a risk of potentially losing it if San Luis Reservoir fills the next year and that supply is "spilled" (converted to CVP supplies for following year's allocation). The CVP contractors also store their supplemental supply (non-project water) such as transfer water or conserved water into a subsequent year. The contractors also risk losing this water if San Luis Reservoir fills. Implementing the B.F. Sisk Dam Raise and Reservoir Expansion Project could increase storage capacity and reduce the likelihood of carried-over supply and other water being lost to CVP contractors. Additionally, the contractors could also capture more project water if excess flows become available.

1.3.2 Project Objectives

As required by the California Environmental Quality Act (CEQA), a lead agency must identify the objectives sought by the proposed project. SLDMWA has developed objectives to optimize the water supply benefits of San Luis Reservoir while reducing additional risks to South-of-Delta water users by:

- Increasing the reliability and quantity of yearly allocations to South-of-Delta contractors dependent on San Luis Reservoir.
- Increasing the certainty of access to supplies stored by South-of-Delta contractors in San Luis Reservoir in subsequent water years.

1.4 Study Area

The study area, shown in Figure 1-3, includes the San Luis Reservoir and its related water infrastructure. The study area also includes the Delta and the service areas of South-of-Delta CVP and SWP contractors and wildlife refuges.

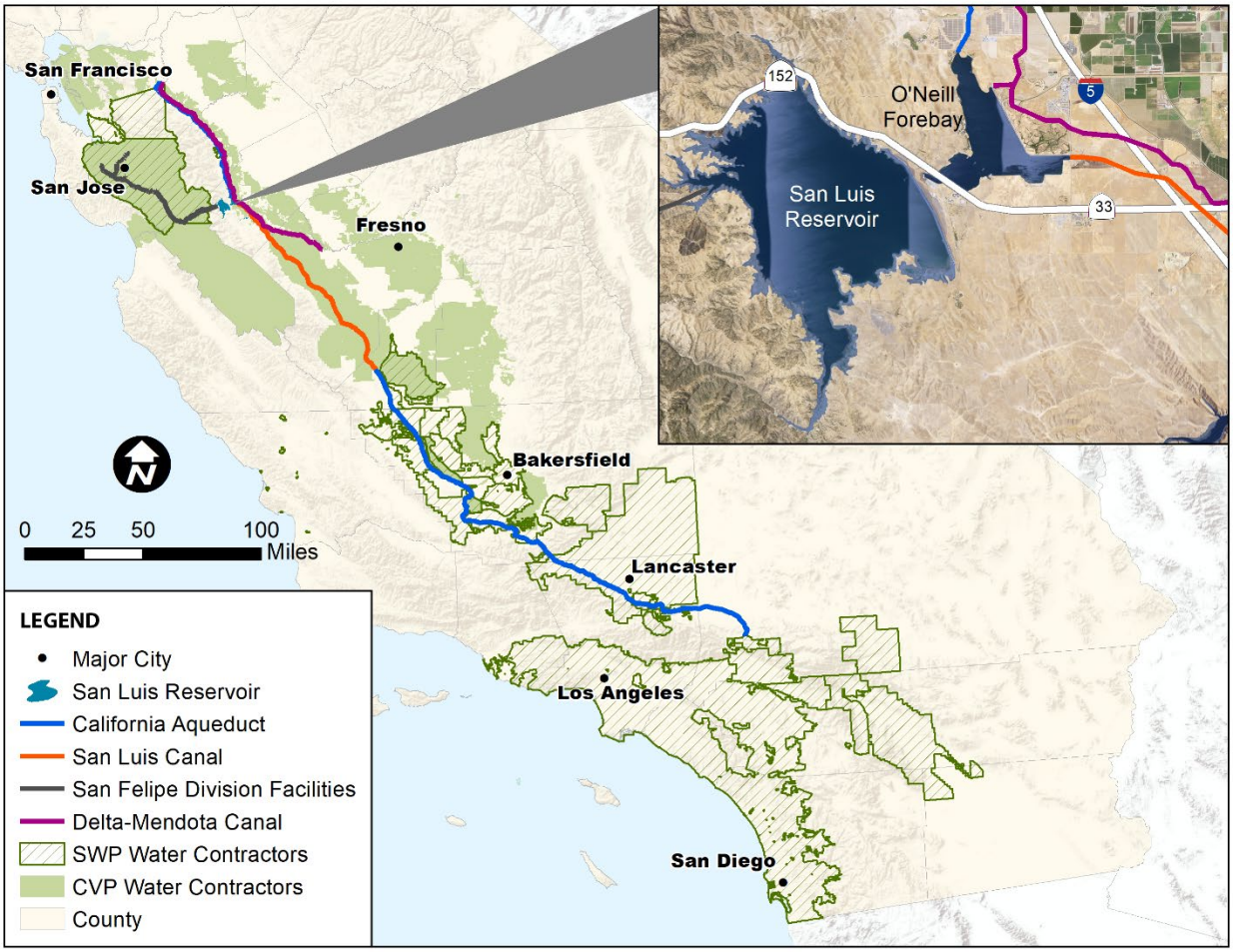

Figure 1-3. Study Area

1.5 Related Studies, Projects, and Programs

Federal, state, and local agencies are participating throughout California in a wide range of other projects and programs that have the potential to influence water supply conditions for both San Luis Reservoir and SLDMWA. The projects and programs listed below are in the study area and are potentially relevant to the study.

1.5.1 Activities of the State of California

State of California programs and plans relevant to the study are described below.

1.5.1.1 California Water Action Plan

The California Water Action Plan is a road map outlining state priorities and providing policy guidance for achieving sustainable water management. The first plan was released in 2014 and was updated in 2016 to reflect the progress toward the goals and provide additional guidance. The California Water Action Plan outlines the California priorities to mitigate the effects of the drought, increase and sustain water conservation, rebalance water rules and enable voluntary transfers of water, expand water recycling, expand surface storage, improve groundwater management, and improve access to safe drinking water in disadvantaged communities.

1.5.1.2 Water Conservation Act of 2009

California enacted Senate Bill X7-7 as the Water Conservation Act of 2009, requiring all water suppliers to increase water use efficiency. For urban retail water agencies, the legislation set an overall goal of reducing per capita urban water use by 20 percent by December 31, 2020, informally referred to as "20 by 2020," with an incremental goal of reducing per capita water use by at least 10 percent by December 31, 2015. Senate Bill X7-7 specified that urban retail water suppliers that do not meet the established water conservation requirements are not eligible for California State water grants or loans.

1.5.1.3 2014 Drought State of Emergency

Following a dry year in 2013, and continued dry hydrology into the beginning of the 2014 water year, California Governor Edmund G. Brown Jr. proclaimed a drought State of Emergency in January 2014, directing local water suppliers to immediately implement water shortage contingency plans and requesting a voluntary 20-percent urban water conservation. With the historically unprecedented drought continuing into the 2015 water year, in April 2015, the Governor issued an Executive Order mandating a 25-percent reduction in potable urban water usage. The State Water Resources Control Board (SWRCB) set conservation targets for urban water agencies based on their 2013 average per capita water use and curtailed senior water rights holders, including those with both pre- and post-1914 rights, from diverting water. CVP and SWP contract allocations were low throughout the period, and Delta water quality objectives required by SWRCB Water Rights Decision 1641 (D-1641) for CVP and SWP operations were relaxed through a series of Temporary Urgency Change Petitions for much of the drought.

The recent drought highlighted the need for improved regional water supply reliability. Although the State of Emergency was lifted in April 2017, long-term water conservation measures intended to make conservation a way of life in California remain in effect. In 2016, California's Governor issued Executive Order B-37-16 instructing various California state agencies to make recommendations for

how to implement long-term improvements to water supply management, water use efficiency, and conservation.

1.5.1.4 Sustainable Groundwater Management Act

A three-bill package, known as the Sustainable Groundwater Management Act (SGMA), was signed into law in 2014. The legislation, amended in 2015, allows local agencies to customize groundwater sustainability plans to their regional economic and environmental needs and creates a framework for sustainable local groundwater management.

SGMA provides local groundwater agencies with the authority, technical, and financial assistance needed to maintain groundwater supplies, provides for sustainable use of groundwater basins, enhances local management of groundwater consistent with rights to use or store groundwater, establishes minimum standards for effective continuous management of groundwater, avoids or minimizes impacts for land subsidence, improves data collection and understanding of groundwater resources and management, increases groundwater storage and removes impediments to recharge, and empowers local agencies to manage groundwater basins while minimizing the State of California's intervention.

1.5.1.5 State Water Project Delivery Capability Report 2015

In July 2015, DWR released the State Water Project Delivery Capability Report 2015 (DWR 2015). This report estimated the current existing (2015) and future (2035) SWP delivery capability and the allocation of the estimated overall deliveries to each of the SWP contractors. The report incorporated regulatory requirements for SWP operations in and upstream of the Delta and made assumptions about water use in the upstream watersheds and by the SWP contractors. Estimates of future delivery capability also factored in potential impacts of climate change and sea level rise. Increasing variability in hydrological conditions and new regulations governing SWP and CVP exports from the Delta have served to reduce SWP water supply reliability.

1.5.1.6 California Water Plan

DWR's California Water Plan provides a framework for water managers, legislators, and the public to consider options and make decisions regarding California's water future (DWR 2019). The plan, which is updated every 5 years, presents basic data and information on California's water resources, including water supply evaluations and assessments of agricultural, urban, and environmental water uses to quantify the gap between water supplies and uses. The plan also identifies and evaluates existing and proposed statewide demand management and water supply augmentation programs and projects to address California's water needs.

DWR's goals in preparing the plan are to meet requirements of the California Water Code, receive broad support among those participating in California's water planning, and serve as a useful document for the public, water planners throughout the State of California, legislators, and other decision-makers (DWR 2019). As a master plan, it guides the control, protection, conservation, development, management, and efficient use of California's water resources (California Water Code section 10005(a)).

1.5.1.7 State Water Resources Control Board Decision 1641

The SWRCB imposes constraints upon the Delta operations of the CVP and SWP through terms and conditions imposed on CVP and SWP water rights. With Water Rights Decision 1641, the SWRCB implements the objectives set forth in the SWRCB 1995 Bay-Delta Water Quality Control Plan and imposes flow and water quality objectives upon the Projects to assure protection of beneficial uses in the Delta. The SWRCB also grants conditional changes to points of diversion for each project with D-1641.

The various flow objectives and export restraints are designed to protect fisheries. These objectives include specific outflow requirements throughout the year, specific export restraints in the spring, and export limits based on a percentage of estuary inflow throughout the year. The water quality objectives are designed to protect agricultural, municipal and industrial, and fishery uses, and they vary throughout the year and by the wetness of the year.

1.5.1.8 Incidental Take Permit for Long-Term Operation of the State Water Project in the Sacramento-San Joaquin Delta

In March 2020, California Department of Fish and Wildlife (CDFW) issued an Incidental Take Permit (ITP) to DWR for long-term operations of the SWP. The permit covers four species protected under the CEQA: Delta smelt, longfin smelt, winter-run Chinook salmon, and spring-run Chinook salmon. The proposed long-term operation of SWP would comply with the 2019 USFWS and National Marine Fisheries Service (NMFS) biological opinions (BOs) for the protection of federally listed species, in addition the state requirements under the ITP. Modeling for the ITP shows there would be increases in modeled entrainment at SWP facilities during April and May, attributed to CVP operations. The SWP may also increase pumping in wetter years, when Delta inflow is over 44,500 cubic feet per second and, in those years, some increases in entrainment can be attributed to both the SWP and the CVP.

1.5.2 Activities of Federal Agencies

Federal studies, projects, programs, and plans relevant to the Feasibility Report are described below.

1.5.2.1 San Luis Drainage Feature Reevaluation Project

The purpose of the San Luis Drainage Feature Reevaluation Project is to identify a plan to provide agricultural drainage service to the CVP's San Luis Unit in accordance with the Ninth District Circuit Court decision that Reclamation must provide drainage service to the San Luis Unit. The San Luis Drainage Feature Reevaluation Project could affect operations of the San Luis Reservoir by altering the schedule for water deliveries.

Drainage service is defined as management of the regional shallow groundwater table through the collection and disposal of shallow groundwater from the root zone of drainage-impaired lands or reduction of water contributions to the shallow groundwater table through land retirement. The related Record of Decision (ROD), signed in March 2007, selected the In-Valley/Water Needs Alternative for implementation. This alternative includes collection systems, reuse areas, treatment, and disposal facilities, as well as the retirement of 184,000 acres of farmland in the Westlands Water District and 10,000 acres in the Broadview Water District. The In-Valley/Water Needs Alternative would retire enough lands to balance the internal water demand of the San Luis Unit with the expected available supply. Reclamation has finalized the estimate of project costs and determined that congressional action is needed to implement the In-Valley/Water Needs Alternative.

1.5.2.2 Central Valley Project Improvement Act

Implementation of the Central Valley Project Improvement Act (CVPIA[4]) changed the management of the CVP by making fish and wildlife protection a project purpose, equal to water supply for agricultural and urban uses. The CVPIA affects exports of water from the Delta to San Luis Reservoir and increases operational pressures on the reservoir to meet South-of-Delta water demands. CVPIA Section 3406 (b)(2) authorized and directed the Secretary of the Interior, among other actions, to dedicate and manage 800 thousand acre-feet (TAF) of CVP yield annually for the primary purpose of implementing the fish, wildlife, and habitat restoration purposes and measures authorized in CVPIA, to assist the state in its efforts to protect the waters of the San Francisco Bay-Delta Estuary, and to help meet obligations legally imposed on the CVP under state or federal law following the date of enactment of the CVPIA.

CVPIA Section 3406(d)(1) required that the Secretary immediately provide specific quantities of water to the refuges referred to as "Level 2" supplies. The CVPIA requires delivery of the Level 2 water in all year types except critically dry water year conditions, when it can be reduced by 25 percent. Section 3406(d)(2) of the CVPIA refers to incremental "Level 4" refuge water supplies, which are the quantities required for optimum habitat management of the existing refuge lands. Incremental Level 4 (IL4) water supplies amount to about 163 TAF above Level 2 water supplies. The availability of IL4 refuge water supplies are influenced by the availability of water for transfer from willing sellers.

1.5.2.3 CVPIA Contract Renewals

The CVP has more than 100 water service contracts. Reclamation has negotiated renewals of long-term water service contracts and conversions to long-term repayment contracts for all CVP contractors, including those within the study area, as required by CVPIA Section 3404(c). As mandated by Section 3404(c), irrigation contracts have a term not exceeding 25 years and municipal and industrial (M&I) contracts have a term not exceeding 40 years. Most contracts have been renewed; those contracts not yet renewed will be executed upon completion of the reinitiated consultation on the Coordinated Long-term Operations of the CVP and SWP. All water service contracts contain terms and conditions for the delivery and use of CVP water, for the repayment of applicable capital construction costs, and for the reimbursement of annual operations and maintenance (O&M) expenditures. Contracts may be converted to permanent repayment contracts under the WIIN Act, regardless of the BOs completion date.

Reclamation recognizes that hydrologic, regulatory, and operational uncertainties constrain its ability to deliver CVP water and that such uncertainties may increase in importance as future water demands increase. Because of uncertainties, competing demands, variable supplies, and stated shortage provisions in service contracts, Reclamation and its contractors recognize that delivery of full contract quantities is not guaranteed and that deliveries may be equal to or less than historical deliveries. The Project may increase Reclamation's ability to deliver greater quantities of water. Furthermore, improved operations of San Luis Reservoir may provide a more reliable water supply for CVP contractors.

[4] Title 34 of P.L. 102-575, the Reclamation Projects Authorization and Adjustment Act of 1992, signed October 30, 1992.

1.5.2.4 Water Supply and Yield Study

The Water Supply and Yield Study describes existing California statewide water demand and available supplies, as well as projected future demand, available supplies, and willingness to pay for CALFED Bay-Delta Program (CALFED) storage and conveyance projects (Reclamation 2008). Using demands from DWR's California Water Plan Update 2005 (DWR 2005) and assuming no interbasin transfers, statewide supply/demand gaps were estimated to be 2.3 million-acre-feet (MAF) in average water years and 4.2 MAF in dry water years. Without investment in storage and conveyance projects, statewide supply/demand gaps were projected to grow to 4.9 MAF in average water years and 6.1 MAF in dry water years, by 2030. The Water Supply and Yield Study also determined that, if CALFED storage and conveyance projects were constructed, the projected 2030 supply/demand gap would be reduced to 1.5 MAF in average water years and 2.2 MAF in dry water years.

1.5.2.5 Rescheduling Guidelines for the Federal Share of Storage in San Luis Reservoir

Reclamation developed guidelines that apply to the annual rescheduling of CVP (Project) water in the San Luis Reservoir. These guidelines may change from year to year to ensure that rescheduling will not interfere with CVP operations and annual changes may include changes to dates, water rates, and other policy considerations. Rescheduled water is the first water scheduled and delivered to individual contractors.

Under current guidelines, development of new CVP water supplies, including supplies for CVPIA acquired/allocated Contract Year water for refuge and wildlife habitat restoration (Level II Refuge Water) has first priority of storage in the federal share of San Luis Reservoir. The complete schedule of storage priorities for the federal share of San Luis Reservoir is as follows:

1. Upcoming Contract Year Project Water, including Level II Refuge Water
2. Upcoming Contract Year Level IV Refuge Water
3. Rescheduled Project Water
    a. Irrigation Water
    b. M&I Water and Level III Refuge Water
    c. Transferred Project Water
4. Cross Valley Canal Contractor Water
5. Current Contract Year Level IV Refuge Water
6. Non-Project water supplies (i.e., water supplies not part of CVP or SWP) acquired by existing South-of-Delta CVP Project contractors
7. San Joaquin River Restoration Settlement interim flow water in San Luis Reservoir
8. All other non-Project water

The Rescheduling Guidelines (Reclamation 2017) set procedures and provide guidance on approval and scheduling of rescheduled water.

1. **Request** – By February 21, Contractors must identify the estimated total quantity of rescheduled water and acquired non-Project water the contractor desires to reschedule/store. A final quantity of rescheduled Project water and acquired non-Project project water request must be submitted no later than March 10.

Rescheduled Quantity of Water – Reclamation allows each contractor to reschedule up to the lesser of all unused Project water or 10% of their contract entitlement. If the federal share of San Luis Reservoir fills and results in reduced CVP pumping from the Delta due to stored rescheduled water, the pumping reduction is known as foregone pumping. Undelivered rescheduled water is reduced by the volume of foregone pumping such that each contractor's share of the imputed foregone pumping is based upon the contractor's proportionate share of undelivered rescheduled water stored in the federal share of San Luis Reservoir.

2. **Limitation on M&I Water** – Rescheduled irrigation water will have priority over rescheduled M&I water.
3. **Schedule** – Once contractors receive written approval from South-Central California Area Office (SCCAO) of the contractor's rescheduling/storage request(s), the contractor must submit a delivery schedule, which will subsequently be approved by Reclamation.
4. **First Water Evacuated** – All rescheduled Project water and acquired non-Project water is subject to available conveyance and storage capacity. If there is insufficient storage space in the federal share of San Luis Reservoir to store these supplies, such water must be evacuated as soon as possible upon notice from Reclamation.
5. **Transfers/Exchanges, and/or Banking of Rescheduled Water** – Rescheduled Project water will be eligible for transfers, exchanges, and/or banking during the upcoming contract year.
6. **Loss Criteria after March 1** – Rescheduled Project water will not interfere with the upcoming contract year Project operations. If Reclamation's share of San Luis Reservoir does not fill prior to a sustained drawdown, the rescheduled Project water and acquired non-Project water will be deemed as having no impact on the upcoming contract year Project supplies and must be the first Project water scheduled and used in the upcoming contract year.

   If Reclamation's share is deemed full prior to or on March 1, Reclamation will maintain a record of foregone pumping from the time the federal share of San Luis Reservoir filled until the conclusion of the sustained drawdown and the loss of rescheduled water.
7. **Section 215 Water** – Contractors may enter temporary contracts with Reclamation for nonstorable or unmanageable flood flows of short duration (Section 215 water).

The Business Practice Guideline No. 8, developed by Reclamation and issued with the Rescheduling Guidelines, provides guidance for developing rates, identifying contractor obligations and payment requirements, and applying revenue for rescheduled Project water (Reclamation 2017).

1.5.3 Joint Activities of Federal and California State Agencies

Programs and plans relevant to the study that were developed or are being developed as collaborations between federal and state agencies are described below.

1.5.3.1 Delta Conveyance Project

The Delta Conveyance Project is being planned by DWR and several state water contractors.

The Delta Conveyance Project planning process began in 2006, when Reclamation and DWR, along with several state and federal water contractors including, Kern County Water Agency, Metropolitan Water District of Southern California, SLDMWA, Santa Clara Valley Water District, Westlands Water District, and the Zone 7 Water Agency (collectively referred to as Potential Authorized Entities) initially proposed the BDCP. The BDCP envisioned updating the SWP by adding new points of diversion in the north Delta and by providing for large-scale species conservation through a 50-year habitat conservation plan (HCP)/natural communities conservation plan (NCCP). The HCP/NCCP was intended to comply with Section 10 of the federal Endangered Species Act and to achieve compliance with the California Endangered Species Act through the California Natural Community Conservation Planning Act. A Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) was released in December 2013.

Following release of the Draft EIS/EIR, Reclamation and DWR issued a Supplemental Draft EIS/Partially Recirculated Draft EIR that included three additional alternatives for consideration that would update SWP without the large-scale conservation efforts in an HCP/NCCP. The Lead Agencies proposed that one of these non-HCP alternatives, known as California WaterFix Alternative 4A, be identified as the preferred alternative in replacement of the BDCP alternative (DWR and Reclamation 2015). The preferred WaterFix Alternative (4A) consisted of three new diversion points in the north Delta, tunnel conveyance and ancillary facilities, operational elements, restoration measures, and an adaptive management program (DWR and Reclamation 2015). The Supplemental Draft EIS/Partially Recirculated Draft EIR also included updates to the BDCP Alternative and other revisions and updates to the 2013 Draft EIR/EIS analyses. In addition, the state proposed California EcoRestore, as a separate program, to provide restoration efforts for species conservation independent of the SWP facility upgrades.

The Final EIS/EIR for the Bay Delta Conservation Plan (BDCP)/California WaterFix that identified the California WaterFix for implementation was released in December 2016. Biological opinions for the California WaterFix were released in June 2017. However, in May 2019, DWR rescinded all permits, permit applications, bond authorizations, and CEQA documentation for California WaterFix and announced that it was working with public water agencies on a new environmental review process for a single tunnel project. In January 2020, DWR initiated a new CEQA process for the Delta Conveyance Project with a Notice of Preparation of an EIR. DWR expects the Draft EIR to be published in 2021 for public review and comment.

1.5.3.2 Biological Opinions on the Long-term Operations of the CVP and SWP

On October 21, 2019, USFWS and NMFS released biological opinions on the effects of coordinated long-term operations of the CVP and SWP (USFWS 2019; NMFS 2019). In the 2019 biological opinion, USFWS concluded that continued long-term operations of the CVP and SWP are "not likely to jeopardize" the continued existence of delta smelt and its critical habitat (USFWS 2019).

Similar to the USFWS biological opinion on delta smelt, NMFS concluded that continued long-term operations of the CVP and SWP are "not likely to jeopardize" continued existence of Sacramento River winter run Chinook salmon, Central Valley spring run Chinook salmon, Central Valley steelhead, and the southern Distinct Population Segment of North American green sturgeon or destroy or adversely modify their designated or proposed critical habitat (NMFS 2019).

On November 21, 2019, the California Natural Resources Agency announced litigation challenging the 2019 USFWS and NMFS Biological Opinions and the "not likely to jeopardize" determinations.

The ROD for the Reinitiation of Consultation on the Coordinated Long-Term Modified Operations of the CVP and SWP was released on February 19, 2020.

1.5.3.3 Coordinated Operating Agreement Addendum

Reclamation and DWR developed and signed a detailed operations agreement, the "Agreement Between the United States of America and the State of California for Coordinated Operation of the Central Valley Project and the State Water Project" (Agreement) in 1986 (Reclamation and DWR 1986). The United States Congress enacted P.L. 99-546, which authorized Reclamation to execute the Agreement. Under this Agreement, Reclamation and DWR established the terms by which they would use their respective water rights to ensure certain contractual and regulatory responsibilities were met while maximizing Reclamation's and DWR's ability to operate the CVP and SWP to meet water right and contract obligations upstream of the Delta, Delta water quality and flow objectives, joint Delta water right requirements issued by the SWRCB, and CVP and SWP water right and contract obligations that depend upon diversions from the Delta. In 2018, Reclamation and DWR amended four key elements of the Agreement to reflect the evolved manner in which the projects have been operated since the Agreement was originally authorized and signed: Article 6(c) in-basin uses, Article 10(b) CVP use of Harvey O. Banks ("Banks") Pumping Plant, Article 10(i) export restrictions, and Article 14(a) the periodic review.

1.5.4 Activities of Regional and Local Entities/Agencies

Regional and local programs and plans relevant to the study are described below.

1.5.4.1 SLDMWA Integrated Regional Water Management Plan

Integrated regional water management plans are produced throughout the State of California to encourage collaborative water resources management within specified regions by generating regional partnerships, identifying regional water resource needs and solutions, and providing support for funding. SLDMWA updated the Westside-San Joaquin Integrated Regional Water Management Plan (IRWMP) to meet new state guidelines and update regional strategies, priorities, and objectives to better reflect current circumstances (SLDMWA 2019). The Final Westside-San Joaquin IRWMP was adopted and submitted to DWR in January 2019.

1.5.4.2 San Luis Low Point Improvement Project

Reclamation and Valley Water are proposing to address water supply reliability and service interruption issues associated with low water levels in San Luis Reservoir. The Draft EIS/EIR was released in July 2019 and identified the Pacheco Reservoir Expansion Alternative as the CEQA Proposed Project. The Pacheco Reservoir Expansion Alternative includes removal of the existing dam, development of a new reservoir (located 0.5 mile upstream of the existing North Fork Dam along Pacheco Creek), a new earthen dam and spillway, new pipelines and tunnels, a new pump

station, and associated channel modifications, a new regulating tank at Pacheco Pumping Plant, and access improvements. The Final EIS/EIR, planned for release in 2020, will identify a National Environmental Policy Act (NEPA) preferred alternative. Construction is planned to start in 2024 (Reclamation and Valley Water 2019).

1.5.4.3 Pacheco Reservoir Expansion Project

Valley Water, the San Benito County Water District and the Pacheco Pass Water District are proposing to increase Pacheco Reservoir's operational capacity from 5,500 acre-feet (AF) to up to 140,000 AF, in order to reduce the frequency and severity of water shortages during droughts (Valley Water 2020). The project would construct new conveyance infrastructure to segments of the CVP San Felipe Division in Merced and Santa Clara counties, and deliver water supply to up to eight South-of-Delta wildlife refuges in Merced County. Construction is planned to begin mid-2027 (California Water Commission 2020). If the Pacheco Reservoir Expansion Alternative is implemented under the San Luis Low Point Improvement, then the Pacheco Reservoir Expansion Project will no longer be analyzed or implemented.

1.5.4.4 Long-Term Water Transfers

The Long-Term Water Transfers EIS/EIR evaluates a range of potential one-year water transfers conducted by CVP contractors located South-of-Delta or in the San Francisco Bay Area. The water would be conveyed through the Delta using CVP or SWP pumps, or facilities owned by other agencies in the San Francisco Bay Area. These types of transfers require annual approval from Reclamation and/or the DWR, which necessitates compliance with CEQA and NEPA.

A water transfer involves an agreement between a willing seller and a willing buyer, and available infrastructure capacity to convey water between the two parties. To make water available for transfer, the willing seller must take an action to reduce the consumptive use of water (such as idle cropland or pump groundwater in lieu of using surface water) or release additional water from reservoir storage. This water would be conveyed to the buyers' service area for beneficial use. Water transfers would only be used to help meet existing demands and would not serve any new demands in the buyers' service areas. The range of potential water transfers analyzed in the Long-Term Water Transfers EIS/EIR would not directly or indirectly affect growth beyond what is already planned.

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Chapter 2 Water Resources and Related Conditions

The plan formulation process completed for this Feasibility Report relied on an early inventory, forecast, and analysis of existing and likely future conditions in the study area. This section describes these conditions in the study area.

2.1 Existing and Likely Future Resource Conditions in Study Area

An important element of any water resources evaluation is defining existing resource conditions in the affected environment and how these conditions may change in the future. The magnitude of change not only influences the scope of the problems, needs, and opportunities, but also the extent of related resources that could be influenced by possible actions taken to address them. Defining the existing and likely future conditions is critical in establishing the basis for comparing potential alternative plans consistent with the principles and guidelines (P&Gs), CEQA, and NEPA guidance. The following section briefly discusses existing conditions in the study area, including existing infrastructure, the physical environment, biological environment, cultural resources, and socioeconomic resources.

2.1.1 Existing Conditions Summary

This section describes existing conditions in the study area. Existing conditions do not include implementation of the B.F. Sisk Dam SOD Modification Project. Section 2.1.2 describes the likely future conditions which includes the B.F. Sisk Dam SOD Modification Project. Existing conditions, likely future conditions, and the approach to the analysis of environmental impacts under CEQA and NEPA are described in more detail in the EIR/SEIS.

2.1.1.1 Physical Infrastructure

Physical infrastructure in the study area includes facilities for San Luis Reservoir and its related water infrastructure. This consists of the associated recreational facilities for the San Luis Reservoir State Recreation Area (SRA), William R. Gianelli Pumping-Generating Plant (Gianelli Pumping Plant), and the California Aqueduct. SR 152 and the South-of-Delta CVP and SWP Contractors' service areas and facilities are also included.

San Luis Reservoir: The San Luis Reservoir is a part of the San Luis Unit of the CVP and SWP. Reclamation and the State of California jointly maintain and operate this joint-use facility, including the O'Neill Dam and Forebay, B.F. Sisk Dam, San Luis Reservoir, Gianelli Pumping Plant, Dos Amigos Pumping Plant, Los Banos and Little Panoche Reservoirs, the San Luis Canal, and associated switchyards. The primary purpose of the San Luis Unit is to provide approximately 1.25 million acre-feet (MAF) of supplemental irrigation water supply to counties such as Fresno, Kings, and Merced.

San Luis Reservoir serves as a major storage reservoir for the CVP and SWP. The reservoir is an artificial lake on San Luis Creek in the eastern slopes of the Diablo Range of Merced County. The reservoir stores water taken from the Delta that would otherwise discharge into the Pacific Ocean. Water is then pumped into the reservoir from the O'Neill Forebay, which is fed by the California Aqueduct and the Delta-Mendota Canal and then released back into the forebay and subsequently into the DMC and San Luis Canal primarily for agricultural irrigation. The reservoir has an approximate depth of 270 feet, length of 9 miles, a surface area of 19.84 square miles, and a surface elevation of 544 feet (Reclamation 2013).

The San Luis Reservoir is also a part of the San Luis Reservoir SRA, owned and operated by the California Department of Parks and Recreation (CDPR). The SRA includes four campgrounds surrounding the reservoir, including Basalt, San Luis Creek, Medeiros, and Los Banos Creek, and several day-use sites. The SRA affords for various recreation activities, including boating, fishing, camping, hiking, equestrian, picnicking, swimming, windsurfing, and off-highway vehicles (OHVs) (CDPR 2016).

San Luis Reservoir can be accessed via SR 152, which is a state-designated scenic highway within Merced County, from the Santa Clara County line to the junction with Interstate (I) 5.

Gianelli Pumping-Generating Plant: The Gianelli Pumping-Generating Plant is located along the western boundary of the O'Neill Forebay at the San Luis Dam (Figure 1-2). This pumping-generating plant is owned by the federal government but is operated as a joint federal-state facility that is shared by the CVP and SWP. The plant generates energy when water is conveyed from San Luis Reservoir into O'Neill Forebay for continued conveyance to the DMC and San Luis Canal. The plant is operated in pumping mode when water is moved from O'Neill Forebay to San Luis Reservoir for storage until heavier water demands develop. The generated power is used to offset CVP and SWP pumping loads. The powerplant can generate up to 424 megawatts, with the CVP share of the total capacity being 202 megawatts. This facility is operated and maintained by California Department of Water Resources (DWR) under an operation and maintenance agreement with Reclamation.

O'Neill Pumping-Generating Plant: The O'Neill Pumping-Generating Plant is located on a channel that conveys water between DMC and the O'Neill Forebay (see Figure 1-2). This pumping-generating plant is owned by the federal government and is operated and maintained by SLDMWA under an operation and maintenance agreement with Reclamation. This plant generates power when water is released from the O'Neill Reservoir to DMC and serves as a pump to convey water from DMC to O'Neill Forebay**.**

California Aqueduct: The California Aqueduct is a primary part of the SWP and carries water from the Delta to the San Joaquin Valley and Southern California. The concrete, open aqueduct has a width of 12 to 85 feet and an average depth of 30 feet. The aqueduct helps deliver SWP water to San Joaquin Valley farms and cities (Water Education Foundation [WEF] 2016).

South-of-Delta CVP Facilities: Reclamation operates the CVP, which diverts water from the Delta through Jones Pumping Plant at the southern end of the Delta and lifts the water into DMC. This canal delivers water to CVP contractors and exchange contractors on the San Joaquin River and to water rights contractors on the Mendota Pool. CVP water is also conveyed to the San Luis Reservoir for deliveries to CVP contractors through the San Luis Canal. Water from the San Luis

Reservoir is also conveyed through the Pacheco Tunnel to CVP contractors in Santa Clara and San Benito counties (Reclamation 2020).

Valley Water and San Benito County Water District (SBCWD), both CVP contractors and SLDMWA members, receive water directly from San Luis Reservoir through the San Felipe Division facilities. Water for Valley Water is delivered to the Coyote Pumping Plant via the Santa Clara Conduit and can be delivered to Calero Reservoir, groundwater recharge facilities, or the Rinconada and/or Santa Teresa water treatment plants (WTPs). Water from the Hollister Conduit serves San Benito County and extends from the Pacheco Conduit to San Justo Reservoir.

South-of-Delta SWP Facilities: DWR operates SWP, which diverts water from the Delta through the Banks Pumping Plant into Bethany Reservoir. The California Aqueduct is 444 miles long and delivers water from Bethany Reservoir to the Central Valley and Southern California. The California Aqueduct flows south for 60 miles to O'Neill Forebay at San Luis Reservoir (DWR 2018). At O'Neill Forebay, the California Aqueduct becomes the San Luis Canal, which is managed jointly by Reclamation and DWR and serves both CVP and SWP. The San Luis Canal is federally built and extends 103 miles southeast from O'Neill Forebay to just past Kettleman City, California (Reclamation 2020). At this point, the canal becomes the California Aqueduct again, an SWP facility that delivers water over the Tehachapi Mountains to Southern California.

South Bay Aqueduct (SBA) was constructed by SWP in the 1960s to provide water to the south San Francisco Bay area in Alameda and Santa Clara counties. The South Bay Pumping Plant lifts water 566 feet into the aqueduct (DWR 2019). Water then flows to a junction and a portion is pumped into Lake Del Valle. SBA conveys water from the Delta through a combination of more than 40 miles of pipelines and canals to the Valley Water, among other water providers. Maximum Table A SWP allocations conveyed by SBA include the delivery of 80 TAF to the Alameda County Flood Control and Water Conservation District (Zone 7), 42 TAF to the Alameda County Water District, and 100 TAF to Valley Water (DWR 2019). SBA ends in a 160-foot-diameter Santa Clara terminal tank in San Jose at the Penitencia WTP (DWR 2019).

2.1.1.2 Physical Environment

Elements of the physical environment related to the study area are described in this section, including geology and soils, paleontological resources, water quality, air quality, and noise.

Geology, Seismicity, and Soils

San Luis Reservoir: The four geologic formations in the area around San Luis Reservoir include (1) the Franciscan formation composed of a thick assemblage of sedimentary (sandstone, shale, chert, conglomerate), igneous, and metamorphic rock; (2) the Panoche formation composed of an arenaceous shale and thinly bedded sandstone, a sedimentary sequence of lenses of coarse-grained conglomerate of porphyritic and granite boulders, cobbles, and pebbles; (3) the Tulare formation composed of nonmarine gravel, sand, and silt derived from the Franciscan formation; and (4) the Tertiary Volcanic formation including small scattered deposits of volcanic rocks.

There are several soil associations that occur around the San Luis Reservoir, including Denverton, Kettleman, and Altamont clay associations, that occupy 2,650 acres of the lands surrounding the reservoir (Reclamation and CDPR 2013). Rough stony land is the second most common soil type in the reservoir area, occupying approximately 2,000 acres predominantly on the western side of the

reservoir (Reclamation and CDPR 2013). Most developed lands near the reservoir, including most recreation areas, have slight or moderate erosion potential. Many of the undeveloped areas along the western, northern, and southern shorelines are categorized as having severe erosion hazard.

Soil types on the reservoir floor were characterized in geologic borings conducted by Reclamation in 1962. In the deeper areas of eastern San Luis Reservoir, reservoir bottom soils consist primarily of lean clay to sandy clay/clayey sand with trace peat/fat clay, overlying silty sand and gravel (Reclamation 1962 as cited in Reclamation and Valley Water 2013). In the western part of the reservoir, starting from approximately halfway between the proposed new intake structure and the connection to the existing intake structure, the soil types transition from lean clay deposits to sandier sediments, sandy silt, silty sand beds, sandy clay beds, and gravels (Reclamation and Valley Water 2013).

San Luis Reservoir is in a seismically active area and is close to several faults and fault systems. The Ortigalita Fault passes under the reservoir in two locations—one along the western shore of the reservoir crossing over Lone Oak Bay to the east, and one that runs from Cottonwood Bay close to the eastern shore of the reservoir on the eastern side of Basalt Hill (Reclamation and CDPR 2013 and U.S. Geological Survey [USGS] 2011). The O'Neill Fault System runs south and east of O'Neill Forebay and south of San Luis Reservoir (USGS 2011). The Calaveras and San Andreas Faults are 23 and 28 miles away, respectively (Reclamation and CDPR 2013). These faults can cause earthquakes at or near San Luis Reservoir, given that fault offsets can take place either along a single fault plane or multiple fault planes. During a seismic event, secondary fault rupture and displacements can take place on neighboring faults that were previously considered to be less than active.

Landslides are common within the Coast Ranges, specifically the west side of Merced County because of steep slopes, unstable terrain, and proximity to earthquake faults (Merced County 1990). The eastern portion of San Luis Reservoir, including O'Neill Forebay, is in a low-potential landslide zone while the western portion of the reservoir is in a medium-potential landslide zone (Merced County 1990).

Paleontological Resources

San Luis Reservoir: Paleontological resources include fossilized remains and the geologic context in which they occur, providing information about the history of life on Earth (City of San Jose 2011). 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 (City and County of San Francisco 2005).

The western side shoreline of San Luis Reservoir lies within the Franciscan formation, from the Jurassic or Cretaceous Period 80–200 million years ago (Reclamation and CDPR 2013). This formation consists of a thick assemblage of sedimentary, igneous, and metamorphic rocks and is ranked as low sensitivity because of the general lack of recorded vertebrate fossils (City and County of San Francisco 2005). The Panoche formation makes up most of the eastern shore of San Luis Reservoir, dating from the late Cretaceous Period approximately 65 million years ago (Reclamation

and CDPR 2013). The Panoche formation consists of shale and thinly bedded sandstone, approximately 25,000-feet-thick and is ranked as moderately sensitive because of the discovery of noteworthy invertebrate marine fossils (California High Speed Rail Authority 2004).

Water Quality

San Luis Reservoir: San Luis Reservoir stores water released from upstream reservoirs that is conveyed through the Delta, with a storage capacity of over 2 MAF. The water arrives through the California Aqueduct and DMC and is pumped from the O'Neill Forebay into the main reservoir during the winter and spring.

San Luis Reservoir and the surrounding area tend to be windy and are characterized by wet/cool winters and warm/dry summers. During the summer months, when water levels are low, water quality in the San Luis Reservoir deteriorates because of a combination of higher warmer temperatures, wind-induced nutrient mixing, and algal blooms near the reservoir surface. Currently, when San Luis Reservoir approaches its late summer/early fall low point, algal growth may begin to degrade water quality for contractors that use the water. If the algal layer is significantly thick (when the lake storage volume is reduced to approximately 300,000 acre-feet [AF]), algae may begin to enter the Lower San Felipe Intake. The water quality within the algal blooms is not suitable for agricultural water users with drip irrigation systems in San Benito County or for municipal and industrial water users relying on existing water treatment facilities in Santa Clara County.

In 2010, San Luis Reservoir and O'Neill Forebay were designated as *impaired* on the Central Valley Regional Water Quality Control Board 303(d) List because of mercury impairment. Potential sources of the impairment are listed as unknown.

Delta Region and South-of-Delta CVP and SWP Facilities: San Luis Reservoir provides off-stream storage primarily sourced from Delta exports. The Delta region forms the low-lying outlet of the Central Valley, located between the bordering Sacramento River to the north and the San Joaquin River to the south. 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) export pumping from the south Delta through the Harvey O. Banks Pumping Plant and Jones Pumping Plant.

The existing water quality constituents of concern in the Delta can be categorized broadly as: metals, pesticides, invasive species, nutrient enrichment and associated eutrophication, and constituents associated with suspended sediments and turbidity, salinity, and organic carbon.

Air Quality

San Luis Reservoir: San Luis Reservoir is located within the San Joaquin Valley Air Basin (SJVAB). The region is highly susceptible to pollutant accumulation because of the mountains that surround the valley. Marine air flows towards the east through gaps in the Coast Range at the Golden Gate and Carquinez Strait.

Low wind speeds contribute to high concentrations of air pollutants in the winter time. During the summer, winds typically originate from the north end of the basin and flow in a south-southeast

direction though the valley. These conditions contribute to persistent summer inversions that prevent the vertical dispersion of air pollutants. Summertime inversions occur when a layer of cool marine air is trapped below a mass of warmer air above.

The federal Clean Air Act requires states to classify air basins (or portions thereof) as either attainment or nonattainment with respect to criteria air pollutants, based on whether the National Ambient Air Quality Standards (NAAQS) have been achieved, and to prepare air quality plans containing emission reduction strategies for those areas designated as nonattainment. Table 2-1 shows the attainment status for the SJVAB.

Table 2-1. Attainment Status for SJVAB (Merced County)

Pollutant	National Standards	California Standards
Ozone (O_3)	Nonattainment, extreme[1]	Nonattainment
Carbon monoxide (CO)	Attainment	Unclassified
Nitrogen dioxide (NO_2)	Attainment	Attainment
Sulfur dioxide (SO_2)	Attainment	Attainment
Inhalable Particulate Matter (PM_{10})	Maintenance	Nonattainment
Fine Particulate Matter ($PM_{2.5}$)	Nonattainment[2]	Nonattainment
Lead (Pb)	Attainment	Attainment

Source: California Air Resources Board (CARB) 2018; U.S. Environmental Protection Agency (EPA) 2020; 40 Code of Federal Regulations 81.305.

Notes:
- Nonattainment means that the area does not meet the ambient air quality standard for that pollutant.
- Attainment means that the area meets the ambient air quality standard for that pollutant.
- Maintenance means that the area has recently met the standard and must continue to provide EPA with information showing that it is maintaining the standard before the area can qualify for redesignation as attainment.

[1] The San Joaquin Valley, which includes Merced County, was designated as a nonattainment area for the 2015 O_3 NAAQS on August 3, 2018 (83 Federal Register [FR] 25776).

[2] Classified as moderate nonattainment for the 2012 annual primary NAAQS and serious nonattainment for the 2006 24-hour NAAQS.

Key: SJVAB = San Joaquin Valley Air Basin; NAAQS = National Ambient Air Quality Standards

Noise

San Luis Reservoir: The area surrounding San Luis Reservoir is dominated by agricultural land uses and publicly owned parkland and wildlife areas, which are relatively quiet. Motorboats are the main source of noise in the vicinity of the San Luis Reservoir at the O'Neill Forebay recreational boating area. Several campgrounds and day-use picnic areas, including San Luis Creek Use Area, are present along the shores of the reservoir and forebay and are relatively close to areas where construction activities would take place. The residences nearest potential construction sites at San Luis Reservoir include a subdivision off SR 152 and a residence on Harper Lane. At these sensitive receptors, the estimated noise level is a Day-Night Average Sound Level (L_{DN}) of 40 A-weighted decibels (dBA), based on the U.S. Environmental Protection Agency (EPA) *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (EPA 1974).

2.1.1.3 Biological Environment

Elements of the aquatic and terrestrial biological environment in the study area are described in this section. The discussion focuses on habitat and species, including special-status species.

Aquatic Resources The following sections describe the existing aquatic resource conditions within the different regions of the area of analysis.

San Luis Reservoir: San Luis Reservoir contains warm-water fish species and recreational fishing is an important use of the reservoir. The reservoir is an artificial environment and does not support a naturally evolved aquatic community. Although a few species native to San Luis Creek (which the reservoir impounds) may be present, most fish species in the reservoir have either been directly introduced or transported into the reservoir via the California Aqueduct and DMC. Although there are fish screens at the CVP and SWP pumps, fish eggs, larvae, small juveniles, and invertebrates can pass through the screens and be transported to San Luis Reservoir. Striped bass are the predominant species in the reservoir. Other species found in the reservoir include threadfin shad (*Dorosoma petenense*), Sacramento sucker *(Catostomus occidentalis),* carp (*Cyprinus carpio*), Sacramento blackfish (*Orthodon microlepidotus*), hitch (*Lavinia exilicauda*), hardhead catfish, white catfish (*Ameiurus catus*), channel catfish, yellow bullhead (*Ictalurus natalis*), brown bullhead (*Ictalurus nebulosus*), black bullhead (*Ictalurus melas*), mosquitofish (*Gambusia affinis*), Sacramento perch (*Archoplites interruptus*), black crappie (*Pomoxis nigromaculatus*), largemouth bass, warmouth (*Lepomis gulosus*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), and red-eared sunfish (*Lepomis microlophus*).

Delta Region. The Delta region includes the Delta, which comprises channels of the Sacramento and San Joaquin Rivers, including from (approximately) the I-Street Bridge in Sacramento on the Sacramento River and Vernalis on the San Joaquin River, west to Martinez, including Suisun Bay and the Suisun Marsh. The Delta is tidally influenced and is the diversion point for both CVP and SWP. The Delta is made up of tidal river channels and sloughs and many constructed features. More than 120 fish species rely on the Delta and San Francisco Bay as important areas to complete one or more life stages. Channels and sloughs of the Delta and Suisun Bay provide important migration and rearing habitats for anadromous salmonids, delta smelt (*Hypomesus transpacificus*), longfin smelt (*Spirinchus thaleichthys*), and splittail (*Pogonichthys macrolepidotus*).

Threatened, Endangered and Special-Status Species. As mentioned above, San Luis Reservoir is an artificial environment that does not support a naturally evolved aquatic community. As such, the potential for presence of threatened, endangered, and special-status aquatic species in San Luis Reservoir is low.

Several native anadromous and resident species have been listed as threatened or endangered under the Federal ESA or California ESA (CESA) or are candidates for listing. Six fish species listed under Federal ESA or CESA have the potential to occur in the watercourses in the Delta region, including Central Valley steelhead *(Oncorhynchus mykiss)*, Central Valley spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, Green sturgeon, Delta smelt, and longfin smelt. Additionally, Central Valley Chinook salmon (fall/late fall-run), California/San Joaquin roach, Sacramento perch, and Pacific Lamprey have the potential to occur in the watercourses in the Delta region that are listed as either federal or state species of concern (CDFW 2016; Moyle 2002).

Terrestrial Resources The following section describes the existing terrestrial resource conditions within the area of analysis.

San Luis Reservoir: Dominant vegetation communities within the San Luis Reservoir region include valley foothill riparian, coast live oak woodland, chaparral/scrub, annual grassland, purple needlegrass grassland, freshwater emergent wetland, seasonal wetland, agricultural, and urban/disturbed (Reclamation and CDPR 2013; Reclamation 2018; Environmental Science Associates [ESA] 2018; ESA 2020).

Riparian woodland support common wildlife species, including amphibians such as Sierran treefrog (*Pseudacris sierra*), California newt (*Taricha torosa*), and California slender salamander (*Batrachoseps attenuatus*); birds such as Wilson's warbler (*Wilsonia pusilla*), Swainson's thrush (*Catharus ustulatus*), yellow warbler (*Dendroica petechia brewsteri*), green heron (*Butorides striatus*), and red-shouldered hawk (*Buteo lineatus*); and mammals such as San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*), gray fox (*Urocyon cinereoargenteus*), and mountain lion (*Puma concolor*) (Santa Clara County 2012).

Scrub/chaparral provides cover for wildlife, including desert cottontail (*Sylvilagus audubonii*), western rattlesnake (*Crotalus viridis*), and coyote (*Canis latrans*).

Grassland habitats support many species of migratory birds and raptors including western meadowlark (*Sturnella neglecta*), savannah sparrow (*Passerculus sandwichensis*), and red-tailed hawk (*Buteo jamaicensis*). Reptiles include western fence lizard (*Sceloporus occidentalis*) and common garter snake (*Thamnophis sirtalis*). Mammals, including California ground squirrel (*Otospermophilus beecheyi*), bobcat (*Felis rufus*), and coyote also inhabit grassland.

Wetlands are important for foraging and breeding habitat for many species of water birds, including wading birds such as great egret (*Ardea alba*); waterfowl such as green-winged teal (*Anas crecca*), mallard, and American coot; shorebirds such as killdeer *(Charadrius vociferous)*, black-necked stilt (*Himantopus mexicanus*), greater yellowlegs (*Tringa melanoleuca*), and American avocet (*Recurvirostra americana);* and passerines such as Brewer's blackbird (*Euphagus cyanocephalus*), red-winged blackbird, brown-headed cowbird (*Molothrus ater*), and American pipit (*Anthus rubescens*) (Santa Clara County 2012).

Developed areas provide limited habitat for wildlife because of their built environment. However, typical bird species found in developed areas include American robin (*Turdus migratorius*), mockingbird (*Mimus polyglottos*), American crow (*Corvus brachyrhynchos*), house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), and rock pigeon (*Columba livia*). Other wildlife adapted to living in developed areas include Norway rat (*Rattus norvegicus*), western gray squirrel (*Sciurus niger*), opossum (*Didelphis virginiana*), and raccoon *(Procyon lotor).*

Threatened, Endangered and Special-Status Species: Special-status plant and wildlife species that have the potential to occur within the San Luis Reservoir region, based on local sightings or the potential presence of suitable habitat, are provided in Table 2-2.

Table 2-2. Federal and State Threatened, Endangered, and Special-Status Species and Species of Note

Common Name	Scientific Name	Status
Vernal pool fairy shrimp	*Branchinecta lynchi*	FT
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT
Vernal pool tadpole shrimp	*Lepidurus packardi*	FE
Western pond turtle	*Actinemys marmorata*	CSC
San Joaquin coachwhip	*Coluber flagellum ruddocki*	CSC
Coast horned lizard	*Phrynosoma blainvillii*	CSC
Giant garter snake	*Thamnophis gigas*	FT, ST
California tiger salamander	*Ambystoma californiense*	FT, ST
Foothill yellow-legged frog	*Rana boylii*	CSC
California red-legged frog	*Rana draytonii*	FT, CSC
Western spadefoot	*Spea hammondii*	CSC
Tricolored blackbird	*Agelaius tricolor*	ST
Golden eagle	*Aquila chrysaetos*	BGEPA, CFP
Western burrowing owl	*Athene cunicularia*	CSC
Swainson's hawk	*Buteo swainsoni*	ST
Northern harrier	*Circus cyaneus*	CSC
California condor	*Gymnogypus californianus*	FE, SE, CFP
Bald eagle	*Haliaeetus leucocephalus*	FD, SE, CFP
Pallid bat	*Antrozous pallidus*	CSC
Townsend's big-eared bat	*Corynorhinus townsendii*	CSC
Giant Kangaroo rat	*Dipodomys ingens*	FE, SE
Fresno kangaroo rat	*Dipodomys nitratoides exilis*	FE, SE
Western mastiff bat	*Eumops perotis californicus*	CSC
American badger	*Taxidea taxus*	CSC
San Joaquin kit fox	*Vulpes macrotis mutica*	FE, ST
Heart Scale	*Atriplex cordulata var. cordulata*	CRPR 1B.2
Lost Hills Crown Scale	*Atriplex coronata var. vallicola*	CRPR 1B.2
Brittle Scale	*Atriplex depressa*	CRPR 1B.2
Lesser saltscale	*Atriplex minuscula*	CRPR 1B.1
Big-scale balsamroot	*Balsamorhiza macrolepis var. macrolepis*	CRPR 1B.2
Mariposa pussypaws	*Calyptridium pulchellum*	FT, CRPR 1B.1
Chaparral harebell	*Campanula exigua*	CRPR 1B.2
Lemmon's jewel-flower	*Caulanthus lemmonii*	CRPR 1B.2
Coyote ceanothus	*Ceanothus ferrisiae*	FE, CRPR 1B.1
Hispid salty bird's-beak	*Chloropyron mollis ssp. hispidum*	CRPR 1B.1
Mt. Hamilton fountain thistle	*Cirsium fontinale var. campylon*	CRPR 1B.2
Mariposa clarkia	*Clarkia biloba ssp. australis*	CRPR 1B.2

Common Name	Scientific Name	Status
Beaked clarkia	*Clarkia rostrata*	CRPR 1B.3
San Francisco collinsia	*Collinsia multicolor*	CRPR 1B.2
Mariposa cryptantha	*Cryptantha mariposa*	CRPR 1B.3
Hospital Canyon larkspur	*Delphinium californicum ssp. interius*	CRPR 1B.2
Recurved larkspur	*Delphinium recurvatum*	CRPR 1B.2
Yellow-lip pansy monkeyflower	*Diplacus pulchellus*	CRPR 1B.2
Santa Clara Valley dudleya	*Dudleya abramsii ssp. setchellii*	FE, CRPR 1B.1
Mariposa daisy	*Erigeron mariposas*	CRPR 1A
Hoover's button-celery	*Eryngium articulatum var. hoover*	CRPR 1B.1
Spiny-sepaled button-celery	*Eryngium spinosepalum*	CRPR 1B.2
Slender-stalk monkeyflower	*Erythranthe gracilipes*	CRPR 1B.2
San Joaquin spearscale	*Extriplex joaquinana*	CRPR 1B.2
Fragrant fritillary	*Fritillaria liliaceae*	CRPR 1B.2
Loma Prieta hoita	*Hoita strobilina*	CRPR 1B.1
Legenere	*Legenere limosa*	CRPR 1B.1
Madera leptosiphon	*Leptosiphon serrulatus*	CRPR 1B.2
Mt. Hamilton coreopsis	*Leptosyne hamiltonii*	CRPR 1B.2
Smooth lessingia	*Lessingia micradenia var. glabrata*	CRPR 1B.2
Congdon's lomatium	*Lomatium congdonii*	CRPR 1B.2
Mariposa lupine	*Lupinus citrinus var. deflexus*	CRPR 1B.2
Shaggyhair lupine	*Lupinus spectabilis*	CRPR 1B.2
Arcuate bush-mallow	*Malacothamnus arcuatus*	CRPR 1B.2
Hall's bush-mallow	*Malacothamnus hallii*	CRPR1B.2
Woodland woollythreads	*Monolopia gracilens*	CRPR 1B.2
Lime Ridge navarretia	*Navarretia gowenii*	CRPR 1B.1
Shining navarretia	*Navarretia nigelliformis ssp. radians*	CRPR 1B.2
Prostrate vernal pool navarretia	*Navarretia prostrata*	CRPR 1B.2
Hairless popcorn-flower	*Plagiobothrys glaber*	CRPR 1A
California alkali grass	*Puccinellia simplex*	CRPR 1B.2
Sanford's arrowhead	*Sagittaria sanfordii*	CRPR 1B.2
Rock sanicle	*Sanicula saxatilis*	CRPR 1B.2
Chaparral ragwort	*Senecio aphanactis*	CRPR 2B.2
Metcalf Canyon jewelflower	*Streptanthus albidus ssp. albidus (=S. glandulosus var. albidus)*	CRPR 1B.1
Most beautiful jewel-flower	*Streptanthus albidus ssp. peramoenus*	CRPR 1B.2
Mt. Hamilton jewelflower	*Streptanthus callistus*	CRPR 1B.3
Arburua Ranch jewelflower	*Streptanthus insignis ssp. lyonii*	CRPR 1B.2
Slender-leaved pondweed	*Stuckenia filiformis ssp. alpina*	CRPR 2B.2
Wright's trichocoronis	*Trichocoronis wrightii var. wrightii*	CRPR 2B.1

Common Name	Scientific Name	Status
Two-fork clover	*Trifolium amoenum*	CRPR 1B.1
Santa Cruz clover	*Trifolium buckwestiorum*	CRPR 1B.1
Saline clover	*Trifolium hydrophilum*	CRPR 1B.2

Source: CDFW 2020, CNPS 2020, Jepson 2020, FNA 1993, USFWS 2020; data compiled by Environmental Science Associates in 2020.

Key:

Federal (USFWS):

BEPA = Bald Eagle Protection Act
FE = Listed as Endangered by the Federal Government
FT = Listed as Threatened by the Federal Government
FPE = Proposed for Listing as Endangered
FPT = Proposed for Listing as Threatened
FD = Federal Delisted Species
FC = Candidate for Federal Listing

State (California Department of Fish and Wildlife):

SE = Listed as Endangered by the State of California
ST = Listed as Threatened by the State of California
SC = Candidate for State Listing
SR = Listed as Rare by the State of California (plants only)
CSC = California species of special concern
CFP = California fully protected species

California Rare Plant Rank:

CRPR 1A – Species considered extinct in California
CRPR 1B – Rare and endangered in California and elsewhere
CRPR 2 – Species considered rare and endangered in California but more common elsewhere
0.1 – Seriously threatened
0.2 – Fairly threatened in California
0.3 – Not very threatened in California

2.1.1.4 Other Resources

Cultural Resources Construction actions under the No Project/No Action Alternative and the Dam Raise Alternative are centered in the western Central Valley region, which was initially inhabited by Native Americans at least 10,000 years ago. The Northern Valley Yokuts, the major native group that would have been encountered by early Euro-Americans, left behind a rich material culture evident in archaeological sites throughout the region. The Northern Valley Yokuts were followed by Spanish, Mexican, and American explorers, missionaries, soldiers, and settlers who transformed the landscape.

Archival and record searches of known cultural resource locations and prior cultural resource studies were carried out at the Central California Information Center of the California Historical Resources Information System in 2012, 2016, and 2020. Pedestrian inventory surveys within the Area of Potential Effect (APE) were also conducted between 2012 and 2020. Using a survey interval of no more than 39 to 29 feet the APE identified for the B.F. Sisk Dam Raise and Reservoir Expansion Project was fully examined, and all previously recorded and newly discovered cultural resources were documented, as appropriate. An architectural field survey and evaluation of the B.F. Sisk Dam and its associated features was conducted in 2018 (JRP Historical Consulting [JRP] 2018). The B.F. Sisk Dam Raise and Reservoir Expansion EIR/SEIS provides information on resources discovered during record searches and pedestrian surveys.

Traffic

San Luis Reservoir: Regional access routes to the San Luis Reservoir SRA include I-5, US 101, SR 152, and SR 33. Local access routes near the San Luis SRA include Fifield Road, a two-lane rural nonfreeway road located west of the San Luis Reservoir running in the east-west direction connecting SR 152 with the San Luis Reservoir SRA; Dinosaur Point Road, a two-lane east-west rural nonfreeway road that connects SR 152 with Fifield Road and the Dinosaur Point parking lot within the San Luis Reservoir SRA; and Basalt Road, a two-lane rural nonfreeway road that runs along the edge of the San Luis Reservoir on the southeast side providing direct access from SR 152 to the Basal Recreation Area.

Public transit near San Luis Reservoir area includes the Merced Area Regional Transit System and Greyhound-Trailways bus lines. These two transit services do not stop at San Luis Reservoir.

The San Luis Reservoir SRA Resource Management Plan (RMP)/General Plan (GP) identified parking shortages at the San Luis Creek and Los Banos Creek use areas during peak visitation periods (Reclamation and CDPR 2013).

Recreation

San Luis Reservoir: Recreation facilities potentially affected within the San Luis Reservoir study area include the San Luis Reservoir SRA and Pacheco State Park (SP).

San Luis Reservoir State Recreation Area. The San Luis Reservoir SRA was developed beginning with an agreement in 1969 and initiation of general plan development in 1971 (Reclamation and CDPR 2013). The San Luis Reservoir SRA spans approximately 27,000 acres and is divided into five main use areas[5] (Basalt, Dinosaur Point, Los Banos Creek, Medeiros, San Luis Creek) and one minor use area for off-highway vehicle use. There are two additional areas designated for wildlife; both allow for hunting and hiking in undeveloped areas, along with nature study activities. The primary activities at each main use area vary, but collectively, the San Luis Reservoir SRA provides opportunities for boating, swimming, windsurfing, camping, and fishing (Reclamation and CDPR 2013).

Visual Resources

San Luis Reservoir: Overall, the area around San Luis Reservoir offers open scenic vistas of undeveloped land and open water. These scenic qualities are enhanced by the surrounding undeveloped landscape consisting of "open grassland, expansive vistas of the rolling terrain, and the adjacent Diablo range" (Reclamation and CDPR 2013). Most shoreline areas allow for uninterrupted views of the open water from the three nearby reservoirs (San Luis Reservoir, O'Neill Forebay, Los Banos Reservoir). The views from the north and south plateaus at the Los Banos Reservoir provide a vista opportunity of the water and adjacent landscape. The San Luis Reservoir SRA RMP/GP notes that future plans for facilities and landscape features should consider the open, uninterrupted nature of the landscape (Reclamation and CDPR 2013). While there are developed areas around the reservoir, the overall layout and configuration of the built structures is "clustered in succinct areas, reducing the sense of sprawl and visual clutter" (Reclamation and CDPR 2013). Additionally, many of the engineered structures contribute to the understanding of the site as a water storage and distribution facility in those areas.

[5] Main use areas refer to the designated major public recreation facilities within the San Luis Reservoir SRA (Reclamation and CDPR 2013).

2.1.2 Summary of Likely "Future Without Project" Conditions

Identification of the magnitude of potential water resources and related problems, needs, and opportunities in the study area is based not only on the existing conditions previously highlighted, but also on an estimate of how these conditions may change in the future. Predicting future conditions is complicated by a variety of factors, including uncertainty regarding future regulatory requirements and ongoing programs and projects affecting the study area.

The EIR/SEIS uses the baseline evaluation presented in the B.F. Sisk Dam SOD Modification Project EIS/EIR (Reclamation 2019), which remains a current and accurate representation of existing conditions. In the EIR/SEIS, the No Project/No Action Alternative reflects the implementation of the crest raise actions evaluated in the B.F. Sisk Dam SOD Modification Project EIS/EIR. The Crest Raise Action includes increasing the dam crest by 12 feet to reduce safety concerns for the downstream public by reducing the likelihood of overtopping if slumping were to occur during a seismic event (Reclamation 2019).

This section describes the changes in the environment expected in the study area, assuming that no federal (or state) actions are implemented to increase storage capacity in San Luis Reservoir. The likely future condition includes actions reasonably expected to occur in the future. This includes projects and actions that are currently authorized, funded, and permitted, including the B.F. Sisk Dam SOD Modification Project.[6]

2.1.2.1 Physical Environment

Physical conditions in the study area are expected to remain relatively unchanged in the future. No changes to area topography, geology, or soils are foreseen. Air quality and greenhouse gas conditions in the study area are expected to change temporarily as a result of the construction actions under the B.F. Sisk Dam SOD Modification Project, by generating NOx emissions and maximum project/annual emissions that exceed thresholds. Mitigation measures will be implemented to reduce changes to air quality and greenhouse gas emissions.

2.1.2.2 Biological Environment

Biological conditions at San Luis Reservoir are expected to remain relatively unchanged in the future. Without any action to improve storage capacity in San Luis Reservoir, there would be no related impacts on special-status fish species or their habitat and no foreseeable impacts on sensitive habitats such as watercourses and riparian communities. There would be no impacts on fish migration corridors and no conflicts with habitat conservation plans or other local plans or policies. Construction of the B.F. Sisk Dam SOD Modification Project would remove or adversely affect natural habitats around San Luis Reservoir, resulting in direct or indirect harm to several special-status wildlife species. Mitigation measures would be implemented to reduce effects to the biological environment.

In addition, as population and urban growth continues and land uses are converted to urban centers, wildlife and plants dependent on native habitat types may be adversely affected.

[6] A full listing of these currently authorized, funded, and permitted projects and actions are detailed in the B.F. Sisk Dam Raise and Reservoir Expansion EIR/SEIS cumulative effects analysis.

2.1.2.3 Other Resources

At San Luis Reservoir, any paleontological, archaeological, historic, or ethnographic resources currently affected by erosion caused by reservoir fluctuations or recreational use of the reservoir and shoreline would continue to be affected. Fossils and artifacts located around the perimeter of the existing reservoir will continue to be subject to potential inadvertent impacts from recreationalists and construction actions. Under the B.F. Sisk Dam SOD Modification Project, direct and indirect impacts to known cultural resources would occur but would be reduced by mitigation measures.

The B.F. Sisk Dam SOD Modification Project construction would reduce recreational opportunities by temporarily closing certain facilities and causing a temporary increase in construction-related traffic that could increase traffic hazard due to a design feature or incompatible use. Mitigation measures will be implemented to reduce recreation and traffic impacts in the study area.

Visual conditions in the study area would be impacted by construction activities, including nighttime construction lighting, under the B.F. Sisk Dam SOD Modification Project. Mitigation measures would be implemented to reduce the severity of visual impacts in the study area.

Chapter 3 Plan Formulation

This chapter describes the formulation and screening process that SLDMWA and Reclamation used to identify, evaluate, and develop alternatives.

3.1 Alternatives Development Report

The Alternatives Development Report (Appendix A of the EIR/SEIS) documents the process used to develop the project alternatives. The first step in developing the initial alternatives is identification of potential measures, which could include programs, projects, or policies that would help achieve the project's objectives/purposes and needs (described in Chapter 1, Sections 1.3.1.1 and 1.3.2). These measures were evaluated for accordance with (1) CEQA Guidelines Section §15126.6(a),), which requires that measures feasibly attain most of the basic objectives of the project and be potentially feasible and (2) NEPA procedures (43 Code of Federal Regulations [CFR] Part 46.420[b]) that include requirements that measures meet the purpose and need of the proposed action.

3.1.1 Measure Development

Based on meetings with SLDMWA and its member agencies and the team's technical understanding of the project's objectives/purposes and needs, the Alternatives Development Report identified 17 measures, as described in Table 3-1.

Table 3-1. Measure Descriptions

Measure	Measure Description
Agricultural Water Supply	Increase agricultural water supply delivered from expanded capacity in San Luis Reservoir
Municipal & Industrial (M&I) Water Supply	Increase M&I water supply delivered from expanded capacity in San Luis Reservoir
Groundwater Stabilization	Reduce seasonal reliance on groundwater supplies through increases in surface water deliveries
Emergency Water Supply	In response to system outages, increased average storage volume in San Luis Reservoir available for use as an emergency supply
Refuge Water	Increases in Level 4 refuge water supply deliveries, avoidance of water supply delivery reductions, and potential support for implementation of proposals for adaptive management of Delta exports to support ecosystem health
Capture of Delta Surplus	Improve capacity to divert and store Delta surplus during periods when the existing San Luis Reservoir would have been full
Coordinated Operations Agreement (COA)	Increases in capacity available to store and carry over additional Delta Central Valley Project (CVP) exports provided by COA.

Measure	Measure Description
Long-Term Storage of Rescheduled Water	Improved security for contractor carryover in San Luis Reservoir regarding risk of potential spill and/or protection for year-to-year ownership of that carryover
Transfer Water – CVP Sources	Increase available capacity for storage of potential carried over transfer water purchased by CVP contractors
Transfer Water – Non-CVP Sources	Increase available capacity for storage of potential carried over transfer water purchased by non-CVP contractors
Recycled Water	Increase available capacity for storage of potential carried over allocated CVP supply not used by contractors owing to the availability of recycled water, along with the potential storage of recycled water produced by the CVP contractors
San Joaquin River Restoration Program (SJRRP) Recaptured Restoration Flows	Increase available capacity for storage of potential carried over recaptured restoration flows for future use by Friant Contractors through recirculation or delivery to other water users via transfer
Temporary Storage of State Water Contractors Supply	Storage capacity made available to State Water Contractors for temporary storage or carryover
Delta-Mendota Canal (DMC) Reverse Flow	Diversion from Mendota Pool to San Luis Reservoir during periods of surplus flows
Groundwater Pump-In Program	Increase available capacity for storage of potential carried over groundwater pumped by member agencies into the DMC for use by other member agencies
Shared CVP and State Water Project (SWP) Ownership	Optional storage configuration to provide split ownership of the expanded storage capacity of San Luis Reservoir between CVP and SWP
Modifications to South-of-Delta CVP Operations	Adjustments to Reclamation's operation of the South-of-Delta CVP, including potential modifications to annual allocations and the provision of rescheduling CVP supply in San Luis Reservoir

3.1.2 Measure Screening

Measures were screened and evaluated based on (1) the ability of the measure to address the project objectives (long-term reliability, quantity of yearly allocations, and increased certainty of access to supplies for South-of-Delta contractors) and (2) the ability of the measure to address the project purposes and needs (additional project benefits under the B.F. Sisk Dam SOD Modification Project federal benefits pursuant to the WIIN Act, and no adverse impacts to the B.F. Sisk Dam SOD Modification Project). Measures were scored qualitatively and ranked as high, medium, or low:

- **High (3)** – measure **fully meets** the project's objectives/purpose and need
- **Medium (2)** – measure **partially meets** the project's objectives/purpose and need
- **Low (1)** – measure **does not meet** the project's objectives/purpose and need

Measures were eliminated from further consideration if they would not contribute to the project's objectives/purposes and needs. Only those measures that scored highest moved forward to be incorporated into the alternatives.

3.1.3 Measure Screening Results

Table 3-2 presents a summary of the screening results against each of the screening criteria for all measures. Detailed screening evaluations for each measure are described in the Alternatives Development Report.

Table 3-2. Screening Results Summary

Measure	Project Objectives		Project Purpose and Need		
	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits Pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Agricultural Water Supply	3	2	3	2	3
M&I Water Supply	3	2	3	2	3
Groundwater Stabilization	2	2	3	3	3
Emergency Water Supply	1	1	3	2	3
Refuge Water	3	3	3	3	3
Capture of Delta Surplus	3	2	3	2	3
Coordinated Operations Agreement (COA)	3	2	3	2	3
Long-Term Storage of Rescheduled Water	3	3	3	2	3
Transfer Water – CVP Sources	2	2	2	2	3
Transfer Water – Non-CVP Sources	2	2	2	2	3
Recycled Water	1	1	2	1	3
SJRRP Recaptured Restoration Flows	1	1	1	1	3
Temporary Storage of State Water Contractors Supply	3	2	3	2	3
DMC Reverse Flow	1	2	1	1	3
Groundwater Pump-In Program	1	1	1	1	3
Shared CVP and SWP Ownership	3	3	1	2	3
Modifications to South-of-Delta CVP Operations	1	3	1	2	3

Key: 3 = High; 2 = Medium; 1 = Low; SOD = Safety of Dams; WIIN = Water Infrastructure Improvements for the Nation; M&I = municipal and industrial; CVP = Central Valley Project; M&I = municipal and industrial; SJRRP = San Joaquin River Restoration Program; DMC = Delta-Mendota Canal; SWP = State Water Project

Twelve measures fully met or partially met project objectives and purpose and need:

- Agricultural Water Supply
- M&I Water Supply
- Groundwater Stabilization
- Refuge Water
- Capture of Delta Surplus
- Coordinated Operations Agreement
- Long-Term Storage of Rescheduled Water
- Transfer Water – CVP sources
- Transfer Water – Non-CVP sources
- Temporary Storage of State Water Contractors Supply
- Shared CVP and SWP Ownership
- Modifications to South-of-Delta CVP Operations

3.2 Feasibility Report

3.2.1 Initial Alternative Formulation and Screening

Screened measures were used to contribute to the development of the initial alternatives. The retained measures were combined into two initial alternatives— (1) one measure or (2) a combination of measures—to achieve good performance relative to the project objectives/purposes and needs (described in Section 3.1.1 and 3.1.2). Table 3-3 shows the division between the two initial alternatives and their respective measures.

Table 3-3. Initial Alternatives and Included Measures

Alternative	Included Management Measures
Non-Structural Alternative	Modifications to South-of-Delta CVP Operations
Dam Raise Alternative	Agricultural Water Supply, M&I Water Supply, Groundwater Stabilization, Refuge Water, Capture Delta Surplus, COA, Long-Term Storage of Rescheduled Water, Transfer Water CVP/Non-CVP Sources, Temporary Storage of State Water Contractors Supply, Shared CVP and SWP Ownership, Modifications to South-of-Delta CVP Operations

Key: COA = Coordinated Operations Agreement, CVP = Central Valley Project, M&I = Municipal and Industrial, SWP = State Water Project

This Feasibility Report is the culmination of numerous technical studies compiled into documentation that will aid federal decision-makers.

3.2.2 Alternative Refinement and Evaluation

Under Reclamation SOD Act, at least three alternatives must be evaluated in the feasibility analysis: (1) the SOD modification alternative (equivalent to the No Action or baseline alternative), (2) the dam safety actions plus additional benefits project alternative, and (3) a non-structural alternative (Reclamation 1978). As such, in addition to the No Action Alternative, this report evaluates the following alternatives:

- Non-Structural Alternative Plan
- Dam Raise Alternative Plan

As required by the Directive and Standard 557 (08/18/2016),[7] SLDMWA and Reclamation developed a Non-Structural Alternative Plan, though it does not fully meet the project's objectives/purposes and needs. The Non-Structural Alternative Plan does not involve construction and, therefore, no engineering design was done. The refinement and evaluation process for the Dam Raise Alternative included detailed hydrologic modeling using CalSim II to assess system operations and Statewide Agricultural Production (SWAP) modeling to simulate local operational changes and M&I/agricultural water supply benefits (see Appendices A1 and A2). The Dam Raise Alternative Plan was developed to a feasibility-level engineering design to ascertain project features and develop costs (see design summary in Appendices B1 and B2).

[7] *The Directive and Standard – Developing Additional Project Benefits in Conjunction with a Safety of Dams Modification Project* (Reclamation 2016a) established requirements for developing additional project benefits in conjunction with a SOD modification project. This directive and standard included the requirement for the evaluation of "a non-structural alternative that meets the needs and objectives of the additional benefits project."

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Chapter 4 Descriptions of Alternatives

This chapter describes the No Project/No Action Alternative and the alternative plans evaluated for feasibility in this Feasibility Report. Appendices B1 and B2 include a description of the Dam Raise Alternative Plan at a feasibility-level of design.

4.1 No Project/No Action Alternative

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. The No Action Alternative (under NEPA) may be described as the future circumstances without the Proposed Action and can also include 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 the No Project/No Action Alternative, crest raise actions from the B.F. Sisk SOD Modification Project would be implemented. The crest raise action under the B.F. Sisk Dam SOD Modification Project includes increasing the dam crest by 12 feet to reduce safety concerns for the downstream public by reducing the likelihood of overtopping if slumping were to occur during a seismic event (Reclamation 2019). As discussed in the B.F. Sisk Dam SOD Modification Project ROD, the crest raise action includes implementation of several mitigation measures to reduce environmental impacts. These mitigation measures are evaluated as project actions under the No Project/No Action analysis in the EIR/SEIS.

The No Project/No Action Alternative includes current conditions in the study area at the time of the Lead Agencies' release of the Notice of Intent and Notice of Preparation for the EIR/SEIS and was analyzed consistently with the Reinitiation of Consultation on the Coordinated Long-Term Operation of Central Valley Project and State Water Project (ROC on LTO) and the 2018 Addendum to the Coordinated Operation Agreement CVP/SWP records of decision.

4.2 Non-Structural Alternative

Under Alternative 2, Non-Structural Alternative, operational measures would be used to meet project objective/project purpose and need[8].

[8] *Directive and Standard* 557 (08/18/2016) – *Developing Additional Project Benefits in Conjunction with a Safety of Dams Modification Project* (Reclamation 2016) established requirements for developing additional project benefits in conjunction with a SOD modification project. This directive and standard included the requirement for the evaluation of "a non-structural alternative that meets the needs and objectives of the additional benefits of the additional benefits project."."

Alternative 2 would rely on a change in the current approach for annual CVP Project water supply allocations. San Luis Reservoir's maximum capacity is 2,027,840 AF, with a federal share of 966 TAF and state share of 1,062 TAF. The annual allocation of CVP supplies is managed by Reclamation. Reclamation develops the annual allocation to fully utilize stored CVP supply in the reservoir to meet CVP contractors' contracts and the requirements of other authorized purposes, such as CVPIA refuge water supplies. Under the Non-Structural Alternative, Reclamation would change its annual allocation process to reserve up to 310 TAF of stored CVP supply in San Luis Reservoir at the end of wetter years. This water would be reserved in San Luis Reservoir for allocation in subsequent drier years to South-of-Delta CVP contractors. In these drier years, the 310 TAF in reserved supply would be allocated to South-of-Delta CVP water contractors consistent with the CVP's current allocation of water supply stored in San Luis Reservoir, but only if supply is sufficient to meet the demands of senior water rights contractors. Under Alternative 2, water supply reserved in wetter water years by Reclamation for delivery to South-of Delta CVP contractors in drier years could potentially be diverted for delivery to the Exchange Contractors in critical water year types. Under this new operational configuration allocated water supply not used by CVP contractors could not be carried over for use in a subsequent year.

This change in San Luis Reservoir operations to increase water supply available in dry and critical years would adversely impact average water supply deliveries to CVP and SWP contractors. The Non-Structural Alternative would not require any additional construction or maintenance actions beyond actions identified under the No Project/No Action Alternative. Therefore, there are no costs associated with the Non-Structural Alternative.

4.3 Dam Raise Alternative Plan

The Dam Raise Alternative would be completed by placing additional fill material on the dam embankment to raise the dam crest an additional 10 feet above the 12-foot embankment raise under development by the B.F. Sisk Dam SOD Modification Project. The 10-foot embankment raise would support an increase in reservoir storage capacity of 130 TAF. The 10-foot increase in San Luis Reservoir's maximum surface elevation would inundate 445 acres of new land around the shore of the reservoir when the reservoir is full. The newly inundated lands are public lands and would not require additional land acquisitions.

The Dam Raise Alternative would build upon the seismic modifications to B.F. Sisk Dam being completed under the B.F. Sisk Dam SOD Modification Project. Construction actions under this alternative would add onto the actions under the B.F. Sisk Dam SOD Modification Project and are evaluated as a connected action in this feasibility report.

As part of this alternative, the dam crest would be raised by adding embankment material (see Figures 4-1 and 4-2) and downstream stability berms and crack filters would be installed. Also included in this alternative are construction of foundation shear keys at slope-wash sections in the abutments and the north valley section (NVS), and a filter around the downstream portion of the existing spillway conduit. The existing saddle dike located north of the main embankment would be modified by adding a downstream filter.

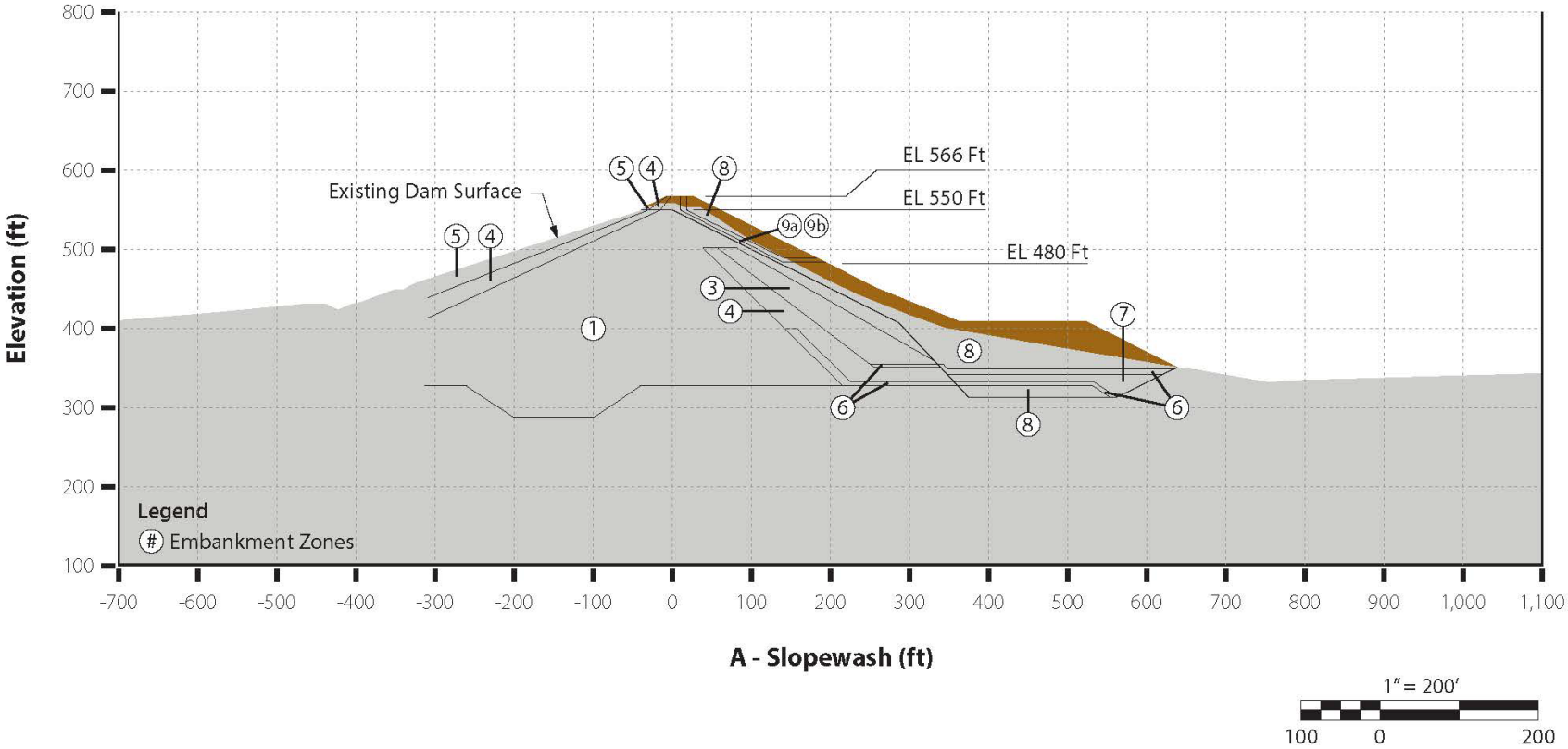

Figure 4-1. Dam Raise Typical Cross Section, Embankment Materials, and Zones

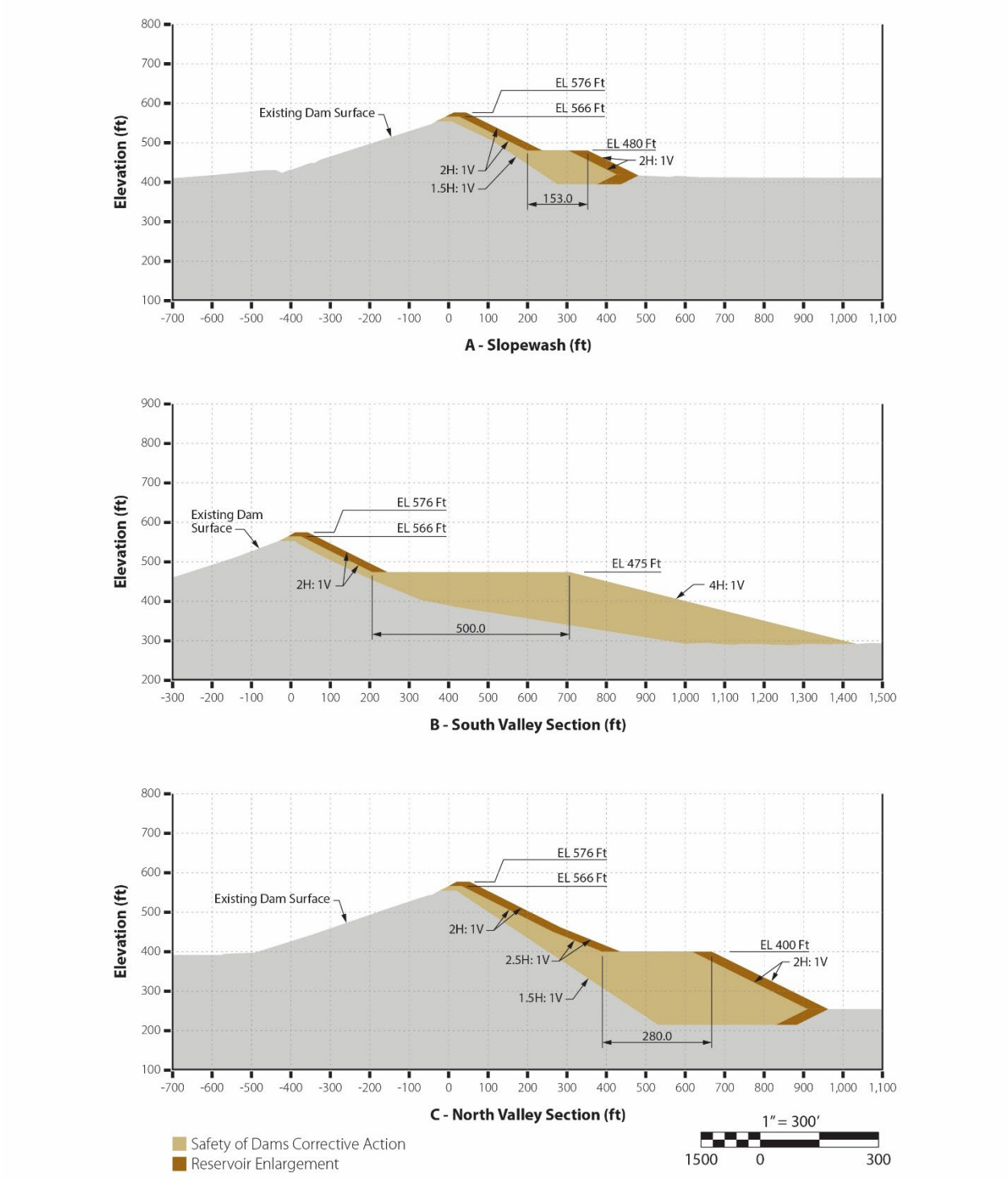

Figure 4-2. Dam Raise Embankment Profiles

With increased reservoir surface elevations, modifications would also be made at multiple locations along SR 152 to prevent inundation of the roadway when the enlarged reservoir is filled to capacity. The SR 152 embankment at Cottonwood Bay would be raised by 10 feet to allow for adequate freeboard to protect against wave action (see Figure 4-3). Modifications to the Dinosaur Point Boat Launch and the Goosehead Point Boat Launch would be made to increase the ramp's operating elevation by 10 feet. The existing berm developed during construction of the Pacheco Pumping Plant would be reconstructed with a higher crest elevation to protect the plant at high storage levels (see Figure 4-4).

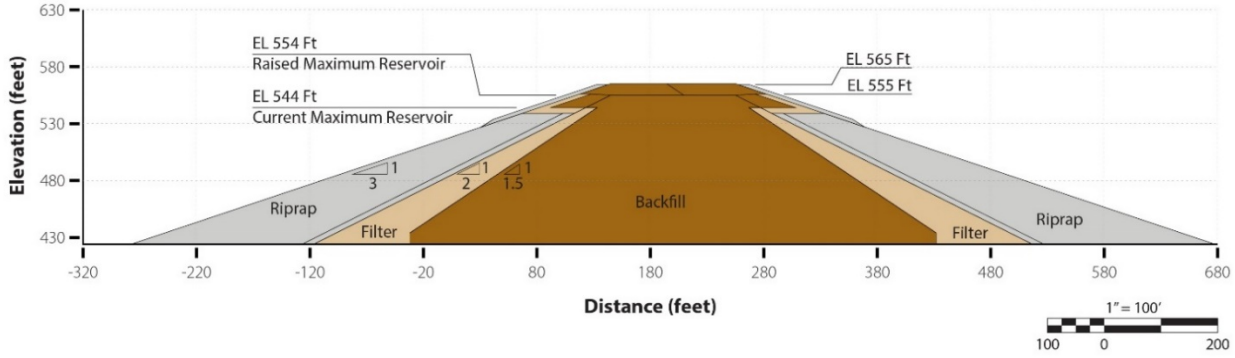

Figure 4-3. State Route 152 Embankment Modification Profiles

4.3.1 Project Facilities

The Proposed Action would expand storage in San Luis Reservoir to increase the yield of the CVP by supporting, in some years when conditions permit, increases in South-of-Delta conveyance. Three operation subalternatives are evaluated under the Dam Raise Alternative (see Section 4.3.5 for details). Implementation of the CVP/SWP split storage alternative could result in increased yield for CVP and SWP. This section outlines the physical modifications that would be developed under this alternative.

4.3.1.1 B.F. Sisk Dam

B.F. Sisk Dam is a zoned earthfill structure with a maximum structural height of 382 feet, a crest length of 18,600 feet, a crest width of 30 feet, and a crest elevation of 556 feet. The dam embankment was constructed of five materials in seven zones, with the central zone consisting primarily of low-plasticity clays (see Figure 4-1). The downstream face of the dam is covered by a 2-foot-thick cobble blanket, and the upstream face is covered by a 3-foot-thick layer of riprap. Both thickness measurements are normal to the dam slope. A saddle dike, known as the East Dike, is present along the north rim of the reservoir, approximately 1,300 feet from the dam.

The foundation that the dam is built on can be divided into sections: the right abutment, the left abutment, the NVS, and the south valley section (SVS) (see Figures 4-1 and 4-2). The NVS and SVS are the alluvial channels of San Luis Creek and Cottonwood Creek that B.F. Sisk Dam impounds and consist of deposits of sands and gravels with clayey or silty fines. The abutments are primarily founded on bedrock (sandstone, shale, and conglomerate), which is covered by clayey slope wash in some locations. In addition, the East Dike is also partially founded on slope wash.

The San Luis Reservoir Expansion Alternative would build on the B.F. Sisk Dam SOD Project, currently under final design, and raise the dam crest an additional 10 feet to a new crest elevation of 576 feet. This additional 10 feet in embankment height would support a new water surface elevation of 554 feet and an additional 130 TAF in storage capacity. In addition to the new embankment height added by the reservoir enlargement, the existing outlet works intake towers, access bridge, and spillway intake would need to be raised by 10 feet.

San Luis Reservoir seasonally operates (in most years) with an approximate 6-month period when CVP and SWP supplies are pumped into the reservoir followed by an approximate 6-month period when the reservoir is drawn down as those stored supplies are delivered to water users. Any work that would reduce the reservoir embankment strength, such as foundation or embankment excavation, would be timed seasonally and would occur during periods of the year when the reservoir is drawn down to lower elevations. Because the reservoir is drawn down as part of regular operations, construction would start after the reservoir is drawn below an elevation sufficient to ensure slope stability during any work that would impact embankment strength. This work would also be scheduled for completion each year prior to San Luis Reservoir being refilled above safe level to protect embankment stability. Scheduling work during regular periods of drawdown would allow for uninterrupted water supply deliveries. Delays to refill could potentially occur if the construction schedule is delayed, but the division of specific modification actions scheduled to occur in one drawdown season would be structured to minimize this risk. In addition, contract requirements would require use of the second construction shift on this particular component of the overall project in the event that work becomes delayed.

4.3.1.2 Cottonwood Bay/State Route 152

Sections of SR 152 near and at Cottonwood Bay could potentially be impacted by the 10-foot increase in water surface elevation, and would be protected by the development of berms separating the reservoir from the roadway in periods when storage in the enlarged reservoir is full (see Figure 4-3).

4.3.1.3 Pacheco Pumping Plant West Dike

The Pacheco Pumping Plant is located on the western side of San Luis Reservoir. The pumping plant is separated from San Luis Reservoir by an approximate 500-foot-wide dike east of the pumping plant. This dike would be replaced with a new dike 20 feet taller than the existing structure to protect the pumping plant from the enlarged reservoir.

4.3.1.4 Dinosaur Point Boat Launch

The Dinosaur Point Boat Launch is located on the western side of San Luis Reservoir, close to the Pacheco Pumping Plant. The boat ramp and portions of the parking lot at Dinosaur Point would be inundated with the 10-foot increase in surface elevation, thus requiring modifications to the facility to maintain launching functions during periods when the enlarged reservoir is at capacity.

4.3.1.5 Goosehead Point Boat Launch

The Goosehead Point Boat Launch is located on the southern side of San Luis Reservoir, close to Basalt Hill. The boat ramp and parking lot at Goosehead Point would be inundated with the 10-foot increase in surface elevation, thus requiring modifications to the facility to maintain launching functions during periods when the enlarged reservoir is at capacity.

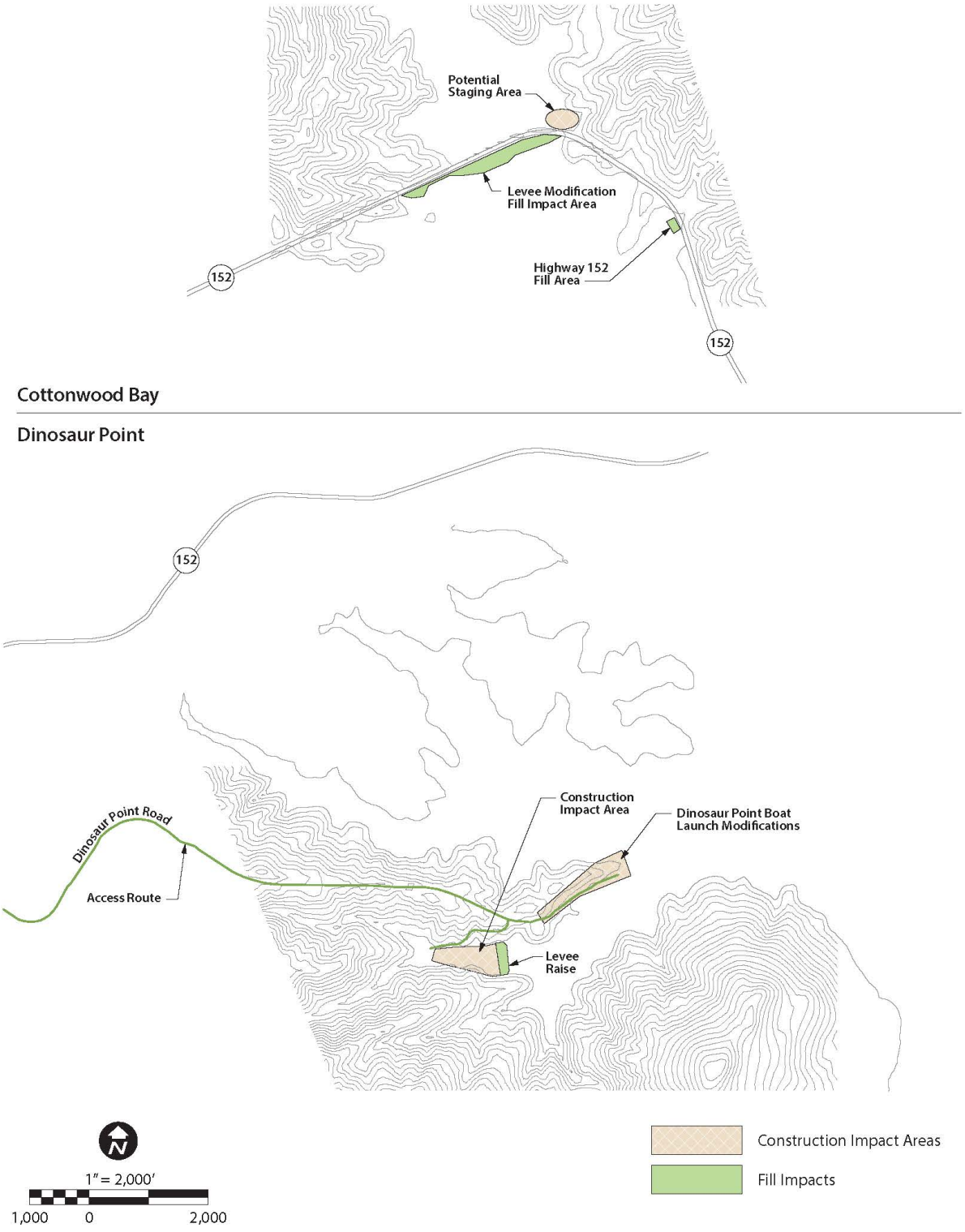

Figure 4-4. Reservoir Expansion Actions along State Route 152 and at Pacheco Pumping Plant

4.3.2 Construction Methods

The NVS shear key and downstream stability berms would be constructed by first excavating the existing liquefiable and soft foundation soils down to bedrock to a depth of 80 feet in the NVS alluvium and to a depth of 50 feet in the sections of the abutments developed on the clayey slope wash. During the shear key excavations, dewatering and unwatering measures would be employed to remove groundwater from the excavation to maintain a dry excavation. The rock blanket or slope protection would also be removed to the top elevation of the embankment and stockpiled downstream of the toe. Next, the existing toe drain would be removed by excavation. These two operations would expose the existing blanket drain and surrounding filter materials in the downstream face of the dam. Above the blanket drain, the existing Zone 3 shell would be exposed.

After completion of the excavations, the existing filters/drains located at the downstream toe would be re-established and a new toe drain seepage collection system would be installed, similar to the one currently in place. Stronger material would then be placed and compacted as backfill. Placement of shell material (Zone 8) and the rock blanket would continue up the downstream side of the embankment until it reaches an elevation of 480 feet. At 480 feet, construction of the two-stage downstream crack filter begins and the filter material along with shell material (Zone 8) continues up to the new dam crest elevation. Above an elevation of 550 feet, the raised crest is developed by simultaneously placing riprap and bedding (Zones 5 and 4), core (Zone 1), a two-stage chimney filter (Zones 9A and 9B), and the downstream shell (Zone 8), as shown in Figure 4-1. Materials used would be stockpiled downstream of the toe and in Borrow Area 6. After fill placement is completed, road base and paving of the dam crest finalize the overlay raise.

The dam raise action would elevate the B.F. Sisk Dam embankment to an elevation of 576 feet from approximate dam station 30+00 to the left abutment with a transition back to the existing crest elevation at the right abutment. The raise would be constructed by initially excavating approximately 8 feet from the top of the dam. This excavation would remove portions of existing Zones 1, 4, and 5. Removing this portion of the dam exposes an approximate 40- to 50-foot-wide surface of the existing low-plasticity clay core (Zone 1) material and provides a working surface for connecting the new zones of the dam overlay to the existing embankment. The 2-foot-thick rock blanket on the downstream slope of the dam would be removed in all areas to be covered by the overlay. For sections of the embankment not also receiving a stability berm, no further excavation would be needed.

An estimated 15 million cubic yard of fill materials for the new enlarged dam embankment would be sourced from two borrow sites—Basalt Hill and Borrow Area 6 (see Figure 4-5). The Basalt Hill Borrow area was used to support construction of the original B.F. Sisk Dam and would again be used to supply rock materials, including gravel, riprap, and cobble slope protection. These materials would be produced on-site from source material present at Basalt Hill. Borrow Area 6 was used to support construction of embankment modifications made in the 1980s and would be again used to supply material for the expansion of the Zone 1 core along with the materials for downstream berms. The only fill materials that would be imported from off-site are the filter sands needed for Zone 9a. It is estimated that approximately 1 million cubic yards of material would need to be sourced from commercial sources in the area.

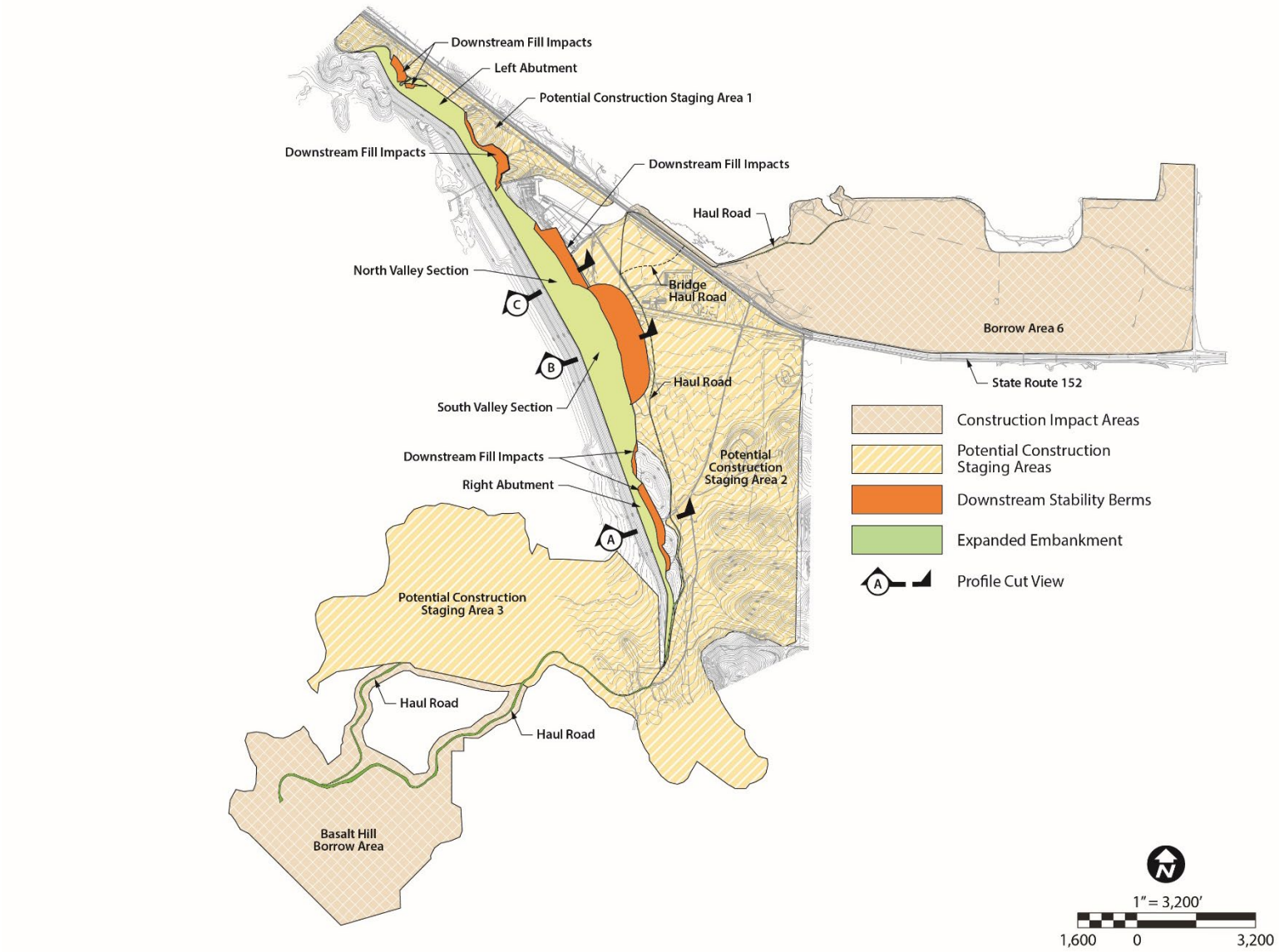

Figure 4-5. Proposed Action Construction and Staging Areas

The preferred method to transport materials to and from the construction site and Borrow Area 6 would be either a conveyor belt system or low-profile trucks passing below SR 152 under the existing bridge that crosses O'Neill Forebay. A temporary platform or roadbed would be developed below the bridge by placing clean riprap and rockfill-sized cobbles and boulders in the water between the second bridge column and the south abutment (approximately 60 feet) and topped with clean gravel to construct a clean (no fine materials) roadway underneath the bridge. This temporary construction road would be used to allow for transportation of materials without impacting traffic on SR 152. The riprap and rockfill-sized cobbles and boulders would be removed, and the area would be returned to preconstruction conditions upon completion of the work.

Under this configuration, a tunnel would be bored under SR 152 to allow for installation of 15-foot-high by 30-foot-wide concrete box culverts. The culverts would allow for conveyor system equipment to be installed (through the culverts) and allow for the transportation of materials without impacting traffic. The location of this tunnel corresponds to the potential route of another routing option to develop either a temporary construction bridge over SR 152 or use of an at-grade road crossing with signalized traffic control.

The last routing option for any materials developed in the construction site that require temporary stockpiling in Borrow Area 6 would utilize Gonzaga Road and the Santa Nella Boulevard underpass to access Borrow Area 6. Haul and access roads would be constructed consistent with the 2009 Reclamation Safety and Health Standards, as amended. New roads would be cleared, and existing roads would be improved and would be either paved or treated to prevent dust. Roads would be approximately 30 feet wide with approximately 100 feet of clearance.

Other material imports to the site would include pipe for new toe drains that would be installed beneath new berms, asphalt pavement for road replacement at the top of the new dam crest, and steel and other materials needed for construction of new transmission towers adjacent to Gianelli Pumping-Generating Plant. Off-site material disposal at area landfills and regional hazardous waste landfills would include steel and other materials from the removed transmission towers, and asbestos-wrapped corrugated metal pipe (CMP) where existing toe drains are removed.

Construction actions that would impact dam strength, such as embankment excavation, would be scheduled for completion during times in the water year that San Luis Reservoir is typically drawn down to lower levels to avoid any adverse impact on storage capacity and water supply. This would be accomplished by halting all excavation actions until the reservoir is drawn below safe levels and scheduling construction deadlines to be completed prior to the annual reservoir refill cycle, which brings the storage levels above safe levels. Temporary in-reservoir construction roads would be constructed on the upstream side of the embankment when the reservoir is lowered during normal operations and then removed prior to reservoir filling the following year.

4.3.2.1 Construction Methods for SR 152 Modifications

Construction of the SR 152 modification would initiate during construction of the B.F. Sisk Dam SOD Modification Project and the dam raise construction activities described above. SR 152 modification would include raising the embankment at Cottonwood Bay by 11 feet and slope protection of the East Overlook Parking Area located approximately half a mile southeast from the SR 152 site. The SR 152 modification construction is scheduled to last for 18–24 months.

Construction of the SR 152 modification would be sequenced to occur in eight steps: (1) rough excavation and site grading; (2) mobilization and assembly of the barge system to move material from the borrow sites to the construction site and the conveyor system to move material from the San Luis Reservoir side to the Cottonwood Bay side; (3) stockpiling rip rap and fill material on San Luis Reservoir and Cottonwood Bay side; (4) placement of riprap on both sides slopes in wet; (5) placement of additional filter material and riprap on both side slopes in dry; (6) placement of backfill and riprap armor to raise the embankment height on the San Luis Reservoir side; (7) placement of backfill and riprap armor to raise embankment height on the Cottonwood Bay side; (8) construction of the new roadway pavement.

Construction of the steps 1 through 5 can occur without lane closures along SR 152. During construction of steps 6 through 8, traffic would be reduced to two-way traffic using two of the existing four lanes along SR 152. Traffic reductions from lane closure would occur for approximately 8–12 months during the scheduled period of construction.

Construction on the Cottonwood Bay side of SR 152 would occur in the dry by dewatering a portion of the bay. Dewatering of the Cottonwood Bay would be facilitated by plugging the 24- and 66-inch existing submerged pipes and installing a cofferdam. An estimated 1.1 million cubic yard of fill materials for SR 152 embankment modification would be sourced from two borrow sites—Basalt Hill and Borrow Area 6—and stockpiled on the embankment slopes and roadway. Stockpiling of materials could result in minor changes to drainage patterns during the period of construction. Large deliveries or waste material transports off-site per day could be expected, along with the transport and disposal of material to local landfills and the regular commuting of construction personnel. Approximately 87,000 cubic yards of waste is expected to be generated from removal of existing riprap and filter material at the site. Roadway pavement material would be sourced from a local asphalt plant.

4.3.3 Equipment and Staging

Equipment in the staging areas would include trailers, equipment to be used, and stockpiled materials. Construction staging and stockpile areas would include:

- Area south of Gianelli Pumping Plant off of Basalt Road for the staging of construction equipment, fill materials transported from the borrow sites, embankment materials excavated and stored for later use, and materials transported from off-site. The area proposed for use consists of approximately 1,000 acres.

- Area north of Gianelli Pumping Plant off of Gonzaga Road for the staging of construction equipment, fill materials transported from the borrow sites, embankment materials excavated and stored for later use, and materials transported from off-site. The area proposed for use consists of approximately 120 acres.

- Dinosaur Point for the staging of construction equipment for both the Pacheco Pumping Plant West Dike replacement and Dinosaur Point Boat Launch modifications. The area proposed for use consists of approximately 28 acres.

- Embankment slopes around SR 152 between milepost MER R5.239 and MER R5.806.

The access route to the two main staging areas would be SR 152 to Basalt Road. Most of the traffic to the site would come from the east. Construction-related traffic would likely begin one to two months after notice to proceed. For the duration of the project, temporary traffic signals would be installed at the current left turn crossing on SR 152 at Basalt Road and at the access road to Romero Visitor Center. Per day, up to 240 large deliveries or off-site waste material transports could be expected, as well as the transport and disposal of material to local landfills, along with the regular commuting of construction personnel.

Aside from areas dedicated to construction staging and transportation, all remaining available space at the areas next to B.F. Sisk Dam would be needed for stockpiling materials for the full duration of construction. These areas would be returned to preconstruction condition after the project is completed.

Equipment used to construct the dam raise action would include:

3 Excavators	2 Scrapers
4 Bulldozers	5 Loaders (2 small, 3 large)
5 Cranes/Lifts	13 Dump trucks
5 Compactors	5 Water trucks
1 Graders	1 Barge
4 Flatbed Trucks	2 Wheel Trenchers
2 Concrete Saw Cutters	2 Concrete Pumpers

Equipment used to construction the SR 152 modification would include:

27 Cranes	4 Pavers	9 Tractors/Loaders/Backhoes	18 Plate Compactors
8 Crawler Tractors	9 Rollers	9 Dump Truck	1 Rollers
8 Excavators	5 Rough Terrain Forklifts	2 Flatbed Truck	1 Pumps
4 Graders	5 Rubber Tired Loaders	7 Haul Truck	2 Welders
5 Off-Highway Trucks	1 Skid Steer Loaders	2 Concrete/Industrial Saws	7 Generators
9 Water Truck	16 Barges (8 aggregate, 4 conveyor, 4 crane)		

4.3.4 Construction Schedule

Recreational activities would be suspended for safety reasons during the entire construction schedule at Basalt use area and Medeiros use area, and during active construction at Dinosaur Point use area (approximately 1 year). Recreational use for boating would be suspended for the full year that both the Basalt and Dinosaur Point use areas are closed and would be limited to areas away from B.F. Sisk Dam for the full construction schedule. The closed Basalt Campground would be used as a temporary camping area for construction workers.

Final design of the dam raise and SR 152 embankment modification would include the development of a construction schedule that coincides the completion work (in the direct path of potential flood flows or on infrastructure specifically designed to direct flood flows) to occur in periods of the year when rain is unlikely and reservoir levels are lower. In addition, the contractor would be required to develop a health and safety plan as an environmental commitment that includes a response plan to

flood forecasts that would require the suspension of construction activities and the movement of construction equipment to higher ground.

Construction of the dam raise action is expected to coincide with the construction of the SOD Modification Project whose construction duration is anticipated to last approximately 8 years. Construction duration is based on 130 anticipated workers on-site during the day shift and 87 workers on-site during the night shift. Work would be performed 24 hours per day, 7 days per week, 12 months per year. The 24-hour work day would consist of two 10-hour work shifts, with a half-hour for lunch each shift, plus a 3-hour maintenance period. Blasting operations at Basalt Hill would be limited to the hours between 6:00 a.m. and 6:00 p.m. It is assumed that construction would start in September 2025.

SR 152 Modification construction is expected to last approximately 18–24 months from summer 2027. The construction duration is based on approximately 75–130 workers on-site. Work would be performed from 6:00 a.m. to 6:00 p.m., 7 days per week, 12 months per year. A smaller crew of 10–20 people would be active at the site performing equipment maintenance, repair activities, crushing operations at Basalt Hill, and borrow operations in Borrow Area 6 from 6:00 p.m. to 6:00 a.m.

4.3.5 Operation of the Dam Raise Alternative

The SLDMWA and its member agencies, Reclamation, and DWR coordinated on the identification of several operational configurations of the Dam Raise Alternative. Those subalternatives have been further configured as "bookends" to capture the range of stakeholder-requested configurations and cover the high- and low-end of potential environmental effects. These effects include potential growth-inducing impacts from increases in municipal and industrial (M&I) water supply reliability and potential environmental impacts to aquatic resources in the Delta resulting from changes in water deliveries conveyed through the Delta.

4.3.5.1 CVP-Only Storage Subalternative

The additional storage in San Luis Reservoir would be Reclamation-owned CVP storage and would be operated consistent with current CVP operations. The new reservoir capacity would be used to store CVP project water, carried-over water,[9] and non-Project water.[10] The maximum quantity of carried-over water would be the same as recent operations under the current rescheduling guidelines. Based on a review of historical rescheduling quantities and the most recent annual rescheduling guidelines, an upper quantity of 180 TAF was used to estimate the aggregate total of carried-over water in high-allocation water years. As an operational bookend, this upper limit was allocated 98% to agricultural and 2% to M&I South-of-Delta CVP water contractors.

[9] Carried-over water refers to Rescheduled Water. Rescheduled Water is defined as allocated CVP water carried over to subsequent water year(s) by the water contractor, pursuant to Reclamation's then-current Rescheduling Guidelines. The water contractors, in storing this carried-over supply in San Luis Reservoir, take on a risk of potentially losing it if San Luis Reservoir fills the next year and that supply is "spilled" (converted to CVP supplies for following year's allocation).

[10] Non-Project water includes transfer water acquired by existing South-of-Delta CVP contractors. or other non-Project water currently stored in San Luis Reservoir such as conserved water. The water contractors can store non-Project water in San Luis Reservoir under the Warren Act. Similar to carried-over water, the contractors take on a risk of potentially losing non-Project water if San Luis Reservoir fills the next year and that supply is "spilled" (converted to CVP supplies for following year's allocation).

Storage priority will follow current rescheduling guidelines with carried-over water and nonproject water being subject to spill consistent with current operating criteria.

4.3.5.2 CVP/SWP Split Storage Subalternative

The additional storage would be split between the CVP and SWP, consistent with the current 45 percent CVP and 55 percent SWP split of the overall reservoir storage. The additional storage would follow current operating criteria and the storage priority will follow the current rescheduling guidelines.

4.3.5.3 Investor-Directed Storage Subalternative

Under this subalternative's four operational configurations, the use of the proposed storage (expanded capacity) would be primarily investor-directed. Remaining expanded capacity not in use by the investors, at any given time, would be available to Reclamation to store CVP water.

Investors could store allocated CVP Project water carried-over water, and non-Project water in the expanded capacity. Investors could forgo delivery of their allocated CVP Project water for delivery in subsequent year(s). This unused CVP Project water would be carried over to subsequent year(s) and continue to be stored in San Luis Reservoir until investor requests delivery of the water without the risk of "spill". Carried-over water in the expanded capacity would be subject to evaporation at the same rate as CVP Project water stored in San Luis Reservoir. Investors would have first priority in storing carried-over water and non-Project water in the expanded capacity without the risk of "spill."

Configuration A – The upper target quantity of carried-over water in San Luis Reservoir would be 180 TAF. The delivery of the carried-over water and CVP project water was allocated proportionally among the SLDMWA investor group at 78% to agriculture, 7% to M&I, and 15% federal refuge water users.

Configuration B – The upper target quantity of carried-over water in San Luis Reservoir would be 180 TAF. The delivery of the carried-over water and CVP project water was allocated proportionally among the SLDMWA investor group at 90% to M&I and 10% to agriculture water contractors.

Configuration C – The upper target quantity of carried over water in San Luis Reservoir would be 310 TAF. The delivery of the carried-over water and CVP project water was allocated proportionally among the SLDMWA investor group at 78% to agriculture, 7% to M&I, and 15% federal refuge water contractors.

Configuration D – The upper target quantity of carried over water in San Luis Reservoir would be 310 TAF. The delivery of the carried-over water and CVP project water was allocated proportionally among the SLDMWA investor group at 90% to M&I and 10% to agriculture water contractors.

4.3.6 Costs

Table 4-1 shows feasibility-level most probable cost estimates for the Dam Raise Alternative Plan. No cost would be accrued by the Non-Structural Alternative. The operation and maintenance costs range from $0.7 million annually to $2.5 million annually under the Dam Raise subalternative. Table 4-2 presents the probable low costs for the Dam Raise Alternative Plan that were developed to support sensitivity evaluations presented in this feasibility report. Additional detail on these probable low cost estimates are presented in Appendix B1 and Appendix B-2.

Table 4-1. Dam Raise Alternative Plan – Most Probable Costs

	Dam Raise	State Route 152 Modifications
Total Project Construction Costs[1]	$539 million	$383 million

Notes:
General: January 2020 price levels.
[1] Interest during construction not included

Table 4-2. Dam Raise Alternative Plan – Probable Low Costs

	Dam Raise	State Route 152 Modifications[2]
Total Project Construction Costs[1]	$453 million	$268 million

Notes:
General: January 2020 price levels.
[1] Interest during construction not included
[2] Based on AACE Estimate Class 4: 1–5 percent Project Definition and Feasibility Study cost range methodology

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Chapter 5 Plan Evaluation and Comparison

A critically important element of federal planning is the evaluation and comparison of alternative plans. This chapter presents results of this evaluation and comparison of the No Action/No Project Alternative (No Action Alternative) and the alternative plans described in Chapter 4. This chapter also documents the consistency of the alternative plans with other water management programs and regulations.

5.1 Alternative Plan Evaluation

Under the feasibility planning process, four accounts are established to display, and facilitate evaluation of, the effects of alternative plans: National Economic Development (NED), environmental quality (EQ), regional economic development (RED), and other social effects (OSE). These four accounts comprise public benefits that include environmental, economic, and social goals. The beneficial and adverse effects of each alternative plan are evaluated through comparison with the No Action Alternative; the plan that maximizes net public benefits should be identified.

5.1.1 National Economic Development Account

The objective of NED analysis is to determine the change in net value of the nation's output of goods and services that would result from implementing each project alternative. Beneficial and adverse effects are evaluated in monetary terms and measured in terms of changes in national income among the No Action and various action alternatives. The NED account describes the part of the human environment that identifies beneficial and adverse effects on the economy. Beneficial effects in the NED account are (1) increases in the economic value of the national output of goods and services from an alternative, (2) the value of output resulting from external economies caused by an alternative, and (3) the value associated with the use of otherwise unemployed or underemployed labor resources. Adverse effects in the NED account are the opportunity costs of resources used in implementing an alternative. These adverse effects include (1) implementation outlays, (2) associated costs, and (3) other direct costs. The NED account may include benefits in the following categories:

- Agricultural floodwater, erosion, and sediment reduction
- Agricultural drainage
- Agricultural irrigation
- Commercial fishing
- Municipal and Industrial (M&I) water supply
- Power (hydropower)
- Recreation
- Transportation (inland navigation)
- Urban flood damage reduction
- Other direct benefits

In this analysis, M&I water supply reliability, irrigation water supply reliability, emergency water supply, transportation safety, and environmental benefits, owing to increases in supplies, are evaluated. Environmental benefits evaluated include increased refuge water supply. Environmental benefits are typically included in the EQ accounts if monetary units cannot be attributed to the benefit. For this analysis, however, refuge water supply benefits are based on the water transfer price and are quantified in the NED account.

5.1.1.1 Monetized Benefits

It is necessary to estimate the economic benefits of potential effects to establish economic feasibility and identify a corresponding final alternative that maximizes net benefits, consistent with federal objectives (also called the NED Plan). This section summarizes valuation methods and estimates for the benefit categories evaluated. Additional detail for each of the benefit categories evaluated is included in Appendix C – Economic Benefits Evaluation.

5.1.1.2 M&I Water Supply Reliability Benefits

The incremental change in annual M&I water supply reliability under the action alternatives relative to the No Action Alternative is the basis for M&I water supply reliability benefits. The hydrologic model results (detailed in Appendix A1 – Modeling) provide the quantity of water available under the No Action and action alternatives' multiple operational configurations. These different operational configurations of the Dam Raise Alternative would provide additional water to reduce shortages under the No Action Alternative, which is an economic benefit. Estimated urban water deliveries associated with B.F. Sisk Dam Raise and Reservoir Expansion Project alternative plans are reported in Table 5-1.

Under the Non-Structural Alternative, average annual South-of-Delta M&I deliveries are expected to change minimally under certain water year types. Under the Dam Raise Alternative subalternatives, average annual South-of-Delta M&I deliveries vary based on the year type and configuration. Increases in deliveries are a result of the expanded storage capacity in the expanded reservoir, while decreases are generally attributable to decreases in SWP deliveries, based on reductions in Article 21 water and Table A deliveries.

Table 5-1. Estimated Change in Municipal and Industrial Water Supply Reliability Provided by the Non-Structural Alternative and the Dam Raise Subalternatives (TAF/year)

Year Type[1]	Non-Structural Alternative	Dam Raise Alternative					
		CVP-Only	CVP/SWP Split	Investor-Directed Storage Subalternative A	Investor-Directed Storage Subalternative B	Investor-Directed Storage Subalternative C	Investor-Directed Storage Subalternative D
Wet	0	4.54	1.30	7.46	68.21	3.39	23.78
Above Normal	-1	-0.53	4.55	-0.96	25.07	-3.04	1.11
Below Normal	0	4.61	-21.09	4.35	34.57	2.45	14.40
Dry	0	4.20	-18.16	3.50	19.07	4.11	25.73
Critical	2	-0.92	26.33	-1.47	5.84	-0.70	14.53
Average Annual Additional Water Quantity	0	2.87	-2.27	3.43	35.74	1.82	18.05

Notes:
[1] Sacramento Valley 40-30-30 Water Year Hydrologic Classification Index used to define water year types.
Modeling Period 1922–2003. Data results from CalSim modeling.
Key:
TAF= thousand acre-feet
CVP= Central Valley Project; SWP= State Water Project
SWP = State Water Project

In NED benefit analysis, the benefits to M&I water users are measured according to the cost of the most likely alternative water supply that would be pursued in the absence of development of the B.F. Sisk Dam Raise and Reservoir Expansion Project alternative plans. For water supply reliability benefits, the cost of the most likely alternative represents the next unit of water supply the water user would purchase, or develop, if the project under consideration were not in place. The cost of the most likely alternative assumes that if the preferred alternative is not implemented, the alternative action most likely to take place provides a relevant comparison. The valuation approach relies upon the costs associated with observed market transactions for water. The data include single-year transactions from 1990 through 2019 of surface water supplies originating in California's Central Valley. The dataset includes 218 transactions for municipal uses, 541 for agricultural uses, and 113 purchases by environmental users. The water transfer price model projects water prices to 2030 by geographic region and hydrologic condition.

Table 5-2 presents the estimated annual M&I water supply reliability benefits for each alternative plan based on the water supplies delivered and the water unit values. The values represent 2030 estimates and are presented in 2020 dollars.

Table 5-2. Average Annual M&I Water Supply Economic Benefits Provided by the Non-Structural Alternative and the Dam Raise Subalternatives

Alternative Plans	NED M&I Water Supply Reliability (TAF/year)	NED M&I Water Supply Annual Benefits relative to No Action Alternative (million $)[1,2]
Non-Structural	0	$0.7
CVP-Only	2.87	$1.5
CVP/SWP Split	–2.27	–$1.8
Investor-Directed Storage Subalternative A	3.43	$1.6
Investor-Directed Storage Subalternative B	35.74	$16.0
Investor-Directed Storage Subalternative C	1.82	$1.1
Investor-Directed Storage Subalternative D	18.05	$9.4

Notes:

[1] NED irrigation water supply reliability benefits are based on average water year type hydrologic conditions and calculated as the weighted average of five water year types and values in Table 5-1. Sacramento Valley 40-30-30 Water Year Hydrologic Classification Index used to define water year types. Based on January 2020 price levels.

[2] M&I water supply benefits have been adjusted for the structural alternatives as detailed in Appendix C to account for a water supply emergency's limits on the availability of this supply.

Key:

M&I = municipal and industrial

NED = National Economic Development

CVP= Central Valley Project

SWP= State Water Project

TAF= thousand acre-feet

5.1.1.3 Irrigation Water Supply Reliability Benefits

The incremental change in annual irrigation water supply under the action alternatives relative to the No Action Alternative is the basis for irrigation water supply reliability benefits. The hydrologic model results provide the quantity of water available under the No Action and action alternatives. Table 5-3 shows the average annual incremental differences in water quantity delivered to agricultural contractors under the Non-Structural Alternative and Dam Raise subalternatives in comparison to No Action.

Table 5-3. Estimated Change in Annual Average Irrigation Water Supply Provided by the Non-Structural Alternative and the Dam Raise Subalternatives (TAF/year)

Year Type[1]	Non-Structural Alternative	Dam Raise Alternative					
		CVP-Only	CVP/SWP Split	Investor-Directed Storage Subalternative A	Investor-Directed Storage Subalternative B	Investor-Directed Storage Subalternative C	Investor-Directed Storage Subalternative D
Wet	-78	77.55	24.03	63.06	14.45	25.71	9.62
Above Normal	-40	22.08	15.02	17.66	2.98	7.28	1.62
Below Normal	-47	38.27	18.76	30.68	4.87	9.76	2.34
Dry	-7	4.89	7.86	2.86	-3.27	11.27	-2.27
Critical	0	1.68	7.99	0.89	-1.79	7.52	-0.94
Average Annual Additional Water Quantity[2]	-39	34.58	15.62	27.65	4.65	14.46	2.93

Notes:
[1] Sacramento Valley 40-30-30 Water Year Hydrologic Classification Index used to define water year types.
[2] Average calculated as the weighted average of five water year types and values in Table 5-2
Key:
TAF= thousand acre-feet
CVP= Central Valley Project
SWP = State Water Project

Economic benefits of increased water supplies are estimated using the Statewide Agricultural Production (SWAP) model. The SWAP model assumes that farmers select the crops, water supplies, and other inputs to maximize profit subject to resource constraints, technical production relationships, and market conditions. Farmers are assumed to face competitive markets in which no single farmer could influence crop prices, but an aggregate change in production could affect crop price.

The SWAP model incorporates project water supplies (CVP and SWP), other local surface water supplies, and groundwater. As conditions change within a SWAP region (e.g., the quantity of available project water supply increases or the cost of groundwater pumping increases), the model optimizes production by adjusting the crop mix, water sources and quantities used, and other inputs. It also fallows land when that appears to be the most cost-effective response to resource conditions. The SWAP model is used to compare the long-run response of agriculture to potential changes in CVP and SWP irrigation water delivery, other surface or groundwater conditions, or other economic values or restrictions. SWAP provides numerous outputs, including information on changes in net income, changes in output, irrigated acreage, crop mix, and water use. The outputs for this analysis primarily include changes in net income and acreage. SWAP output was post-processed using a spreadsheet tool that converts the output to be consistent with NED outputs. Appendix A2 – Statewide Agricultural Production Model further describe the SWAP model and Appendix C –

Economic Benefits Evaluation and describes the irrigation water supply benefits analysis using the SWAP model.

As described in Appendix C – Economic Benefits Evaluation, the SWAP model includes groundwater pumping volume constraints that reflect aquifer conditions and well pumping capacities in 2014. For the economic analysis, the endogenous groundwater pumping volume for each region from the Future No Action Alternative was applied as the groundwater pumping limits for each of the alternatives. As such, no additional groundwater pumping is allowed to offset reductions in surface water deliveries. This approach was followed to account for the potential future limits on groundwater pumping due to the SGMA. The effects of SGMA on future groundwater availability for agricultural uses are not known at this time so this approach is an approximation.

Table 5-4 presents the estimated annual agricultural water supply benefits for the Dam Raise subalternatives. The values represent 2030 estimates and are presented in 2020 dollars.

Table 5-4. Estimated Irrigation Water Supply Reliability NED Benefits Provided by the Non-Structural Alternative and the Dam Raise Subalternatives

Alternative Plans	NED Agricultural Water Supply Reliability (TAF/year)	NED Agricultural Water Supply Annual Benefits relative to No Action Alternative (million $)[1,2]
Non-Structural	–39	–$10.8
CVP-Only	34.58	$7.4
CVP/SWP Split	15.62	$4.4
Investor-Directed Storage Subalternative A	27.65	$5.8
Investor-Directed Storage Subalternative B	4.65	$0.9
Investor-Directed Storage Subalternative C	14.46	$3.0
Investor-Directed Storage Subalternative D	2.93	$0.5

Notes:

[1] NED irrigation water supply reliability benefits are based on average water year type hydrologic conditions and calculated as the weighted average of five water year types and values in Table 5-3. Sacramento Valley 40-30-30 Water Year Hydrologic Classification Index used to define water year types. Based on January 2020 price levels.

[2] Irrigation water supply benefits have been adjusted for the structural alternatives as detailed in Appendix C to account for a water supply emergency's limits on the availability of this supply.

Key:

NED = National Economic Development

TAF= thousand acre-feet

CVP= Central Valley Project

SWP = State Water Project

5.1.1.4 Enhanced Emergency M&I Water Supply Benefits

The B.F. Sisk Dam Raise Alternative Plans provide emergency water supply benefits from increased storage. Emergency storage benefits are increased supplies stored in reservoirs that can be delivered in the event of a major levee failure in the Delta that would significantly degrade water quality, or a major earthquake that would disrupt the ability of SLDMWA to import water into their service area. An analysis was performed to quantify and value emergency water supplies, and those available to

SLDMWA M&I water users in the event of a Delta water supply outage. The incremental change in enhanced emergency M&I water supply under the alternatives relative to the No Action Alternative is the basis for irrigation water supply reliability benefits. The hydrologic model results provide the quantity of water available under the No Action and action alternatives. Table 5-5 shows the water quantity that could potentially be delivered to M&I contractors in emergency conditions under the Dam Raise subalternatives in comparison to No Action. The Non-Structural Alternative would not provide emergency water supply, as it could impact contractual obligations to other water users.

Table 5-5. Estimated Change in Annual Average Emergency M&I Water Supply Provided by the Non-Structural Alternative and the Dam Raise Subalternatives (TAF/year)

Alternative Plans	Emergency Supply (TAF)
Non-Structural	–
CVP-Only	28
CVP/SWP Split	17
Investor-Directed Storage Subalternative A	31
Investor-Directed Storage Subalternative B	31
Investor-Directed Storage Subalternative C	63
Investor-Directed Storage Subalternative D	63

Key: M&I = municipal and industrial; TAF= thousand acre-feet; NED = National Economic Development; CVP= Central Valley Project; SWP= State Water Project

Table 5-6 shows the estimated NED benefits for emergency response under 2030 future conditions. The total surface water volumes were multiplied by the annual probability of occurrence and value to obtain the expected total and annual benefit for each alternative plan. Additional details can be found in Appendix C – Economic Benefits Evaluation. The values represent 2030 estimates and are presented in 2020 dollars.

Table 5-6. Estimated NED Benefits for Enhanced M&I Emergency Water Supply

Alternative Plans	NED Emergency Water Supply Annual Benefits relative to No Action Alternative (million $)[1]
Non-Structural	–
CVP-Only	$12.5
CVP/SWP Split	$4.4
Investor-Directed Storage Subalternative A	$14.7
Investor-Directed Storage Subalternative B	$14.7
Investor-Directed Storage Subalternative C	$27.8
Investor-Directed Storage Subalternative D	$27.8

Notes:
[1]Total economic losses were multiplied by the annual probability of occurrence of 0.042 to obtain the emergency response annual benefits. Based on January 2020 price levels.

Key: M&I = municipal and industrial; TAF= thousand acre-feet; NED = National Economic Development; CVP= Central Valley Project; SWP= State Water Project

5.1.1.5 Transportation Safety Benefits

The Dam Raise Alternative includes modifications along SR 152 at the Cottonwood Bay crossing. SR 152 is a state highway that runs east from near the middle of California SR 1 in Watsonville to SR 99 southeast part of Merced County. Its western portion (which is also known as Pacheco Pass Road and Pacheco Pass Highway) provides access to and from Interstate 5 toward Southern California for motorists in or near Gilroy, and Hollister in the Silicon Valley.

The PR&G's identify public safety as one of the overarching concepts the federal government seeks to promote through federal investments in water development project (CEQ 2014). Public safety benefits are identified in actions that include reducing threats to people, including both loss of life and injury, from natural events. As noted previously, the Ortigalita Fault passes under the SR 152 embankment that crosses Cottonwood Bay. The Dam Raise Alternative includes modifications to SR 152 with three design actions: (1) raising the SR 152 embankment at the Cottonwood Bay crossing by 11 feet to prevent inundation of the roadway when the enlarged reservoir is filled to capacity; (2) flattening the side slopes from 2:1 to a 3:1 slope to increase seismic stability of the embankment at Cottonwood Bay; and (3) slope protection of the East Overlook Parking Area located approximately half a mile southeast from the SR 152 Cottonwood Bay crossing. The modifications to the Cottonwood Bay SR 152 embankment to increase seismic stability and reduce current seismic risk would be a public safety benefit as described in the PR&G's.

Failure of the existing SR 152 embankment during a seismic event is given the fault potential on site estimated to generate a significant slumping of the embankment core that would during period of high reservoir storage put the SR 152 under water. In periods of lower water storage levels in the reservoir this significant slumping is anticipated to generate buckling and failure of the roadway surface. In either condition this impact to the roadway would present significant safety risk to motorists crossing the embankment at highway speeds. In addition to this direct safety impact to motorists, failure of the roadway would generate a long-term public safety effect by inhibiting access for emergency vehicles needing to respond not only to the seismic event that generated the embankment failure but also generate significant interruptions for emergency response to potential wildfires or other natural disasters in the region, transit of emergency vehicles accessing medical facilities in communities along the US 101 corridor to the west and Interstate 5 and SR 152 corridors to the east. It is assumed that repair of this embankment following a seismic failure would take approximately 2 years, however the highway would be fully closed to traffic during the 2-year period. During this outage, the fastest potential detour would rely on existing SR 130. This alternate route would add an additional 2 hours of travel time and significantly inhibit emergency access.

Two methods were applied to estimate economic benefits for transportation safety along State Route 152. The first approach identified benefits by valuing the cost of lost time. Transportation benefits using the first approach are presented in Table 5-7 identified benefits generated by addressing the seismic risk issue by considering the impact to the economy from delays generated for commercial and non-commercial traffic during a closure of the roadway following a seismic failure that is further described in Appendix C – Economic Benefits Evaluation. The second approach identified benefits using a "least cost" most likely alternative formulated solely for the purpose of reducing seismic risk and increasing public safety, further described in Appendix C – Economic Benefits Evaluation.

Approach 1: Value of lost time approach The approach builds on estimates for the value of lost time and is consistent with the methodology applied by the U.S. Department of Transportation (DOT). This approach assumes, the SR 152 embankment would be fully closed to traffic for a 2-year period following a seismic failure. During this outage, the fastest potential detour would add an additional 2 hours of travel time. This approach monetizes the potential trip delay of 2 hours to commercial and personal passengers due to the closure of SR-152 Highway (see Table 5-7). This approach does not quantify all potential economic benefits to the nation from the avoidance of seismic failure at the embankment including impacts to emergency response times during the two-year highway outage including response times to emergencies at the San Luis Reservoir State Recreation Area.

Table 5-7. Estimated Public Safety Benefits for Modification to State Route 152 – Approach 1

Alternative Plan[1]	Benefit based on lost time to commercial and personal vehicles only (million $)[2]	Annual Benefits (million $)
Lost Time to Commercial and Personal Vehicles Only	$9.1	$0.3

Notes:
[1] All operational configurations of the Dam Raise Alternative include the full SR 152 upgrade which would provide this transportation safety benefit
[2] Based on January 2020 price levels.

Approach 2: Least-cost most likely alternative approach The least-cost most likely alternative formulated to reduce seismic risk at the existing embankment considered flattening the slope of existing embankment from 2:1 to a 3:1 slope. This alternative would maintain the current crest elevation (El. 555), add a 90-foot-wide riprap buttress from the toe of the slopes to an elevation of El. 499, and add riprap reinforcement to the upper portion of the embankment ranging from 40 feet wide to 10 feet wide. The single purpose alternative would also introduce a 50-foot-wide bench at El. 499 and a 10-feet-wide bench at El. 550. The design slopes for the lower buttress and the upper reinforcement would be 2H:1V and 2.4H:1V, respectively. All the additional material would consist of riprap for this single purpose alternative, which includes adding approximately 513,000 cy of riprap for slope protection and 3,500 cy of embankment.

This approach evaluated other alternative solutions including structural and non-structural elements to avoid, reduce and mitigate threat to motorists from the seismic risk associated with the SR 152 embankment. The potential nonstructural alternative that was identified and evaluated would decommission the existing embankment. Under this alternative motorists would need to rely on existing SR 130 to connect between the US 101 corridor to the west and Interstate 5 corridor to the east. However, the SR 130 route would add an additional 2 hours of travel time which would cause a significant impact to motorists and it was screened from further consideration.

Other structural options evaluated included numerous potential configurations including replacement of the existing embankment with a bridge, rerouting of the state route around Cottonwood Bay, and modification of the existing embankment to address the seismic risk. The option of replacing the existing embankment with a bridge was evaluated and given the increased

length of the span when compared to the existing embankment, the need to construct this new bridge in the reservoir without impacting its operation, and the active fault line that it would need to cross, it was estimated to increase its potential cost higher than modifying the existing embankment. Similarly, rerouting the roadway around Cottonwood Bay was also screened given the complexity of procuring privately owned lands that the new roadway would traverse along with mapped active landslides throughout its potential alignment.

Table 5-8. Estimated Public Safety Benefits for Modification to State Route 152 – Approach 2

Alternative Plan[1]	Public Safety Benefit based on Seismic Only Upgrade (million $)[2]	Public Safety Annual Benefits (million $)
Dam Raise Alternative	$256.0	$7.6

Notes:
[1] All operational configurations of the Dam Raise Alternative include the full SR 152 upgrade which would provide this transportation safety benefit
[2] Based on January 2020 price levels.

5.1.1.6 Refuge Water Supply Benefits

The Investor-Directed Storage Subalternatives A and C would provide increased water supply allocations to Grasslands Water District (SLDMWA agency representing the Grassland Resource Conservation District). The CVP-Only and CVP/SWP Split alternatives would provide minimal increases in water supply to South-of-Delta CVPIA refuges, with an annual increase of approximately 1 TAF/year. The Non-Structural Alternative and Investor-Directed Storage Subalternatives B and D refuge deliveries would not change and would remain the same as the No Project/No Action Conditions. Table 5-9 shows the average annual incremental differences in water quantity delivered to agricultural contractors under Dam Raise subalternatives in comparison to No Action.

Table 5-9. Estimated Change in Annual Average Refuge Water Supply Provided by the Non-Structural Alternative and the Dam Raise Subalternatives (TAF/year)

Year Type[1]	Non-Structural Alternative	Dam Raise Alternative					
		CVP-Only[3]	CVP/SWP Split[3]	Investor-Directed Storage Subalternative A	Investor-Directed Storage Subalternative B	Investor-Directed Storage Subalternative C	Investor-Directed Storage Subalternative D
Wet	-	-	-	13.1	-	4.4	-
Above Normal	-	-	-	4	-	1.5	-
Below Normal	-	-	-	6.6	-	2	-
Dry	-	-	-	1.8	-	3.7	-
Critical	-	-	-	0.7	-	2.3	-
Average Annual Additional Water Quantity[2]	-	-	-	6	-	3	-

Notes:

[1] Sacramento Valley 40-30-30 Water Year Hydrologic Classification Index used to define water year types.

[2] Average calculated as the weighted average of five water year types

[3] Refuge deliveries are minimal with an average annual increase of approximately 1 TAF/year.

Key:

TAF= thousand acre-feet

CVP= Central Valley Project

SWP= State Water Project

The approach to estimate ecosystem enhancement benefits considers the estimated short-term price to purchase water supplies on the open market, the most likely alternative in the absence of a firm water supply from the Dam Raise Subalternatives. This method is consistent with the least cost alternative method. To monetize these ecosystem benefits for San Joaquin River watershed refuges, the cost associated with acquiring equivalent water supply on the open market was determined for 2030 future conditions. The analysis relies on values estimated through application of a water-transfer pricing model, with consideration of the costs associated with conveying the water to the refuges being served.

Table 5-10 presents the estimated annual ecosystem benefits for each alternative plan. The values represent 2030 estimates and are presented in 2020 dollars.

Table 5-10. Average Annual Refuge Water Supply Economic Benefits Relative to No Action Alternative

Alternative Plan	NED Refuge Water Supply Reliability (TAF/year)	NED Refuge Water Supply Annual Benefits (million $)[1]
Non-Structural	–	–
CVP-Only	–	–
CVP/SWP Split	–	–
Investor-Directed Storage Subalternative A	6.2	$1.8
Investor-Directed Storage Subalternative B	–	–
Investor-Directed Storage Subalternative C	3.2	$1.1
Investor-Directed Storage Subalternative D	–	–

Notes:

[1] Refuge water supply benefits have been adjusted for the structural alternatives as detailed in Appendix C to account for a water supply emergency's limits on the availability of this supply.

Key:

NED = National Economic Development

Based on January 2020 price levels.

5.1.1.7 NED Benefit Summary

Table 5-11 summarizes the estimated annual economic benefits for the proposed project alternatives used to calculate benefit-cost ratios and net benefits. The economic benefits estimated in this analysis rely on a set of assumptions. Changes in these assumptions will change the estimated benefits and could affect the applicability of the methods applied to estimate the benefits.

Table 5-11. Summary of Estimated Economic Benefits by the Non-Structural Alternative and the Dam Raise Subalternatives, Adjusted for Delivery of Emergency Supplies (million $)

Benefit Category	Non-Structural	CVP-Only	CVP/SWP Split	Investor-Directed Storage Subalternative A	Investor-Directed Storage Subalternative B	Investor-Directed Storage Subalternative C	Investor-Directed Storage Subalternative D
Annual M&I Water Supply Benefits (million $)[1, 2]	$0.7	$1.5	–$1.8	$1.6	$16.0	$1.1	$9.4
Annual Agricultural Water Supply Benefits (million $)[2, 3]	–$5.7	$7.4	$4.4	$5.8	$0.9	$3.0	$0.5
Enhanced Emergency M&I Water Supply (million $)[2]	–	$12.5	$4.4	$14.7	$14.7	$27.8	$27.8
Transportation Benefits – Approach 1 (million $)	–	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
Transportation Benefits – Approach 2 (million $)	–	$7.6	$7.6	$7.6	$7.6	$7.6	$7.6
Annual San Joaquin Refuge Water Supply (million $)[2,4]	–	–	–	$1.8		$1.1	–
Total Annual Economic Benefits[5]	–$5.0	$21.7/ $29.0	$7.3/ $14.6	$24.3/ $31.6	$31.9/ $39.2	$33.3/ $40.6	$38.0/ $45.3

Notes:

General: January 2020 price levels. All values are rounded for display purposes; as a result, not all totals may sum.

[1] Market-based estimates of the cost of water transfers to Bay Area M&I agencies.

[2] Non-emergency water supply benefits have been adjusted for the structural alternatives as detailed in Appendix C to account for a water supply emergency's limits on the availability of this supply.

[3] Based on SWAP Modeling results.

[4] Market-based estimates of the cost of water transfers to wildlife Refuges in the San Joaquin Valley.

[5] The first value includes Transportation Benefit – Approach 1 i.e. the Value of Lost Time Approach. The second value includes Transportation Benefit – Approach 2 i.e. the least-cost most likely alternative approach.

Key:

M&I = municipal and industrial

CVP= Central Valley Project

SWP= State Water Project

5.1.1.8 Cost Estimates

This section summarizes monetized NED costs and other direct costs for the Dam Raise Alternative. Construction components would remain unchanged between the subalternatives. Table 5-12 defines the key components of NED costs.

Table 5-12. Definition of National Economic Development Cost Components

Cost Terminology	Definition
Field Cost	Cost estimate for a feature or project from award to construction closeout.
Non-Contract Cost	Cost of work or services provided to support feature construction and other work that can be attributed to the feature as a whole. It also includes cost of avoiding and/or mitigating adverse impacts on environmental resources.
Construction Cost	Sum of the feature field costs plus non-contract costs.
Interest During Construction	The compound interest calculated by spreading construction cost over the construction period and using the federal discount rate.
Capital Cost	Sum of the construction costs and interest during construction.
Annual Cost	Sum of interest and amortization of the capital cost, and other annual costs, such as operations, maintenance, and replacement costs.

There are no construction costs associated with the Non-Structural Alternative. Table 5-13 and Table 5-14 summarize total construction cost and annual construction interest during construction, replacement, and O&M cost estimates for the Dam Raise and SR 152 Modification components together. The total cost was amortized over the alternatives' assumed 100-year project life at the 2020 federal discount rate of 2.75 percent. The Dam Raise construction schedule would initiate during construction of the embankment raise phase of the B.F. Sisk Dam SOD Modification Project, currently scheduled to start in 2025 and assumes an 8-year construction schedule. The SR 152 modification construction would start in 2027 and assumes a 2-year construction schedule. Preconstruction and design of the project would begin in 2022.

Annual O&M costs would begin after construction is complete. Total costs also include interest during construction, which is the compound interest calculated by spreading construction costs over the construction period and using the federal discount rate. Total interest during construction was calculated by dividing the total construction cost by 8 years to identify the anticipated annual expenditure. That estimated annual expenditure was then divided by 2 to calculate the half annual expenditure. For each year, the half annual expenditure was added with the previous year's expenditure and interest and multiplied by the 2020 federal discount rate of 2.75. Each year's interest during construction was summed to find the total interest during construction.

5.1.1.9 NED Results

Table 5-15 and Table 5-16 summarize the annual economic benefits and costs of the alternatives and presents net annual benefits or costs and a benefit-cost ratio for each alternative. Based on this economic evaluation, the Investor-Directed Storage Subalternative D would have the highest benefit-cost ratio range of 1.2 to 1.9, based on the most probable and probable low feasibility level cost estimates and benefits evaluation. The Investor-Directed Storage Subalternative D maximizes the net economic benefits and is the NED Plan, as described further in Chapter 6.

Table 5-13. Most Probable Cost Estimates for the Alternatives (million $)

	CVP-Only	CVP/SWP Split	Investor-Directed Storage Subalternative A	Investor-Directed Storage Subalternative B	Investor-Directed Storage Subalternative C	Investor-Directed Storage Subalternative D
Total Construction Cost	$922.1	$922.1	$922.1	$922.1	$922.1	$922.1
Interest and Amortization for Construction Costs, 2.75%, 100 yr	$27.2	$27.2	$27.2	$27.2	$27.2	$27.2
Interest and Amortization for Replacement Costs, 2.75%, 100 yr	$0	$0	$0	$0	$0	$0
Interest and Amortization for IDC, 2.75%, 100 yr	$2.8	$2.8	$2.8	$2.8	$2.8	$2.8
Average Annual O&M Cost	$1.7	$1.9	$2.5	$2	$0.7	$0.7
Total Annual Cost	$31.7	$31.9	$32.5	$32.0	$30.7	$30.7

Key: yr = year; IDC = Interest During Construction; O&M = operations and maintenance
Based on January 2020 price levels.

Table 5-14. Probable Low Cost Estimates for the Alternatives (million $)

	CVP-Only	CVP/SWP Split	Investor-Directed Storage Subalternative A	Investor-Directed Storage Subalternative B	Investor-Directed Storage Subalternative C	Investor-Directed Storage Subalternative D
Total Construction Cost	$720.5	$720.5	$720.5	$720.5	$720.5	$720.5
Interest and Amortization for Construction Costs, 2.75%, 100 yr	$21.2	$21.2	$21.2	$21.2	$21.2	$21.2
Interest and Amortization for Replacement Costs, 2.75%, 100 yr	N/A	N/A	N/A	N/A	N/A	N/A
Interest and Amortization for IDC, 2.75%, 100 yr	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2
Average Annual O&M Cost	$1.7	$1.9	$2.5	$2.0	$0.7	$0.7
Total Annual Cost	$25.1	$25.3	$26.0	$25.5	$24.1	$24.1

Key: yr = year; IDC = Interest During Construction; O&M = operations and maintenance
Based on January 2020 price levels.

Table 5-15. NED Benefit-Cost Summary for Most Probable Construction Cost, Annual Values, 2020 Dollars

		Dam Raise Alternative					
	Non-Structural Alternative	CVP-Only	CVP/SWP Split	Investor-Directed Storage Subalternative A	Investor-Directed Storage Subalternative B	Investor-Directed Storage Subalternative C	Investor-Directed Storage Subalternative D
Annual M&I Water Supply Reliability Benefits (million $)[1,2]	$0.7	$1.5	-$1.8	$1.6	$16.0	$1.1	$9.4
Annual Agriculture Water Supply Reliability Benefits (million $)[1,2]	–$5.7	$7.4	$4.4	$5.8	$0.9	$3.0	$0.5
Annual Refuge Water Supply Reliability Benefits (million $)[1,2]	–	$0.0	$0.0	$1.8	$0.0	$1.1	$0.0
Transportation Benefit – Approach 1[1,3]	–	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
Transportation Benefit – Approach 2[1,3]		$7.6	$7.6	$7.6	$7.6	$7.6	$7.6
Emergency Water Supply Benefit[1,2]	–	$12.5	$4.4	$14.7	$14.7	$27.8	$27.8
Total Annual Benefits (million $)[1,2,3]	**–$5.0**	**$21.7/$29.0**	**$7.3/$14.6**	**$24.3/$31.6**	**$31.9/$39.2**	**$33.3/$40.6**	**$38.0/$45.3**
Total Construction Cost (million $)	–	$27.2	$27.2	$27.2	$27.2	$27.2	$27.2
Total Interest During Construction (million $)	–	$2.8	$2.8	$2.8	$2.8	$2.8	$2.8
Annual O&M Costs (million $)[4]	–	$1.7	$1.9	$2.5	$2	$0.7	$0.7
Total Annual Costs (million $)[5]	–	**$31.7**	**$31.9**	**$32.5**	**$32.0**	**$30.7**	**$30.7**
Net Annual Benefits or Costs (million $)[4]	**N/A**	**-$10.0/-$2.7**	**-$24.6/-$17.3**	**-$8.2/-$0.9**	**-$0.1/$7.2**	**$2.6/$9.9**	**$7.3/$14.6**
Benefit-Cost Ratio[4]	**N/A**	**0.7/0.9**	**0.2/0.5**	**0.7/1.0**	**1.0/1.2**	**1.1/1.3**	**1.2/1.5**

Key: N/A = Not applicable; NED = National Economic Development; O&M = operations and maintenance;

Notes: Based on January 2020 price levels.

[1] Benefits represent annual benefits estimated in the year 2030.

[2] Non-emergency water supply benefits have been adjusted for the structural alternatives as detailed in Appendix C to account for a water supply emergency's limits on the availability of this supply.

[3] Transportation Benefit – Approach 1 presents estimated benefits generated by avoidance of transportation delays, Transportation Benefit – Approach 2 presents economic benefits estimated using the "least cost" most likely alternative approach.

[4] Annual costs include construction cost amortized over 100 years at 2.75% discount rate, interest during construction annualized over 100 years at 2.75% discount rate, annual operations and maintenance costs.

[5] Total annual costs include construction costs and interest during construction, as is noted in Appendix D costs for long-term O&M are allocated 100% to the non-federal sponsor for all benefits except for the Refuge Water Supply Benefit under Investor Directed Subalternative C that allocates costs assigned to that benefit allocated 75% federal and 25% to the non-federal sponsor.

Table 5-16. NED Benefit-Cost Summary for Probable Low Cost Construction Cost, Annual Values, 2020 Dollars

		Dam Raise Alternative					
	Non-Structural Alternative	CVP-Only	CVP/SWP Split	Investor-Directed Storage Subalternative A	Investor-Directed Storage Subalternative B	Investor-Directed Storage Subalternative C	Investor-Directed Storage Subalternative D
Annual M&I Water Supply Reliability Benefits (million $)[1,2]	$0.7	$1.5	-$1.8	$1.6	$16.0	$1.1	$9.4
Annual Agriculture Water Supply Reliability Benefits (million $)[1,2]	–$5.7	$7.4	$4.4	$5.8	$0.9	$3.0	$0.5
Annual Refuge Water Supply Reliability Benefits (million $)[1,2]	–	$0.0	$0.0	$1.8	$0.0	$1.1	$0.0
Transportation Benefit – Approach 1[1,3]	–	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
Transportation Benefit – Approach 2[1,3]		$7.6	$7.6	$7.6	$7.6	$7.6	$7.6
Emergency Water Supply Benefit[1,2]	–	$12.5	$4.4	$14.7	$14.7	$27.8	$27.8
Total Annual Benefits (million $)[1,2,3]	**–$5.0**	**$21.7/$29.0**	**$7.3/$14.6**	**$24.3/$31.6**	**$31.9/$39.2**	**$33.3/$40.6**	**$38.0/$45.3**
Total Construction Cost (million $)	–	$21.2	$21.2	$21.2	$21.2	$21.2	$21.2
Total Interest During Construction (million $)	–	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2
Annual O&M Costs (million $)[4]	–	$1.7	$1.9	$2.5	$2.0	$0.7	$0.7
Total Annual Costs (million $)[5]	–	**$25.1**	**$25.3**	**$25.9**	**$25.4**	**$24.1**	**$24.1**
Net Annual Benefits or Costs (million $)[4]	**N/A**	**-$3.4/$3.9**	**-$18.0/-$10.7**	**-$1.6/$5.7**	**$6.5/$13.8**	**$9.2/$16.5**	**$13.9/$21.2**
Benefit-Cost Ratio[4]	**N/A**	**0.9/1.2**	**0.3/0.6**	**0.9/1.2**	**1.3/1.5**	**1.4/1.7**	**1.6/1.9**

Key: N/A = Not applicable; NED = National Economic Development; O&M = operations and maintenance

Notes: Based on January 2020 price levels.

[1] Benefits represent annual benefits estimated in the year 2030.

[2] Non-emergency water supply benefits have been adjusted for the structural alternatives as detailed in Appendix C to account for a water supply emergency's limits on the availability of this supply.

[3] Transportation Benefit – Approach 1 presents estimated benefits generated by avoidance of transportation delays, Transportation Benefit – Approach 2 presents economic benefits estimated using the "least cost" most likely alternative approach.

[4] Annual costs include construction cost amortized over 100 years at 2.75% discount rate, interest during construction annualized over 100 years at 2.75% discount rate, annual operations and maintenance costs.

[5] Total annual costs include construction costs and interest during construction, as is noted in Appendix D costs for long-term O&M are allocated 100% to the non-federal sponsor for all benefits except for the Refuge Water Supply Benefit under Investor Directed Subalternative C that allocates costs assigned to that benefit allocated 75% federal and 25% to the non-federal sponsor.

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5.1.2 Regional Economic Development Account

Regional economic effects would occur as a result of construction, O&M, and repair and replacement expenditures associated with the Dam Raise Alternative. As noted previously, construction costs would remain unchanged between the subalternatives. The Non-Structural Alternative is not included in this analysis because there are no construction-related expenditures associated with the alternative. The IMPLAN (IMpact analysis for PLANning) modeling package was used to assess the regional economic impacts from the construction expenditures. Appendix C – Economic Benefits Evaluation presents the RED account evaluation.

Construction expenditures would temporarily increase employment, output, and labor income in the economic region during the construction period. Table 5-17 and Table 5-18 summarize direct, indirect, induced, and total employment and output effects of construction expenditures for the alternatives.

Table 5-17. Direct, Indirect, Induced Employment and Output Effects of Construction Expenditures Under the Dam Raise Alternative – Most Probable Construction Cost

	Dam Raise Alternative	SR 152 Modification Action	Total
Construction Duration	**8 years**	**2 years**	**--**
Employment Direct Effect (# jobs)	3,451	1,116	4,567
Indirect Effect (# jobs)	719	555	1,274
Induced Effect (# jobs)	558	242	800
Total Employment Effect (# jobs)	**4,729**	**1,1912**	**6,641**
Output Direct Effect (million $)	$506.0	$362.3	$868.3
Output Indirect Effect (million $)	$92.6	$74.5	$167.1
Output Induced Effect (million $)	$79.7	$34.5	$114.2
Total Output Effect (million $)	**$678.3**	**$471.3**	**$1,149.6**

Key:
Direct effects – changes in final demand
Indirect effects – changes in expenditures within the region in industries supplying goods and services
Induced effects – changes in expenditures of household income
Based on January 2020 price levels.

Table 5-18. Direct, Indirect, Induced Employment and Output Effects of Construction Expenditures Under the Dam Raise Alternative – Probable Low Cost Construction Cost

	Dam Raise Alternative	SR 152 Modification Action	Total
Construction Duration	**8 years**	**2 years**	--
Employment Direct Effect (# jobs)	3,079	843	3,922
Indirect Effect (# jobs)	557	387	944
Induced Effect (# jobs)	479	176	655
Total Employment Effect (# jobs)	4,115	1,405	5,520
Output Direct Effect (million $)	**$427.5**	**$253.8**	**$681.30**
Output Indirect Effect (million $)	$71.0	$51.9	$122.90
Output Induced Effect (million $)	$68.3	$25.1	$93.40
Total Output Effect (million $)	**$566.9**	**$330.7**	**$897.60**

Key:
Direct effects – changes in final demand
Indirect effects – changes in expenditures within the region in industries supplying goods and services
Induced effects – changes in expenditures of household income
Based on January 2020 price levels.

Annual O&M of the alternatives would have minor regional economic benefits and are not quantified. O&M cost is mostly attributed to pumping costs and would not generate RED effect. The RED effects of O&M would be long term and occur each year during project operation. Direct effects would occur in the water, sewage, and other treatment and delivery systems sector. There would be minor increases in employment due to O&M; in some instances, existing staff could be able to provide services and new employment would not be generated.

Both the Dam Raise and the Non-Structural Alternatives would provide water supplies to agricultural users in the CVP service area in the San Joaquin Valley. The increased surface water supply would likely substitute groundwater pumping. This would increase farm revenues by decreasing input costs but would not increase the amount of land in production. There would be minor regional economic impacts related to increased water supplies.

5.1.3 Environmental Quality Account

The EQ account is a means of integrating information about the EQ resources and NEPA human environment effects (as defined in 40 Code of Federal Regulations 1507.14) of the Dam Raise Alternative into water resources planning. These include ecological, cultural, and aesthetic properties of natural and cultural resources that sustain and enrich human life. The EQ account includes nonmonetized positive and negative benefits, while the NED account includes monetized positive and negative benefits.

An evaluation of the ecological, cultural, and aesthetic properties of EQ resources was performed as part of the NEPA environmental review and documentation process. A detailed discussion of possible effects of the alternatives and proposed mitigation measures is included in the EIR/Supplemental EIS. These documents provide details on methods, process, procedures, and assumptions used in evaluating environmental effects associated with the projects with each project alternative. All of the phases of the proposed project, including construction and operation, were evaluated in the analysis. The impacts were organized by environmental resource or issue area. Significance criteria were used to define the level at which an impact would be considered significant, in accordance with NEPA and CEQA.

Table 5-19 summarizes key effects that were categorized as either beneficial, less than significant with mitigation, or significant and unavoidable for all resource categories for the EQ account. Appendix C – Economic Benefits Evaluation presents a detailed evaluation of alternative plans relative to environmental quality.

Table 5-19. Summary of EQ Effects

Impact	Alternative Plan	Significance Determination (W/O Mitigation, W Mitigation)	Mitigation
Surface Water Supply			
Operational impacts on water supply would be considered significant if the alternative would substantially reduce the annual supply of water available to CVP, SWP, refuges, or other water users during the long-term operation of the alternative.	2	S	None
Air Quality			
Conflict with or obstruct implementation of the applicable air quality plan.	1	S, LTS	AQ-1, AQ-2, AQ-3
	3	S	AQ-1, AQ-2, AQ-3, AQ-4
Greenhouse Gases			
Generate greenhouse gas emissions, either directly or indirectly, that could have a significant impact on the environment.	1	S, LTS	GHG-1
	3	S, LTS	AQ-1, AQ-2, GHG-1, GHG-2
Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases.	1	S	–
	3	S, LTS	AQ-1, AQ-2, GHG-1, GHG-2
Visual Resources			
Have a substantial adverse effect on a scenic vista.	1	S, LTS	VIS-1
Substantially damage scenic resources within a state scenic highway corridor.	1	S, LTS	VIS-1
	3	S, LTS	VIS-2
Substantially degrade the existing visual character or quality of public views of the site and its surroundings or conflict with applicable regulations governing scenic quality.	1	S, LTS	VIS-1

Impact	Alternative Plan	Significance Determination (W/O Mitigation, W Mitigation)	Mitigation
Create a new source of substantial light or glare, which would adversely affect day or nighttime views in the area.	1	S, LTS	VIS-1
	3	S, LTS	VIS-1
Noise and Vibration			
Expose sensitive receptors to noise levels in excess of standards established in the local general plan or noise ordinance.	1	S	NOI-1, NOI-2, NOI-3
	3- Dam Raise	S	None
Cause a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.	1	S	NOI-1, NOI-2, NOI-3
	3- Dam Raise	S	None
Traffic and Transportation			
Cause a substantial increase in traffic in relation to the existing traffic load and capacity of the street system.	3	S	None
Substantially increase traffic hazards caused by a geometric design feature or incompatible uses.	1	LTS	TR-1
	3	S, LTS	TR-1
Result in inadequate emergency access.	1	LTS	TR-1
	3	S, LTS	TR-1
Hazards and Hazardous Materials			
During construction activities, there is potential to encounter contaminated soil and/or groundwater, which could result in an accidental release of hazardous materials and pose a threat to the public and the environment.	1	S, LTS	HAZ-1
Construction activities at San Luis Reservoir could conflict with seaplane maneuvers on San Luis Reservoir and operations at the San Luis Reservoir Seaplane Base, resulting in safety hazards for pilots and people working and residing in the area.	1	S, LTS	HAZ-2, HAZ-3
During construction activities use of Basalt Road and SR 152 for site access could temporarily interfere with an emergency response plan or emergency evacuation plan for the State Responsibility Area.	1	LTS	TR-1
	3	S, LTS	TR-1
The use of mechanical equipment during construction could increase the risk of wildfire within the vicinity of the study area.	1	LTS	HAZ-4
	3	S, LTS	HAZ-1

Impact	Alternative Plan	Significance Determination (W/O Mitigation, W Mitigation)	Mitigation
Terrestrial Resources			
Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as an endangered, threatened, candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW, NMFS, or USFWS.	1	S, LTS	TERR-1 through TERR-16
	3	S, Construction - LTS	TERR-1,2,3,8,10,11,12,14; TERR-15: Species-specific mitigation measures; TERR-4,5,6,7,9 and 13
Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the CDFW, NMFS, or USFWS.	1	S, LTS	TERR-16
	3	S, Construction - LTS	TERR-16: Jurisdictional wetlands or waters, and streambeds and streambank mitigation
Have a substantial adverse effect on federal- or state-protected wetlands (including, but not limited to, marsh, vernal pool, coast, etc.) through direct removal, filling, hydrological interruption, or other means.	1	S, LTS	TERR-16
	3	S, Construction - LTS	TERR-16: Jurisdictional wetlands or waters, and streambeds and streambank mitigation
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.	3	S	None
Conflict with any local policies or ordinances protecting biological resources, or adopted Habitat Conservation Plan (HCP), Natural Community Conservation Plan (NCCP), or other approved local, regional, or State conservation plan.	3	S, LTS	TERR-1,2,3,8,10,11,12,14; TERR-15: Species-specific mitigation measures; TERR-16: Jurisdictional wetlands or waters, and streambeds and streambank mitigation TERR-4,5,6,7,9 and 13
Recreation			
Project construction could result in temporary closure to recreation facilities, resulting in a substantial loss of recreation opportunities.	1	S, LTS	REC-1
	3	S, LTS	REC-1
Operational changes to water levels in recreational water bodies could affect recreational uses.	3	S, LTS	REC-1, REC-2
Cultural Resources			
Project construction and operation could result in adverse effects to historic properties and/or substantial adverse changes to historical resources, unique archaeological resources, or tribal cultural resources or result in the disturbance of human remains.	1	S, LTS	CR-1
	3	S	CR-1, CR-2, CR-3

Impact	Alternative Plan	Significance Determination (W/O Mitigation, W Mitigation)	Mitigation
Geology, Seismicity, and Soils			
Construction activities could directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.	3	S, LTS	GEO-1
Maintenance activities during operations could expose people or structures to adverse effects related to the rupture of a known earthquake fault.	1	B	--
	3	B	--

Key: Alt = alternative, B= beneficial, CDFW = California Department of Fish and Wildlife, HCP = Habitat Conservation Plan, LTS = less than significant, NCCP = Natural Communities Conservation Plan, NI = no impact, NMFS = National Marine Fisheries Service, S = Significant, USFWS = U.S. Fish and Wildlife Service, W = with, WO = without

5.1.4 Other Social Effects Account

The OSE account measures effects to the social well-being of a community from implementing an alternative. This OSE analysis uses a series of criteria to assist in identifying relevant social effects. These criteria take into account social well-being factors, including health and safety, economic vitality, social connectedness and identity, social vulnerability, public participation, and leisure and recreation. The OSE evaluation is qualitative and describes potential social effects related to increased water supplies under the alternatives relative to the No Action Alternative. Table 5-20 summarizes OSE account evaluation for the alternatives.

Appendix C – Economic Benefits Evaluation presents a detailed evaluation of alternative plans relative to social criteria.

Table 5-20. OSE Account Evaluation

OSE Account Criteria	Alternative Evaluation
Health and Safety	Non-Structural Alternative Plan would reduce water supply deliveries and would not provide any improvement to health and safety. The Dam Raise Alternative Plan would increase water supply reliability for South-of-Delta contractors and reduce potential water shortages, which would improve long-term health and safety. The Dam Raise Alternative Plan would also provide social health and safety benefits relative to the No Action Alternative, including emergency response to natural hazards.
Economic Vitality	Economic vitality relates to employment opportunities, business development, and population growth. The Non-Structural Alternative Plan would reduce water supply deliveries and would not provide any improvement to economic vitality. The Dam Raise Alternative Plan would provide a local, more reliable water supply for businesses, which would support employment and economic activity. A reliable municipal and industrial water supply would support projected increase in population and long-term economic vitality. Water provided for agricultural uses under the Dam Raise Alternative Plan would support the agricultural economy in the Central Valley, including jobs.

OSE Account Criteria	Alternative Evaluation
Social Connectedness and Identity	Social connectedness and identity consider how residents connect to and view their community. The change in San Luis Reservoir operations under the Non-Structural Alternative Plan would not affect residents' view of their community. In Merced County, San Luis Reservoir is one of the top three community assets (Merced County 2007). In comparison to the No Action Alternative, the Dam Raise Alternative Plan would affect recreation at San Luis Reservoir at the Dinosaur Point and Goosehead Point Boat launches for approximately 1 year during construction. Merced County residents' social connectedness with the reservoir could be affected.
Social Vulnerability	Social vulnerability refers to the capacity for being adversely affected by hazards or other impacts and disproportionate effects to vulnerable populations in the ability to prepare for and respond to impacts. The alternatives would rely on imported CVP supplies from San Luis Reservoir, which could have reliability issues in case of a natural disaster if infrastructure or conveyance is damaged. Additional water supply under the Dam Raise Alternative Plan could help alleviate effects of climate change, such as extreme heat or increased wildfires. Water supplies would be delivered within all areas and to all customers within a contractor service area; hence, there would be no disproportionate effects on vulnerable populations.
Leisure and Recreation	Dam Raise Alternative Plan could adversely affect recreation opportunities at San Luis Reservoir in Merced County during the construction period. Two main use areas, Basalt and Dinosaur Point, would be closed to the public because of construction activities.
Participation	Participation means being able to interact with others to influence social outcomes. Reclamation and SLDMWA are pursuing this project in an open and transparent process allowing participation by all stakeholder groups. Reclamation and SLDMWA have and will provide opportunities for public participation throughout the planning process. All affected stakeholder groups would have the same opportunities to participate in this process. All alternatives would have the same opportunities for participation.

Key:
OSE = Other Social Effects
SLDMWA = San Luis & Delta-Mendota Water Authority
CVP = Central Valley Project

5.2 Comparison of Final Alternatives

Consistent with the standards for formulating and evaluating alternatives for planning and water resource-related projects outlined in the P&Gs, the evaluation and comparison of alternatives in this Feasibility Report 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. This section further describes the federal criteria and their application in the evaluation and comparison process, and the preliminary results of this comparison.

5.2.1 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. Two performance measures (Full Spectrum of Objectives, and Operational Implementability) 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.

5.2.1.1 Full Spectrum of 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:

- Allow contractors to efficiently manage water supplies by increasing supply and storage management options
- Allow contractors to carry over unused water supply with reduced likelihood of spill

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. Under the Non-Structural Alternative, average annual South-of-Delta M&I deliveries are expected to decrease under certain year types. The Investor-Directed Storage subalternatives under the Dam Raise Alternative would increase SLDMWA's water supplies and also give contractors more control over the additional storage, allowing them to carry over water and reduce spill. The CVP-Only subalternative would increase SLDMWA's water supplies. However, operations of the additional storage would be controlled by Reclamation. The additional storage would reduce some spill of carryover storage, but not to the extent under the Investor-Directed Storage subalternatives. The CVP/SWP Split subalternative would also increase SLDMWA's water supplies, but to a lower extent than the Investor-Directed Storage and CVP-Only subalternatives.

5.2.1.2 Operational Implementability

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. The Non-Structural Alternative and Investor-Directed subalternatives would rely on changes to operational measures from the current approach for annual CVP water supply allocations and ranked low. The CVP/SWP Split subalternatives would follow current San Luis Reservoir operations and it was ranked high. The CVP-Only subalternatives would change current operations under the control of Reclamation and is therefore ranked as medium.

5.2.1.3 Overall Completeness Ranking

Table 5-21 summarizes how each of the alternatives was ranked for overall completeness. Investor-Directed Storage Subalternatives A, B, C, and D were ranked medium, given their increases in water supply balanced against operational implementability concerns. The CVP-Only and CVP/SWP Split subalternative were ranked low-medium in effectiveness because of their limited ability to increase M&I water supply to South-of-Delta CVP contractors and refuge water supply to South-of-Delta CVP refuges.

Table 5-21. Overall Completeness Ranking for Final Alternatives

Completeness Criteria	Non-Structural Alternative	Dam Raise Alternative					
		CVP-Only	CVP/SWP Split	Investor-Directed Storage Subalternative A	Investor-Directed Storage Subalternative B	Investor-Directed Storage Subalternative C	Investor-Directed Storage Subalternative D
Full Spectrum of Objectives	Low	Medium	Low	High	High	High	High
Operational Implementability	Low	Medium	High	Low	Low	Low	Low
Overall Ranking	Low	Medium	Medium	Medium	Medium	Medium	Medium

5.2.2 Effectiveness

The effectiveness criterion addresses how well an alternative would alleviate problems and achieve opportunities. Four performance measures were developed for this criterion to compare the extent to which each alternative satisfies this criterion.

5.2.2.1 Increase M&I Water Supply

This performance measure indicates each alternative's capacity to increase M&I water supply to South-of-Delta CVP contractors. The performance measure is ranked based on the average annual supply increase.

The Non-Structural Alternative has an average annual increase of 0.16 TAF. The CVP-Only subalternative has an average annual increase of 2.8 TAF, while the CVP/SWP split subalternative has an average annual decrease of 2.2 TAF. Investor-Directed Storage Subalternatives A and C have an average annual increase of 3.4 TAF and 1.8 TAF, respectively. Therefore, the Non-Structural Alternative, CVP-Only, CVP/SWP Split, and Investor-Directed Storage Subalternatives A and C were ranked as low. Investor-Directed Storage Subalternative B has an average annual increase of 35.7 TAF; as such, it was ranked as high. Investor-Directed Storage Subalternative D has an average annual increase of 18 TAF; therefore, it was ranked as medium.

5.2.2.2 Increase Agricultural Water Supply

This performance measure indicates each alternative's capacity to increase agricultural water supply to South-of-Delta agricultural contractors. The performance measure is ranked based on the average annual supply increase.

The Non-Structural Alternative has an average annual decrease of 39 TAF and is therefore ranked as low. The CVP-Only subalternative provides an average annual increase of 35 TAF. Investor-Directed Storage Subalternative A provides an average annual increase of 28 TAF. Therefore, the CVP-Only subalternative and the Investor-Directed Storage Subalternative A are ranked as high. The CVP/SWP Split subalternative provides an annual average supply increase of 16 TAF. Investor-Directed Storage Subalternative C provides an average annual supply increase of 14 TAF. Therefore, the CVP/SWP Split subalternative and Investor-Directed Storage Subalternative C are ranked as medium. Investor-Directed Subalternatives B and D have an average annual increase of 5 TAF and 3 TAF, respectively, and are ranked as low.

5.2.2.3 Increase Refuge Supply

This performance measure indicates each alternative's capacity to increase refuge water supply to South-of-Delta CVP refuges. The performance measure is ranked based on the average annual supply increase.

Investor-Directed Storage Subalternative A provides an average annual increase of 6 TAF. Investor-Directed Storage Subalternative C provides an average annual increase of 3 TAF. Therefore, Investor-Directed Storage Subalternatives A and C were ranked as medium. The Non-Structural Alternative is expected to have no changes to refuge supply and is ranked as low. Under operation of CVP-Only subalternative and CVP/SWP Split subalternative, changes to South-of-Delta CVP refuge deliveries are expected to be minimal. As such, the CVP-Only and CVP/SWP Split subalternatives are ranked as low.

5.2.2.4 Overall Effectiveness Ranking

Table 5-22 summarizes how each alternative was ranked for relative effectiveness. Investor-Directed Storage Subalternatives A, B, C, and D were ranked as having medium effectiveness. The CVP-Only and CVP/SWP Split subalternative were ranked low-medium in effectiveness because of their limited ability to increase M&I water supply to South-of-Delta CVP contractors and refuge water supply to South-of-Delta CVP refuges. The Non-Structural Alternative was ranked low, given its limited increases in M&I, agricultural, and refuge water supplies.

Table 5-22. Overall Effectiveness Ranking for Final Alternatives

Effectiveness Criteria	Non-Structural Alternative	CVP-Only	CVP/SWP Split	Investor-Directed Storage Subalternative A	Investor-Directed Storage Subalternative B	Investor-Directed Storage Subalternative C	Investor-Directed Storage Subalternative D
Increase M&I Water Supply	Low	Low	Low	Low	High	Low	High
Increase Agricultural Water Supply	Low	High	Medium	High	Low	High	Low
Increase Refuge Supply	Low	Low	Low	Medium	N/A	Medium	N/A
Overall Ranking	Low	Low-Medium	Low-Medium	Medium	Medium	Medium	Medium

5.2.3 Acceptability

The 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 the acceptability criterion focus on potential environmental effects, which are further described in the accompanying EIR/SEIS that satisfies CEQA and NEPA. The performance measures for this

criterion consider the alternatives' potential environmental impacts to biological, physical, and social resources[11] in the study area.

5.2.3.1 Biological, Physical and Social Resource Effects

Biological, physical, and social resource effects for all of the Dam Raise subalternatives will be very similar, as their impacts are highly correlated with construction of the dam.

Biological Effects: Construction of the Dam Raise subalternatives would affect sensitive terrestrial habitats including wetland and riparian vegetation communities, disturb terrestrial wildlife, nesting birds, adversely impact special status plant species, and conflict with local policies or ordinances protecting biological resources. Mitigation measures including preconstruction surveys, establishment of buffers, construction monitoring, and compensatory mitigation where impacts could not be avoided would reduce all of these potential impacts to a less than significant level.

Physical Effects: Construction of the Dam Raise subalternatives could impact physical effects such as air quality, geology and soils, groundwater, noise, climate change, and visual resources. Mitigation measures where impacts could not be avoided would reduce all of these potential impacts to a less than significant level. Some impacts related to air quality and noise would be significant yet unavoidable but are considered short-term impacts during construction activities. Impacts to water quality are expected to be less than significant for the Non-Structural and Dam Raise Alternatives. Impacts to water supply are expected to be significant and unavoidable under the Non-Structural Alternative.

Social Effects: Under the Dam Raise subalternatives, there could be significant but unavoidable impacts to recreation in the form of temporary closures to recreation facilities. These would be short-term impacts likely to take place only during construction. Additionally, project construction could result in adverse effects to historic properties or cultural resources. Mitigation measures would be used to minimize potential impacts.

5.2.3.2 Overall Acceptability Ranking

Table 5-23 summarizes how each of the Final Alternatives was ranked for relative acceptability.

Table 5-23. Overall Acceptability Ranking for Final Alternatives

Acceptability Criteria	Non-Structural Alternative	CVP-Only	CVP/SWP Split	Investor-Directed Storage Subalternative A	Investor-Directed Storage Subalternative B	Investor-Directed Storage Subalternative C	Investor-Directed Storage Subalternative D
Biological Resources	High	Medium	Medium	Medium	Medium	Medium	Medium
Physical Resources	Low	Medium	Medium	Medium	Medium	Medium	Medium
Social Resources	High	Medium	Medium	Medium	Medium	Medium	Medium

[11] Biological Resources include aquatic and terrestrial resources. Physical Resources include geology and soils, water quality, groundwater, air quality, noise, climate change, and visual resources. Social Resources include cultural resources, socioeconomics, hazardous materials, traffic, and recreation.

Acceptability Criteria	Non-Structural Alternative	CVP-Only	CVP/SWP Split	Investor-Directed Storage Subalternative A	Investor-Directed Storage Subalternative B	Investor-Directed Storage Subalternative C	Investor-Directed Storage Subalternative D
Overall Ranking	Medium-High	Medium	Medium	Medium	Medium	Medium	Medium

5.2.4 Efficiency

This evaluation criteria 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 each Final Alternative was evaluated using its estimated net economic benefit and benefit-cost ratio, which are presented in Table 5-15 and Table 5-16.

5.3 Summary of Comparisons

As summarized in Table 5-24, the alternatives were compared based on the planning objectives and the four P&G criteria.

Table 5-24. Summary Comparison of Final Alternatives

Alternative	Completeness	Effectiveness	Acceptability	Efficiency	Overall Relative Ranking
No Action Alternative	Would include none of the elements required to achieve benefits.	Would include none of the elements required to achieve benefits.	Would include none of the elements required to achieve benefits.	No cost would be accrued by the No Action Alternative; there would be no economic benefits.	N/A
Non-Structural Alternative	Would decrease South-of-Delta M&I deliveries under certain year types and would rely on changes to operational measures from the current approach for annual CVP water supply allocations. Low	Would minimally increase or decrease M&I, agriculture, and refuge supply under average annual conditions. Low	Would cause minimal to no biological and physical effects owing to lack of construction activities. Would generate significant and unavoidable social resource effects on water supply given limits on reservoir fill. Medium-High	No cost would be accrued by the Non-Structural Alternative; there would be no economic benefits.	Low-Medium

Alternative	Completeness	Effectiveness	Acceptability	Efficiency	Overall Relative Ranking
CVP-Only	Would increase SLDMWA's water supplies with operations controlled by Reclamation. Medium	Would minimally increase M&I water supply and substantially increase agricultural water supply. Would not change refuge supply. Low-Medium	Would affect sensitive terrestrial habitats, air quality, noise, recreation, and cultural resources. These impacts are expected to generally be short-term during construction and would include mitigation measures to reduce potential impacts. Medium	Would result in a benefit-cost ratio range of 0.7 to 1.2. Low	Low-Medium
CVP/SWP Split	Would increase SLDMWA's water supplies but to a lower extent than the Investor-Directed Storage and CVP-Only subalternatives. The alternative would follow current San Luis Reservoir operations. Medium	Would minimally increase M&I water supply and moderately increase agricultural water supply. Would not change refuge supply. Low-Medium	Would affect sensitive terrestrial habitats, air quality, noise, recreation, and cultural resources. These impacts are expected to generally be short-term during construction and would include mitigation measures to reduce potential impacts. Medium	Would result in a benefit-cost ratio range of 0.2 to 0.6. Low	Low

Alternative	Completeness	Effectiveness	Acceptability	Efficiency	Overall Relative Ranking
Investor-Directed Storage Subalternative A	Would increase SLDMWA's water supplies and give contractors more control over additional storage, allowing them to carry over water and reduce spill. This would rely on changes to operational measures from the current approach. Medium	Would slightly increase M&I water supply and substantially increase agricultural water supply. Would also provide moderate increases in refuge supply. Medium	Would affect sensitive terrestrial habitats, air quality, noise, recreation, and cultural resources. These impacts are expected to generally be short-term during construction and would include mitigation measures to reduce potential impacts. Medium	Would result in a benefit-cost ratio range of 0.7 to 1.2. Low	Medium
Investor-Directed Storage Subalternative B	Would increase SLDMWA's water supplies and give contractors more control over additional storage, allowing them to carry over water and reduce spill. This would rely on changes to operational measures from the current approach. Medium	Would substantially increase M&I water supply and slightly increase agricultural water supply. Would not provide changes in refuge supply. Medium	Would affect sensitive terrestrial habitats, air quality, noise, recreation, and cultural resources. These impacts are expected to generally be short-term during construction and would include mitigation measures to reduce potential impacts. Medium	Would result in a benefit-cost ratio range of 1.0 to 1.5. Medium	Medium

Alternative	Completeness	Effectiveness	Acceptability	Efficiency	Overall Relative Ranking
Investor-Directed Storage Subalternative C	Would increase SLDMWA's water supplies and give contractors more control over additional storage, allowing them to carry over water and reduce spill. This would rely on changes to operational measures from the current approach. Medium	Would slightly increase M&I water supply and substantially increase agricultural water supply. Would also provide moderate increases in refuge supply. Medium	Would affect sensitive terrestrial habitats, air quality, noise, recreation, and cultural resources. These impacts are expected to generally be short-term during construction and would include mitigation measures to reduce potential impacts. Medium	Would result in a benefit-cost ratio range of 1.1 to 1.7. Medium	Medium
Investor-Directed Storage Subalternative D	Would increase SLDMWA's water supplies and give contractors more control over additional storage, allowing them to carry over water and reduce spill. This would rely on changes to operational measures from the current approach. Medium	Would substantially increase M&I water supply and slightly increase agricultural water supply. Would not provide changes in refuge supply. Medium	Would affect sensitive terrestrial habitats, air quality, noise, recreation, and cultural resources. These impacts are expected to generally be short-term during construction and would include mitigation measures to reduce potential impacts. Medium	Would result in a benefit-cost ratio range of 1.2 to 1.9. High	High

5.4 Consistency of Alternative Plans with Other Programs

Reclamation provided directives and standards on the development of additional project benefits in conjunction with a Safety of Dams (SOD) modification project. The SOD Act (43 United States Code [U.S.C.] §506 et seq.), was amended by P.L. 114-113 to include authority for Reclamation to develop additional project benefits in conjunction with a B.F. Sisk Dam SOD Modification Project. Pursuant to Section 5.B. of the SOD Act, as amended, Reclamation must determine that additional project benefits are necessary and in the interest of the United States prior to developing any additional project benefits, consistent with Reclamation law. Furthermore, it must be determined that the development of additional project benefits will not negatively impact the B.F. Sisk Dam SOD Modification Project.

The expansion of the B.F. Sisk Dam Embankment an additional 10 feet above the 12-foot dam raise analyzed and approved in connection with the B.F. Sis Dam SOD Modification Project would increase storage capacity in the reservoir and provide M&I water supply, agriculture water supply, refuge water supply, emergency M&I supply, and transportation benefits. Construction-related impacts to water quality, paleontological resources, air quality, GHG emissions, visual resources, noise, traffic conditions, hazards, terrestrial resources, and cultural resources would be similar to those identified under the B.F. Sisk Dam SOD Modification Project. Adverse impacts to public safety are not anticipated. Therefore, the Dam Raise Alternative would be considered beneficial in conjunction with the B.F. Sisk Dam SOD Modification Project.

Chapter 6 Plan Selection, Implementation, and Uncertainty

This chapter further describes the Dam Raise Alternative pursuant to Reclamation Directives and Standards (FAC 09-03). Reclamation provided feasibility-level cost estimates as a resource for use in discussions among interested parties evaluating specific alternatives. Where appropriate, Reclamation will articulate support for further action in a report containing recommendations to the Secretary of the Interior and Congress. This section also presents the determination of feasibility, risk, and uncertainty, as well as unresolved issues and special considerations.

6.1 Rationale for Plan Selection

As required by the P&G, the alternative with the greatest net NED benefits is to be identified as the NED Plan and is typically selected for recommendation to the Secretary of the Interior for consideration and approval (U.S. Water Resources Council 1983). However, the Secretary of the Interior may grant an exception based on overriding considerations and merits of another plan. If another plan is recommended instead of the NED Plan, the NED Plan is still presented as a basis of comparison to define the extent of federal financial interest in the plan recommended for implementation. A plan recommending federal action is the plan that best addresses the targeted water resources problems while still considering public benefits relative to costs.

This Final Feasibility Report is recommending that the Secretary of the Interior, acting through Reclamation, participate in funding and implementing the Dam Raise Alternative Plan as the Recommended Plan. This Final Feasibility Report is not; however, recommending which operational subalternative configuration under the Dam Raise Alternative Plan be selected for implementation. As was described in Chapter 4 the subalternatives were formulated to evaluate a potential bookended range of the potential benefits and environmental effects that could be produced by varying assumptions on its ultimate operation. Chapter 5 presents the results from those evaluations and identifies more than one subalternative that is economically feasible. Given interest amongst the member agencies of SLDMWA, the nonfederal partner, further development and refinement of the economically feasible subalternative configurations is needed prior to final selection to determine which plan best addresses the project purpose and need. This refinement is planned to continue past the development of this Feasibility report. This chapter provides a detailed description of the Dam Raise Alternative Plan as the Recommended Plan. Included within the description are references to the operational subalternative that provides the greatest net benefits and has; therefore, been identified as the NED Plan consistent with the P&G.

The Dam Raise Alternative, Investor-Directed Storage Subalternative D is the NED Plan based upon the evaluation and comparisons described in Chapter 5. This operational configuration of the Dam Raise Alternative has the highest net total NED benefit ($7.3 million to $21.2 million) among the alternatives, a benefit-cost ratio range of 1.2 to 1.9, and a ranking of high overall for completeness, effectiveness, efficiency, and acceptability. The Dam Raise Alternative, Investor

Directed Storage Subalternative D provides M&I and agricultural water user benefits, emergency water supply benefits, and transportation safety benefits.

Council on Environmental Quality Regulations require identification of the environmentally preferable alternative (or alternatives) in the ROD (40 CFR 1505.2[b]). The environmentally preferable alternative may be different from the preferred alternative and refers to the alternative that would result in the fewest adverse effects on the human environment. Reclamation must consider, but is not obligated to select, the environmentally preferable alternative in its decision on the proposal (40 CFR 1505.2[a] and 43 CFR 46.450).

The Secretary of the Interior will submit the Final Feasibility Report, the Final EIR/SEIS, and supporting information to Congress. Congress will consider the Secretary of the Interior's recommendations and use these documents, as well as any additional information Congress deems appropriate, to determine the public interest in the project and any specific project authorization language. Most activities pursued by the federal government require assessing trade-offs, and, in many cases, the final decision requires judgment regarding the appropriate extent that monetized and nonmonetized benefits and impacts are factored into the decision.

6.2 Recommended Plan

The following sections describe the major components and accomplishments of the Dam Raise Alternative Plan as the Recommended Plan. These major components and accomplishments are also attributed to the Investor-Directed Storage Subalternative D, which is the operational subalternative configuration that has been identified as the NED Plan. The national economic development benefits of the NED Plan as well as a description of the potential operations are also detailed in the following in accordance with the P&G.

6.2.1 Major Components

Major components of the Dam Raise Alternative Plan include:

- **B.F. Sisk Dam** – B.F. Sisk Dam is a zoned earthfill structure with a maximum structural height of 382 feet, a crest length of 18,600 feet, a crest width of 30 feet, and a crest elevation of 556 feet. The Dam Raise Alternative would build on the B.F. Sisk Dam SOD Modification Project, currently under final design to raise the dam 12 feet, and raise the dam crest an additional 10 feet. This additional 10 feet in embankment height would support a new water surface elevation of 554 feet and an additional 130 TAF in storage capacity. In addition to the new embankment height added by the reservoir enlargement, the existing outlet works intake towers, access bridge, and spillway intake would need to be raised by 10 feet.

- **Pacheco Pumping Plant West Dike** – The Pacheco Pumping Plant is located on the western side of San Luis Reservoir. The pumping plant is separated from San Luis Reservoir by an approximate 500-foot-wide dike east of the pumping plant. This dike would be replaced with a new dike 20 feet taller than the existing structure to protect the pumping plant from the enlarged reservoir.

- **Dinosaur Point Boat Launch** – The Dinosaur Point Boat Launch is located on the western side of San Luis Reservoir, close to the Pacheco Pumping Plant. The boat ramp and portions

of the parking lot at Dinosaur Point would be inundated with the 10-foot increase in surface elevation, thus requiring modifications to the facility to maintain launching functions during periods when the enlarged reservoir is at capacity.

- **Goosehead Point Boat Launch** – The Goosehead Point Boat Launch is located on the southern side of San Luis Reservoir, close to Basalt Hill. The boat ramp and parking lot at Goosehead Point would be inundated with the 10-foot increase in reservoir surface elevation, thus requiring modifications to the facility to maintain launching functions during periods when the enlarged reservoir is at capacity.

- **State Route 152 near the Cottonwood Bay crossing** – The SR 152 embankment between milepost MER R5.239 and MER R5.806 would be modified to allow adequate freeboard to protect against wave action. The modification will include flattening the side slopes from 2:1 to a 3:1 slope to increase seismic stability of the embankment. In addition to the embankment modification at Cottonwood Bay crossing, the embankment at milepost MER R6.295 would require the placement of downslope fill to prevent inundation of the roadway when the enlarged reservoir is filled to capacity.

6.2.2 Operations

Operation of the Recommended Plan would, as is detailed in Chapter 4, vary depending on the subalternative. This section summarizes the proposed operation of the NED Plan. Under the operation of the NED Plan, Investor-Directed Storage Subalternative D, the use of the proposed storage (expanded capacity) would be primarily investor-directed. Remaining expanded capacity not in use by the investors, at any given time, would be available to Reclamation to store CVP Project water.

Under Investor-Directed Storage Subalternative D, Investors could store allocated CVP Project water, carried-over water, and non-Project water in the expanded capacity. Investors could forego delivery of their allocated CVP Project water for use in subsequent year(s). This unused CVP Project water would be carried over to subsequent year(s) and continue to be stored in San Luis Reservoir until the investor requests delivery of the water without the risk of "spill." Carried-over water in the expanded capacity would be subject to evaporation at the same rate as CVP Project water stored in San Luis Reservoir. Investors would have first priority in storing carried-over water and non-Project water in the expanded capacity without the risk of "spill." The upper target quantity of carried-over water in San Luis Reservoir would be 310 TAF. The delivery of the carried-over water and CVP Project water was allocated proportionally among the SLDMWA investor group at 90 percent to M&I and 10 percent to agricultural water contractors.

6.2.3 Major Accomplishments

The following are the benefits of the Dam Raise Alternative Plan subalternatives:

- **M&I Water Supply –** The Dam Raise Alternative Plan would improve water supply reliability to M&I water users in the South-of-Delta CVP service area.

- **Irrigation Water Supply –** The Dam Raise Alternative Plan would provide opportunities to improve water supply to agricultural producers in the Central Valley through CVP water deliveries from San Luis Reservoir.

- **Refuge Water Supply** – Under two operational configurations of the Dam Raise Alternative Plan, the expanded reservoir would improve water supply to refuges in the South-of-Delta CVP service area.

- **M&I Emergency Water Supply –** The Dam Raise Alternative Plan would be operated to provide water supplies to M&I water users during emergencies. Such emergency circumstances could include Delta export outages, imported water conveyance outages, regional infrastructure failures, or extended drought periods when waters supplies are required to meet essential health and safety needs for drinking, hygiene, sanitation, and fire protection, or to avoid permanent land subsidence caused by groundwater depletion.

- **Transportation Safety and Reliability –** The Dam Raise Alternative Plan would improve transportation safety areas along SR 152. The modifications along State Route 152 would provide benefits to public safety by preventing inundation of the roadway when the enlarged reservoir is filled to capacity, thus reducing its current seismic risk.

6.2.4 Benefits

The following is a summary of the costs and benefits of the Dam Raise Alternative subalternatives that were projected in Chapter 5 to be economically feasible:

- **Estimated Costs –** The estimated total most probable construction cost is $922.1 million. The estimated total annual most probable cost of this plan is $30.7 million. A sensitivity evaluation of the probable low cost estimated is also presented in this feasibility report. The total probable low construction cost is $720.5 million, and the total annual probable low cost of this plan is $24.1 million.
- **Estimated Benefits** – The estimated total annual monetary benefit ranges from $33.3 million to $45.3 million.
- **Estimated Net Benefits –** The estimated annual net benefit ranges from $2.6 million to $21.2 million.

6.3 Feasibility Evaluation

The feasibility of the Dam Raise Alternative Plan can be described with four key considerations:

- **Technical Feasibility –** It is possible to design, construct, and operate the alternative using existing proven technologies and construction techniques.
- **Environmental Feasibility –** It is possible to complete environmental compliance and permitting activities.
- **Economic Feasibility –** The alternative would result in benefits that are greater than the costs.
- **Financial Feasibility –** The beneficiaries have the ability to pay for the costs of the alternative.

6.3.1 Technical Feasibility

The Dam Raise Alternative Plan is projected to be technically feasible; it is both constructible and can be operated and maintained. A Design, Cost Estimating, and Construction (DEC) Review was performed in June 2020. The DEC Review Team identified three recommendations and suggestions on the design and cost estimates to improve the clarity and reduce risk of the project. These recommendations and suggestions were incorporated in the Feasibility Design Reports and are presented in Appendix B.

6.3.2 Environmental Feasibility

The Dam Raise Alternative Plan, along with all operational subalternatives, were evaluated in the B.F. Sisk Dam Raise Project EIR/SEIS that includes detailed discussion of possible effects of the Dam Raise Alternative Plan and proposed mitigation measures. The alternative would implement a major construction action over 8 years at San Luis Reservoir, with the potential to impact the air quality, greenhouse gas emissions, visual resources, noise, recreation, traffic conditions, terrestrial resources, and cultural resources. The Dam Raise Alternative Plan would implement the mitigation actions to help reduce the severity of those impacts. However, even after the implementation of mitigation measures, some impacts would remain significant and unavoidable, including air quality, noise, traffic, recreation, and cultural resources. These significant and unavoidable impacts would be associated with the construction of the Dam Raise Alternative Plan and would have a short-term impact on the area surrounding San Luis Reservoir. The Dam Raise Alternative Plan will be considered environmentally feasible once the ROD is signed and the permits and approvals are secured for construction.

6.3.3 Economic Feasibility

As discussed in Chapter 5, there is more than one operational subalternative that is considered economically feasible NED benefits greater than NED costs and a positive benefit-cost ratio. Subalternative D, identified as the NED Plan, provides the greatest net NED benefits of the alternatives evaluated. The NED Plan is projected to be economically feasible, because the estimated annual benefits exceed the estimated most probable annual costs, resulting in a positive total net benefits range of $7.3 million to $21.2 million annually with a benefit-cost ratio range of 1.2 to 1.9. Alternate valuation methods and sensitivity analyses (presented in Appendix C – Economic Benefits Evaluation) demonstrate that, overall, the estimated economic benefits values and assumptions are reasonable and are consistent with values generated through different approaches.

6.3.4 Financial Feasibility

Financial feasibility was determined by comparing the plan beneficiaries' payment capacity with the annualized costs. The estimated average M&I and agricultural water users annual ability to pay is large in comparison to the estimated total annual water supply cost provided by the Dam Raise Alternative, which indicates that the potential water users that would benefit from the Dam Raise Alternative Plan will be able to repay their allocated annualized costs. Under the WIIN Act, an agreement must be secured providing the upfront funding necessary to pay the non-federal share of the capital costs before the commencement of construction. This upfront funding further demonstrates the financial feasibility of the Dam Raise Alternative Plan.

6.3.4.1 Authorities for Federal Financial Participation

Costs allocated to each purpose are assigned to federal taxpayers and project beneficiaries based on the specific project authorization, existing federal law, existing cost-sharing requirements, and laws

and objectives of nonfederal entities, including states, counties, and nonprofit organizations. Applicable federal authorities are summarized in Table 6-2.

Table 6-2. Existing Authorities for Federal Financial Participation for Monetized Benefit Categories

Purpose	Pertinent Federal Legislation	Description
Federal Cost Share for a Federally Owned Storage Project	Water Infrastructure Improvements for the Nation Act, 2015–2016 (Public Law 114-322)	Provides authorization for federal funding in federally owned surface storage projects and limits federal participation to not more than 50% of the total cost of the federally owned storage project.[1]
M&I Water Supply (Including Emergency Water Supply)	Reclamation Act of 1939, as amended	Provides for up-front Federal financing of M&I water supply purposes, with 100% repayment of capital costs (including interest during construction and interest over the repayment period); 100% of OM&R costs are non-federal.
Irrigation Water Supply	Reclamation Act of 1902, as amended	Provides for up-front federal financing of irrigation water supply purposes, with 100% repayment of construction costs, without interest, and OM&R costs by beneficiaries.
State Route 152 Improvements	Reclamation Project Act, 1939 (43 U.S.C § 485)	Provides authorization for road improvements, maintenance, reconstruction, or relocation of existing public roads when deemed necessary for the construction of any authorized project for the development of water resources.
State Route 152 Improvements	River and Harbor Act, 1962 (Public Law 87-874)	Provides for federal financing for the replacement of public roads, consistent with design standards established by the State, that would be taken in order for a water resources project to be constructed. Federal costs under this authority are non-reimbursable.

Notes:
[1] Total cost interpreted as total capital cost.
Key:
M&I = municipal and industrial
U.S.C. = United States Code

Authorization for federal financial participation in implementing the B.F. Sisk Dam Raise and Reservoir Expansion Project is established by the WIIN Act, 2015–2016 (Public Law 114-322). WIIN Act language is described in-depth in Chapter 1 in the 1.2 Project Background and History section. Public Law 114-322, Section 4007 (a)(1) establishes B.F. Sisk Dam Raise and Reservoir Expansion as a qualified federally owned storage project.

The Dam Raise Alternative's multiple operational configurations are formulated to provide a range of quantifiable benefits that include the following:

1. Support for Reclamation's delivery of contractually obligated M&I and agricultural water supplies through increased CVP yield and improvements in the security of rescheduled water supply stored in the enlarged reservoir.

2. Enhanced M&I emergency water supply available to South-of-Delta CVP contractors by increasing storage.

3. Refuge water supply, through increased reliability and deliveries of Incremental Level 4 water.

4. Safety improvements to SR 152 that were generated by correction of an existing seismic deficiency at its crossing of Cottonwood Bay.

The Dam Raise Alternative Plan, Investor-Directed Storage Subalternative D that is the NED Plan would provide increased M&I and agricultural water supply, additional M&I emergency water supply, and the safety improvements to SR 152.

In addition to these quantifiable benefits, numerous additional benefits that cannot be quantified but remain important to the nonfederal partner (the SLDMWA member agencies):

1. Improved certainty of long-term water supply to safely support the development of higher value permanent crops.

2. Access to additional surface water supply to offset potential expansion in limits on SLDMWA member agencies access to groundwater as a part of their water supply portfolio with implementation of the Sustainable Groundwater Management Act (SGMA).

3. Improvements in recreational opportunity at San Luis Reservoir with increased opportunity for recreationists to access its water surface at higher storage levels.

All these benefits contribute to federally authorized purposes and are considered federal benefits for this feasibility investigation, consistent with a scope defined by the WIIN Act for federal interest in federally owned storage projects.

6.3.4.2 Cost Allocation

Reclamation law and policy require an initial and final allocation of costs to project purposes. The initial allocation of costs is conducted to test financial feasibility during the planning phase. When construction of the project is determined to be substantially complete, the final allocation of costs is conducted to determine actual federal and non-federal costs and is the basis for assignment of costs to beneficiaries.

The primary purpose of cost allocation is to determine the assignment of costs to beneficiaries for repayment. Costs to be allocated include construction costs and annual operations, maintenance, and replacement (OM&R) costs. The example cost allocation presented in this chapter includes results from the most probable cost estimate for the NED Plan. Appendix D – Cost Allocation further describes the initial cost allocation and presents initial cost allocations for all operational configurations of the Dam Raise Alternative Plan with NED benefits that exceeded the NED costs.

Table 6-3 provides the estimated most probable costs to be allocated for the Dam Raise Alternative Plan.

In the separable costs-remaining benefits (SCRB) analysis, single-purpose project costs for project components that contribute to a single purpose are compared to the benefits for each purpose to determine a justifiable expenditure for each purpose. Separable costs are subtracted from the justifiable expenditure to determine the percent of remaining benefits that are used to allocate costs. Separable costs are costs that are necessary specifically because of a single purpose that is included in the multipurpose project. Separable costs are estimated as the reduction in financial costs that would result if a purpose were excluded from an alternative.

Table 6-3. Dam Raise Alternative Plan Costs to be Allocated – Most Probable Costs (million $)

	Cost
Capital Cost	
Construction Cost	$922.1
Interest During Construction	$95.7
Total Capital Cost	$1,017.9
Annual Cost	
Interest & Amortization	$27.2
Interest During Construction	$2.8
Operations, Maintenance, and Replacement	$0.7
Total Annual Cost	$30.7

Notes:
General: January 2020 price levels. All values are rounded for display purposes; therefore, line items may not sum to totals. Interest During Construction calculated with a 2.75 percent rate. Interest and amortization based on a 2.75 federal discount rate over a 100-year period analysis. For this alternative, no replacement costs are assumed to be incurred over the 100-year period of record.

Total separable costs are subtracted from the total cost to determine the total joint costs. The resulting allocated joint costs are calculated based off the percentage of the remaining benefits of each project purpose. Total allocated costs are the sum of the separable costs and allocated joint costs. This approach remains the same for any cost categories: OM&R, capital, annual, or total costs.

Table 6-4 shows the total capital cost and annual OM&R costs allocated for each project purpose based on this analysis for the NED Plan. The allocation is detailed in Appendix D – Cost Allocation.

Table 6-4. Initial SCRB Analysis and Annual Construction and OM&R Cost Allocation Summary for the NED Plan (million $/year)

Item[1]	Emergency Water Supply A	M&I Water Supply B	Irrigation Water Supply C	Transportation Safety and Reliability D	Total E
Total Construction Costs	$451.23	$257.38	$13.13	$200.36	$922.10
Percentage of total	48.9%	27.9%	1.4%	21.7%	100.0%
Interest During Construction	$46.8	$26.7	$1.4	$20.8	$95.7
Percentage of total	48.9%	27.9%	1.4%	21.7%	100.0%
Total Annual OM&R Costs	$0.34	$0.20	$0.01	$0.15	$0.70
Percentage of total	48.9%	27.9%	1.4%	21.7%	100.0%

Notes:
General: January 2020 price levels. All values are rounded for display purposes; therefore, line items may not sum to totals. Interest and amortization based on a 2.75 federal discount rate over a 100-year period analysis. For this alternative, no replacement costs are assumed to be incurred over the 100-year period of record.
[1] Refuge Water Supply benefits are not included because the NED Plan does not provide refuge water supply.
Key:
NED = National Economic Development
M&I = municipal and industrial
OM&R = operations, maintenance, and replacement
SCRB = separable costs-remaining benefits

6.3.4.3 Cost Assignment

The assignment percentages used as the basis for assigning costs are based on existing federal authorities and are summarized in Table 6-5. The cost assignment presented in this chapter includes results from the most probable cost estimate for the NED Plan. Appendix D – Cost Allocation further describes the initial cost assignment and presents initial cost assignments for all operational configurations of the Dam Raise Alternative Plan with NED benefits that exceeded the NED costs.

Table 6-5. Initial Cost Assignment Percentages

Cost Type	Cost Category	Emergency Water Storage	M&I Water Supply	Agricultural Water Supply	Transportation Safety and Reliability
Construction[1]	Federal Costs	0%	50%	50%	100%
Construction[1]	Non-Federal Costs	100%	50%	50%	0%
OM&R[2]	Federal Costs	0%	0%	0%	0%
OM&R[2]	Non-Federal Costs	100%	100%	100%	100%

Notes:
[1] The WIIN Act (Public Law 114-322) limits federal participation to not more than 50 percent of the total cost of a federally owned storage project.
[2] Cost assignment for OM&R associated with NED Plan facilities was assigned as 100 percent non-federal, to be paid by the project proponents. The project proponents have expressed a willingness to pay this cost.
Key:
M&I = municipal and industrial
OM&R = operations, maintenance, and replacement
WIIN = Water Infrastructure Improvements for the Nation

The assignment of costs includes costs to accomplish all purposes consistent with the planning objectives. The total most probable construction cost amounts to $922.1 million and a total annual OM&R cost amounting to $95.7 million for the NED Plan (see Table 6-4). Pursuant to WIIN Act requirements, federal costs are not more than 50 percent of the total cost.

Table 6-6 provides the initial construction cost assignment for the Dam Raise Alternative Plan and the NED Plan. It is anticipated that federal funding would be provided via the WIIN Act, which caps federal funding participation at 50 percent of the total project cost. Of the construction costs allocated, 50 percent of construction costs are estimated to be federal costs and 50 percent are estimated to be non-federal costs. The federal construction costs for the NED Plan would be $461.1 million.

Table 6-6. Initial Construction Cost Assignment for the Dam Raise Alternative Plan by Project Purpose – Most Probable Construction Costs (million $)

Purpose/Action	Non-Federal Assigned Percentage	Cost	Federal Assigned Percentage	Cost	Total Cost
Emergency Water Supply	100%	$420.7	0%	$0.0	$420.7
M&I Water Supply	17%	$38.3	83%	$191.8	$230.2
Agricultural Water Supply	17%	$2.0	83%	$10.2	$12.2
Transportation Safety and Reliability	0%	$0.0	100%	$259.0	$259.0
Total	**50%**	**$461.1**	**50%**	**$461.1**	**$922.1**

Notes:
General: January 2020 price levels. All values are rounded for display purposes; therefore, line items may not sum to totals. The WIIN Act (Public Law 114-322) limits federal participation to not more than 50 percent of the total cost of a federally owned storage project.

Table 6-7 presents an estimate of the annual OM&R costs assigned to beneficiaries for each project purpose for the Dam Raise Alternative Plan. As shown in Table 6-7, there would be no federal OM&R costs for the NED Plan.

Table 6-7. Initial OM&R Cost Assignment for the Dam Raise Alternative Plan by Project Purpose (million $/year)

Purpose/Action	Non-Federal Assigned Percentage	Cost	Federal Assigned Percentage	Cost	Total Cost
Emergency Water Supply	100%	$0.44	0%	$0.00	$0.44
M&I Water Supply	100%	$0.24	0%	$0.00	$0.24
Agricultural Water Supply	100%	$0.01	0%	$0.00	$0.01
Transportation Safety and Reliability	100%	$0.00	0%	$0.00	$0.00
Total	100%	$0.70	0%	$0.00	$0.70

Key:
M&I = municipal and industrial
OM&R = operations, maintenance, and replacement

6.3.4.4 Payment Capacity and Ability to Pay

Reclamation law requires that federal investments be repaid by the beneficiaries of that investment, except where that benefit is for the common welfare or defense of the nation. Financial feasibility is ultimately based on the ability of the project beneficiary, SLDMWA, to pay the costs associated with an implemented plan, per Reclamation law. Costs beyond a particular beneficiary's repayment ability may be paid by other project beneficiaries, as Reclamation policy allows and where resources are available. If beneficiaries have the collective financial resources, per Reclamation law, to pay the costs allocated to them, then the project is considered financially feasible.

The ability of the non-federal sponsor to pay demonstrates the financial feasibility of implementing the Dam Raise Alternative Plan.

6.4 Implementation Requirements

After the Feasibility Report is completed, several requirements will remain before the project can be implemented. These requirements are described below.

6.4.1 Agreement on Up-Front Cost-Share with Non-Federal Partner

Consistent with the WIIN Act, the Secretary of the Interior, acting through the Commissioner for Reclamation, would need to negotiate and enter into an agreement with non-federal partner(s) on behalf of the United States for planning, permitting, design, and construction costs. Section 4007 of the WIIN Act contains a set of requirements that must be met prior to funding. Of these requirements, this Feasibility Report confirms the following:

- Storage project is feasible in accordance with Reclamation laws.
- In return for the federal cost-share investment in the storage project, a proportional share of the project benefits are the federal benefits.
- Federal cost-share is an amount equal to but not more than 50 percent of the total cost of the federally owned storage project.

6.4.2 Project Funding

The Project is eligible to receive funding under the WIIN Act as a federally owned storage project and would be eligible for federal funding up to 50 percent of total cost. The non-federal cost-sharing partner would be a public entity organized pursuant to California law and would request an agreement with the United States for the permitting, design, and construction of the Project. Funding could be provided for the project if enacted appropriations legislation designates funding to it by name, after the Secretary of the Interior recommends the specific project for funding and transmits such recommendation to the appropriate congressional committees.

6.4.3 Water Rights

Reclamation's existing water rights will not be impacted by the Dam Raise Alternative Plan. No new Reclamation water rights will be needed for the Dam Raise Alternative Plan. SLDMWA will respect the current use and conditions of all other water contractors' water rights. The B.F. Sisk Dam Raise and Reservoir Expansion Project does not assume an increase or change in CVP allocations for CVP contractors.

6.4.4 Operational Agreements and Plans

CVP and SWP water rights are conditioned by the SWRCB to protect the beneficial uses of water within each project and jointly protect the beneficial uses of water within the Sacramento Valley and Delta. CVP and SWP operation is coordinated to meet these joint water right requirements and ensure that water is available for legal uses. The B.F. Sisk Dam Raise and Reservoir Expansion Project and as an extension the selected operational subalternative will comply with existing regulatory requirements, including the 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).

6.4.4.1 Development Process

A detailed operations agreement or amendment to the existing integrated operations agreement between Reclamation and SLDMWA will be developed during the preconstruction phase (see Preconstruction Activities section later in this chapter). As further described below, a detailed operations study will be conducted, operations principles will be further refined and prescribed in a final integrated operations agreement, and governance and management structures will be formed.

Detailed Operations Study – In support of developing an integrated operations agreement, Reclamation will lead a detailed operations study, in coordination with SLDMWA. The study will consider current and projected future water system facilities and operations and detail governance and management structures for the expanded storage. This study will build upon the CalSim II planning studies conducted in support of this feasibility study and the EIR/SEIS.

SLDMWA-Reclamation Coordinated Operations Principles – The principles of a new operations agreement between Reclamation and SLDMWA are currently under development by both agencies. These will outline the contractual agreement terms and conditions, and water rights permit conditions, if any, including:

- Water supply deliveries under the Project would use SLDMWA's allocated CVP supply and the water rights or contract entitlements of SLDMWA.
- Water supplies developed by the Project would not adversely affect CVP or SWP contract deliveries.
- Operations of the Project may result in the rescheduling of CVP water in San Luis Reservoir, if project partners pursue this as a means of providing additional operational flexibility.
- Operation of the Project would not injure prior local water rights or cause unreasonable harm to fish and wildlife resources, consistent with the findings in the Final EIR/SEIS.
- Protocol for annual start-of-year scheduling and end-of-year reporting of project deliveries to refuges to the RWSP and Central Valley Operations Office as needed for the CVPIA work plan or for other purposes.
- Protocol for coordination on WIIN Act reporting requirements and WIIN Act opportunities, including opportunities to increase deliveries to South-of-Delta CVP contractors.

Reclamation's Central Valley Operations Office will take a lead role in coordinating with SLDMWA to develop a final integrated operations agreement. The Central Valley Operations Office is

responsible for recommending CVP operations policy, developing annual operating plans, coordinating with the SWP and other system operators, and making real-time operating decisions.

Reclamation - DWR Coordinated Operations Principles – Given the importance of effective coordinated operations of the CVP and SWP, the existence and/or extent of any SWP water supply reduction from the Project will be reassessed prior to construction, during construction, and at the time that any new regulatory requirement or permit issued for the Project, affect SWP operations. SLDMWA, through these reassessments and ongoing coordination of operations between Reclamation and DWR, shall confirm at these intervals that any SWP water supply reduction resulting from the Project's construction or operation is less than significant. Any adaptive management measures or restrictions imposed on SLDMWA, Reclamation, or the CVP through permits or other regulatory approvals issued for the Project's operations will be coordinated with DWR consistent with the rights and obligations of and between Reclamation and DWR agreed to in other independent agreements.

6.4.5 Regulatory and Related Requirements for Environmental Compliance

Construction and operation of the authorized plan would be subject to the requirements of federal, state, and local laws, policies, and environmental regulations. Reclamation and/or SLDMWA (the CEQA lead agency) would need to obtain various federal, state, and local permits and regulatory authorizations before project construction would begin. A list of potential permits and approvals is included in the Final EIR/SEIS. Reclamation would have to make the determination that the proposed project partnerships would not injure Reclamation water rights or negatively impact the B.F. Sisk Dam SOD Modification Project.

6.4.6 Preconstruction Activities

If the Secretary of the Interior determines that the requirements of Section 4007 of the WIIN Act are met and Congress authorizes federal funding for construction of a project, Reclamation and SLDMWA would initiate and complete required preconstruction activities. Key activities include:

- Complete additional surveys for final designs.
- Refine designs and cost estimates; update analyses of potential effects and economics (and related NEPA or CEQA analyses and documentation, if necessary); prepare detailed plans, specifications, and bid packages.
- Conduct a detailed operations study to examine integrated operations, consistent with existing, new, and modified water right permits.
- Develop the operations agreement for the NED Plan.

6.4.7 Federal and Non-Federal Responsibilities

Federal and non-federal obligations and requirements would be included in a Project Cooperation Agreement. After Project Cooperation Agreements are signed and nonfederal partners provide required financial contributions and assurances, the federal government would have the following roles and responsibilities:

- Process the Final EIR/SEIS, complete all federal permitting, and prepare a ROD.
- Prepare final operating plan(s) and post-authorization decision document.
- Enter into cost-share agreement with SLDMWA.

Reclamation, as owner and operator of the expanded San Luis Reservoir, would take a lead role in final design and construction of project facilities, in coordination with SLDMWA. Operations would occur in coordination with SLDMWA, who would have the following roles and responsibilities:

- Process and certify the Final EIR/SEIS.
- Complete investigation and design of all project facilities, including mitigation requirements.
- Secure up-front project funding.

6.5 Risk and Uncertainty

The Dam Raise Alternative Plan evaluation incorporates assumptions where information is not yet available. These assumptions are based on the currently available information and result in valuable information for the feasibility and environmental analysis. Key areas of remaining risk and uncertainties are described below.

6.5.1 Effects of Hydrology and Climate Variability

Potential future climate variability could result in hydrologic conditions that differ from those used to evaluate the No Action/No Project Alternative and alternative plans. Future climate change scenarios indicate that a variety of changes are possible for California's precipitation and hydrology. Potential changes include decreased snowpack and sea level rise. Rising air temperatures could further increase the current imbalance between water supply and demands through changes to seasonal runoff, increased reservoir evaporation rates, and rising sea levels reducing flexibility in Sacramento-San Joaquin Delta operations. These changes will affect the availability of CVP, SWP, and local water supplies and could reduce the amount of water exported from the Delta. Reclamation developed the Sacramento and San Joaquin Rivers Basin Study in 2016 to evaluate the potential effect of climate and socioeconomic change on future water demands. The study found that sea level is expected to rise but the range of potential increase is uncertain. Any change in sea level could increase the difficulty of conveying water through the Sacramento-San Joaquin Delta with rising water surface elevation changing the flow-salinity dynamics of the Delta, which would require more Delta outflow to meet water quality standards and other regulatory requirements. The study reported that temperatures are projected to increase in both the Sacramento and San Joaquin River Basins. Increased temperatures across the CVP and SWP service areas are likely to increase demand for both M&I and agricultural water supply while simultaneously accelerating evaporation from surface water reservoirs across the basins. Precipitation may increase in the areas north of the Sacramento-San Joaquin Delta, with minimal change projected in the Tulare Lake Basin, where some of the greatest agricultural demands exist; and snowpack will decline with warming temperatures, particularly in the lower elevations of the mountains surrounding California's Central Valley (Reclamation 2016b). These changes, including increases in surface water demands, are likely to impact effectiveness of the Dam Raise Alternative Plan by reducing the overall availability of CVP supplies for import into San Luis Reservoir.

6.5.2 Effects of Regulatory Conditions and New Infrastructure

Predictions of future water system operations depend on assumptions about future facilities, operational constraints, hydrology, and changes in Delta exports based on federal and state regulations. As described in Chapter 1 Related Studies, Projects, and Programs, operational

constraints for the CVP and SWP are affected by changing regulatory conditions in California. For this feasibility investigation, CVP and SWP operational assumptions were based on operations described in Reclamation's Reinitiation of Consultation on the Long-Term Operation of the Central Valley Project and State Water Project, the 2019 USFWS biological opinion (BO) and 2019 NMFS BO, and the 2018 Coordination Operations Agreement Addendum. These assumptions were used to guide the refinement, modeling, and evaluation of alternatives and were used as the basis of analysis in this Feasibility Report.

Implementation of new conveyance infrastructure, such as Delta Conveyance, may also affect operations of the CVP and SWP and, subsequently, the estimated benefits of the NED Plan. The cumulative effects of potential new storage projects upstream from the Delta, other potential new water management infrastructure, and changes to regulatory constraints present some uncertainty with respect to CVP and SWP operations and project benefits; however, the operational flexibility provided by the Project is expected to provide resiliency to such changes.

6.5.3 System Operations

The CalSim II system operations model was used to simulate existing and future operations of the CVP and SWP with and without the alternatives. CalSim II is a tool that provides valuable information, but it is designed to function only as a comparative tool and does not provide precise predictions of how the system would work. The version of CalSim II used for the analysis includes the best available inputs and assumptions at the time that the modeling was completed, including the 2019 USFWS BO and 2019 NMFS BO on the Long-term Operations of the CVP and SWP. These operational constraints are subject to continued uncertainty. In addition, changes in hydrology could produce conditions that are different than current water operations were designed for, and the modeling results used in this Feasibility Report could change.

6.5.4 Cost Estimates

All cost estimates have inherent risks and uncertainties, including labor costs, materials availability, competitive bidding environments, unidentified field conditions, financial or commodity market conditions, and changing regulatory environments. Of primary consideration, varying uncertainties are associated with the material and unit costs used to develop the estimates. Unknowns include the price of construction materials and labor costs. In particular, the construction market has experienced extreme price volatility in the last several years. While future inflation trends are difficult to predict, new market forces (e.g., higher material commodity pricing, energy costs, lack of competition) will likely continue to have significant impacts on heavy civil infrastructure construction costs for the foreseeable future. Because of uncertainty and variability among the short-term regressions, a longer view of the market is preferred. Consequently, while forward cost trends are always difficult to predict, there is some basis to believe that cost escalation is normalizing back to historical levels at approximately 3 percent per year. Interest during construction (IDC) was calculated for the period between when construction begins, and benefits are derived to account for future cost trends. IDC was calculated using the federal discount rate of 2.75 percent. Project Schedule

The preconstruction and construction schedule and associated costs for the proposed alternative are based on receiving appropriations consistent with the schedule. Partial or no appropriations would extend the construction schedule, which would result in increased costs—both construction field costs and noncontract costs.

The current schedule estimates about an 8-year construction period. The 8-year period could potentially be reduced through measures such as optimizing contract packaging, selective use of design-build for certain facilities, and requiring shorter, more aggressive contract durations employing multiple shift work. Implementing measures to accelerate the schedule could potentially reduce schedule risk, raising the confidence in the overall 8-year construction period.

6.5.5 Activities Needed to Secure Construction Funding

Following approval of the Final Feasibility Report, various activities will be required before construction funding can be secured, including completion and signing of a ROD. The current project schedule assumes a ROD will be signed in early 2021, after the Secretary of Interior has found the project to be eligible for funding under the WIIN Act and made a recommendation to Congress. Agency consultation under the ESA and Section 106 is required before a ROD can be signed. Pre-consultation meetings with the required resource agencies occurred, but formal consultation did not begin and no formal review of the acceptability of proposed mitigation actions, as documented in the Final EIR/SEIS, occurred. A detailed schedule for completion of all required consultations under ESA and other permitting activities is under development and will be used to refine the proposed schedule for signing a ROD.

6.5.6 Non-Federal Cost Share

Up-front local cost-sharing will be provided for implementation of the Project fulfilling requirements of the WIIN Act. Payment capacity and ability to pay analysis of the beneficiaries, as presented in Appendix D – Cost Allocation, demonstrates overall project financial feasibility. The WIIN Act under the authority of Reclamation Act 1902, as amended, provides for federal financing with 100 percent repayment of the capital cost including interest during construction and interest during payment period associated with water supply benefits. If federal funding were provided for the water supply benefits associated with the Dam Raise Alternative, Reclamation would enter into a repayment contract in accordance with Reclamation Manual.

6.5.7 Economics and Benefit Monetization

Estimating economic (monetized) benefits of potential project accomplishments is critical to establishing economic feasibility and identifying a corresponding operational plan. Valuation methods for each NED benefit category are presented in Appendix C – Economic Benefits Evaluation and summarized in Chapter 5. As described, varying uncertainties are associated with each valuation method.

6.6 Timeline and Status of Feasibility Study

Table 6-8 summarizes major activities that either occurred or are planned to occur as part of the feasibility study.

If and when the Secretary of the Interior determines that the project meets the authorizing requirements of the WIIN Act and related congressional appropriations occur, project implementation is expected to take place in two phases (preconstruction and construction). The preconstruction phase is estimated to occur between 2022 and 2025 after construction authorization and would include initial development/construction of staging areas, developing detailed project designs, acquiring necessary permits, and other preconstruction activities. Once these initial

preconstruction phase activities are complete on individual work packages, construction of major project features would begin. Design and construction activities for major project features would likely span 8 years from 2025 to 2032.

Table 6-8. Summary and Status of the Feasibility Investigation

Activity	Description
Completed and Ongoing Activities	
B.F. Sisk Safety of Dam Project (2019)	Reclamation and DWR prepared and released a joint Final EIS/EIR in August 2019 for the B.F. Sisk Safety of Dams Modification Project to reduce seismic risks at B.F. Sisk Dam. Reclamation signed a ROD in December 2019.
Alternatives Development Report (April 2020)	Evaluated 15 resource management measures and several initial alternatives for their ability to contribute to the primary and secondary objectives.
Formal Initiation of Environmental Compliance Processes (NOI/NOP on May 14, 2020)	Formal initiation of environmental compliance processes began with issuance of a NOI and a NOP, consistent with federal and state regulations.
Draft EIR/SEIS (released August 2020)	Draft EIR/SEIS was released for public review and comment.
Administrative Draft Feasibility Report (November 2020)	Administrative Draft Feasibility Report released for executive level review.
Final Feasibility Report and Accompanying Final EIR/SEIS	The Final Feasibility Report evaluates and compares comprehensive plans and identifies the NED Plan. The Final EIR/SEIS includes responses to public comments and identifies the preferred alternative.
Executive-Level Review and Processing of Final Feasibility Report and Final EIR/SEIS	The Feasibility Report and Final EIR/SEIS will be reviewed and processed within the U.S. Department of the Interior and the President's Office of Management and Budget before being made available to the public.
Determination by the Secretary of the Interior	The Secretary of the Interior will submit to the appropriate committee(s) of Congress a written notification of his/her determinations on compliance with Section 4007 requirements, within 30 days of making such determinations.
Congressional Review and Appropriations	Appropriate committees of Congress will review the Secretary's determinations and decide whether to appropriate funds to the project. Legislation containing appropriations would be sent to the President for approval.
Record of Decision	U.S. Department of the Interior will issue a ROD for the B.F. Sisk Dam Raise and Reservoir Expansion Project.

Key:
DWR = California Department of Water Resources; EIS - Environmental Impact Statement; SEIS = Supplemental Environmental Impact Statement; EIR = Environmental Impact Report; ROD = Record of Decision; NED = National Economic Development; NOI = Notice of Intent; NOP = Notice of Preparation

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Chapter 7 Coordination and Public Involvement

Reclamation and SLDMWA reached out to interested parties throughout the feasibility report and EIR/SEIS process for this project. Those efforts are described in this chapter.

7.1 Stakeholder and Public Outreach

The purpose of stakeholder and public outreach is to obtain feedback from agencies, the public, and other interested parties on significant issues associated with a project. This information helps guide an agency's environmental review of a project.

The Notice of Preparation (NOP) was circulated for a 30-day comment period beginning on May 14, 2020 and ending on June 14, 2020. Written comments on the proposed content and scope of the EIR received in response to SLDMWA's NOP were also reviewed and incorporated as appropriate in the draft EIR/SEIS.

The NEPA process begins with publication of a Notice of Intent (NOI), stating Reclamation's intent to prepare an EIS for the Project. The NOI was published in the *Federal Register* (FR) on May 14, 2020 to coincide with release of the NOP.

On May 26, 2020, SLDMWA conducted a public scoping meeting as required under CEQA. Given the Coronavirus disease pandemic and the associated precautions and procedures being followed throughout California, the public scoping meeting was conducted online utilizing a web-based tool that allowed presentation of the project and public participation through the online chat function. Additionally, SLDMWA and Reclamation are working closely with Caltrans on several aspects of the project specific to SR 152.

SLDMWA and Reclamation maintain a project website that provides information to interested parties about the status of the B.F. Sisk Dam Raise and Reservoir Expansion Project.[12] The documents from each study milestone are available on SLDMWA and Reclamation websites.

7.2 Agency Coordination

The development of the B.F. Sisk Dam Raise and Reservoir Expansion EIR/SEIS, and implementation of the proposed action, requires coordination with a variety of federal, state, and local agencies. The following sections describe these agencies and their roles in the process.

[12] SLDMWA website can be found at http://sldmwa.org/sisk-project/

7.2.1 U.S. Fish and Wildlife Service

Reclamation will consult with USFWS to ensure its actions do not jeopardize the continued existence of any species listed, pursuant to the ESA.

7.2.2 U.S. Army Corps of Engineers

The Dam Raise Alternative has the potential to impact wetlands. Therefore, Reclamation will coordinate with the U.S. Army Corps of Engineers (USACE) Regulatory Division regarding development of a Clean Water Act Section 404 permit.

7.2.3 U.S. Environmental Protection Agency

The Dam Raise Alternative has the potential to impact wetlands. Therefore, Reclamation will coordinate with EPA regarding any development of a Clean Water Act Section 404 permit.

7.2.4 California Department of Parks and Recreation

CDPR manages the lands surrounding San Luis Reservoir. SLDMWA and Reclamation will coordinate with CDPR to discuss how potential impacts from the B.F. Sisk Dam Raise and Reservoir Expansion Project may affect recreation.

7.2.5 State Historic Preservation Officer

Implementation of the alternative selected for the B.F. Sisk Dam Raise and Reservoir Expansion Project will require compliance with United States Code (U.S.C.) 54 Section 306108, commonly known as Section 106 of the National Historic Preservation Act (NHPA). To complete the Section 106 process, as outlined at 36 CFR Part 800, Reclamation is required to consult with the State Historic Preservation Officer (SHPO) and afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment regarding the effects of the proposed undertaking on historic properties. Historic properties are cultural resources that are listed, or eligible for listing, on the National Register of Historic Places. Reclamation must fully comply with NHPA Section 106 compliance requirements, as outlined at 36 CFR Part 800, prior to signing a ROD regarding the B.F. Sisk Dam Raise and Reservoir Expansion Project.

7.2.6 Central Valley Regional Water Quality Control Board

The Dam Raise Alternative could require several permits from the Central Valley Regional Water Quality Control Board (RWQCB) including a dewatering permit and coverage under a National Pollutant Discharge Elimination System permit for General Construction. Reclamation will be consulting with RWQCB to determine the correct permits and their requirements. SLDMWA and the construction contractor will obtain these permits prior to construction.

7.2.7 State Water Resources Control Board

SLDMWA will be coordinating with SWRCB on the Clean Water Act (CWA) Section 401 Water Quality Certification process that will be conducted concurrent with the CWA Section 404 permitting process.

7.2.8 San Joaquin Air Pollution Control District

The Dam Raise Alternative has the potential to impact air quality in Merced County. Reclamation will coordinate with the SJVAPCD regarding air quality impacts in Merced County. If necessary, Reclamation will prepare a General Conformity Determination.

7.2.9 California Department of Fish and Wildlife

The B.F. Sisk Dam Raise and Reservoir Expansion Project has the potential to affect species covered under the California Endangered Species Act. SLDMWA will consult with CDFW to ensure compliance with the California Endangered Species Act.

7.2.10 California Department of Water Resources

The Dam Raise Alternative would change operations at San Luis Reservoir. San Luis Reservoir is jointly managed by Reclamation and DWR. Depending on the operational configuration selected for implementation, Reclamation and/or SLDMWA will coordinate with DWR on potential changes to San Luis Reservoir operations.

7.2.11 California Department of Transportation

Implementation of the Dam Raise Alternative would include modifications to a section of SR 152 that crosses over Cottonwood Creek within Caltrans' right-of-way. Reclamation and SLDMWA have started coordination with Caltrans, a cooperating agency for this EIR/SEIS, to mitigate any impacts.

7.2.12 Native American Heritage Commission

SLDMWA and Reclamation will initiate formal consultation with native American tribes in the study area consistent with Assembly Bill 52.

7.2.13 Local Governments

The B.F. Sisk Dam Raise and Reservoir Expansion Project proposes construction within Merced County and operation of the proposed alternatives could affect water system operations in Contra Costa, Fresno, Imperial, Kern, Kings, Los Angeles, Merced, Orange, Riverside, San Benito, San Bernardino, San Diego, San Joaquin, San Luis Obispo, Santa Clara, Stanislaus, and Ventura counties.

7.3 Public and Agency Review and Comment

Many of the comments received during the scoping process for the EIR/SEIS focused on the potential for environmental effects and detailed feedback on how to assess those effects; those comments are more specifically related to the EIR/SEIS and are not repeated here. The comments described below are related to the alternative formulation and were considered during development of the alternative plans. All additional comments on the project received during the public review of the EIR/SEIS will be addressed in the Final EIS/EIR. In addition, comments that are received during the public review of the EIR/SEIS on the feasibility study process and alternative formulation will be considered during completion of the Final Feasibility Report.

7.3.1 Alternative Formulation

- The public wanted the EIR/SEIS to evaluate a range of alternatives that avoid or reduce any environmental impacts.

- When considering a range of alternatives, commenters wanted to see both structural and nonstructural options explored to meet the project's purpose and design criteria to allow consideration of nonstructural project components that may provide smaller individual contribution.

- Members of the public wanted to assess the extent to which the need for water could be reduced through available conservation measures, including more efficient irrigation practices.

Chapter 8 Findings and Considerations

This chapter summarizes major findings and considerations of the feasibility investigation.

8.1 Summary of the NED Plan

The Dam Raise Alternative, Investor-Directed Storage Subalternative D, was identified as the NED Plan as it would achieve the highest net NED benefits. However, there is more than one operational subalternative under the dam Raise Alternative Plan that is considered economically feasible with NED benefits exceeding NED costs and a positive benefit-cost ratio. The Dam Raise Alternative Plan itself is considered to be technically and financially feasible. All operational subalternatives have been evaluated for environmental feasibility under the EIR/SEIS. This section presents a summary of the Dam Raise Alternative Plan including information relevant to the Investor-Directed Storage Subalternative D given this configuration's identification as the NED Plan.

8.1.1 Costs and Benefits

Table 8-1 and Table 8-2 summarize the benefit-cost analysis for the Investor-Directed Storage Subalternative D of the Dam Raise Alternative under the most probable and probable low cost estimates respectively. The Investor-Directed Storage Subalternative D of the Dam Raise Alternative increases storage capacity in San Luis Reservoir to provide greater operational flexibility and water supply reliability to SLDMWA member agencies. The Investor-Directed Storage Subalternative D of the Dam Raise Alternative would provide an estimated 18.05 TAF (long-term average) M&I water supply and 3 TAF (long-term average) agricultural water supply.

The plan provides water supply to various south-of-Delta CVP M&I water users[13] in the event of a regional water supply disruption (emergency water supply). Finally, the plan also includes seismic upgrades to portions of SR 152 that would improve public safety by reducing its current seismic risk.

8.1.2 Feasibility

The Dam Raise Alternative Plan and; therefore, the NED Plan are determined to be technically, environmentally, economically, and financially feasible at the feasibility level of detail.

8.1.2.1 Technical Feasibility

The Dam Raise Alternative Plan is projected to be technically feasible, constructible, operable, and maintainable. The Reclamation design, estimating, and construction review was completed, and the

[13] The south-of-Delta CVP M&I water users identified with a potential demand for emergency water supply stored in an expanded San Luis Reservoir are: the cities of Tracy, Huron, Hollister, Coalinga, and Avenal, the California Department of Fish and Wildlife, Byron-Bethany Irrigation District, Del Puerto Water District, Panoche Water District, San Luis Water District, Westlands Water District, Lemoore Naval Air Station through Westlands Water District, Fresno County and Tulare County.

results concur that the project design, drawings, and geotechnical analysis meet the standards for a feasibility level of detail.

8.1.2.2 Environmental Feasibility

The Dam Raise Alternative Plan will be considered environmentally feasible once the ROD is signed and the permits and approvals are secured for construction. The EIR/SEIS evaluates environmental effects and identifies mitigation measures.

Table 8-1. Dam Raise Alternative for Most Probable Construction Cost (Investor-Directed Storage Subalternative D) Annual Benefit-Cost Summary

	Investor-Directed Storage Subalternative D under the Dam Raise Alternative
Annual M&I Water Supply Benefits (million $)[1,2]	$9.4
Annual Agricultural Water Supply Benefits (million $)[1,2]	$0.5
Annual Emergency Water Storage Benefits (million $)[1]	$27.8
Annual Transportation Safety Benefits – Approach 1 (million $)[1]	$0.3
Annual Transportation Safety Benefits – Approach 2 (million $)[1]	$7.6
Total Annual Benefits (million $)[1,3]	**$38.0/$45.2**
Total Construction Cost (million $)	$27.2
Total Interest During Construction (million $)	$2.8
Annual OM&R Costs (million $)	$0.7
Total Annual Costs (million $)[4]	**$30.7**
Net Annual Benefits or Costs (million $)[3]	**$7.3/$14.5**
Benefit-Cost Ratio[3]	**1.2/1.5**

Notes:

[1] Benefits represent annual benefits estimated in the year 2030.

[2] M&I and Agricultural water supply benefits have been adjusted as detailed in Appendix C to account for a water supply emergency's limits on the availability of this supply.

[3] The first value includes Transportation Benefit – Approach 1 i.e. the Value of Lost Time Approach. The second value includes Transportation Benefit – Approach 2 i.e. the least-cost most likely alternative approach.

[4] Annual costs include construction cost amortized over 100 years at 2.75 percent discount rate, interest during construction annualized over 100 years at 2.75 percent discount rate, and annual O&M costs.

Key:

OM&R = operations, maintenance, and replacement

M&I = municipal and industrial

Table 8-2. Dam Raise Alternative Probable Low Cost Construction Cost (Investor-Directed Storage Subalternative D) Annual Benefit-Cost Summary

	Investor-Directed Storage Subalternative D under the Dam Raise Alternative
Annual M&I Water Supply Benefits (million $)[1,2]	$9.4
Annual Agricultural Water Supply Benefits (million $)[1,2]	$0.5
Annual Emergency Water Storage Benefits (million $)[1]	$27.8
Annual Transportation Safety Benefits – Approach 1 (million $)[1]	$0.3
Annual Transportation Safety Benefits – Approach 2 (million $)[1]	$7.5
Total Annual Benefits (million $)[1,3]	**$38.0/$45.2**
Total Construction Cost (million $)	$21.2
Total Interest During Construction (million $)	$2.2
Annual OM&R Costs (million $)	$0.7
Total Annual Costs (million $)[4]	**$24.1**
Net Annual Benefits or Costs (million $)[3]	**$13.9/$21.1**
Benefit-Cost Ratio[3]	**1.6/1.9**

Notes:
[1] Benefits represent annual benefits estimated in the year 2030.
[2] M&I and Agricultural water supply benefits have been adjusted as detailed in Appendix C to account for a water supply emergency's limits on the availability of this supply.
[3] The first value includes Transportation Benefit – Approach 1 i.e. the Value of Lost Time Approach. The second value includes Transportation Benefit – Approach 2 i.e. the least-cost most likely alternative approach.
[4] Annual costs include construction cost amortized over 100 years at 2.75 percent discount rate, interest during construction annualized over 100 years at 2.75 percent discount rate, and annual O&M costs.
Key:
OM&R = operations, maintenance, and replacement
M&I = municipal and industrial

8.1.2.3 Economic Feasibility

The Investor-Directed Storage Subalternative D under the Dam Raise Alternative, at the feasibility level of design, is projected to be economically feasible because the estimated benefits exceed the estimated most probable costs, resulting in a positive total net benefits range of $7.3 million to $21.1 million annually with a benefit-cost ratio range of 1.2 to 1.9.

8.1.2.4 Financial Feasibility

An initial allocation of construction costs was performed for the NED Plan (Investor-Directed Storage Subalternative D under the Dam Raise Alternative). Approximately 27.9 percent was allocated to M&I water supply, 1.4 percent was allocated to agricultural water supply, 48.9 percent was allocated to emergency water supply, and 21.7 percent was allocated to transportation safety benefit. Appendix D – Cost Allocation documents the cost allocation analysis.

The WIIN Act establishes federal participation in a federally owned storage project providing a benefit (in meeting any obligation) under federal law, including meeting CVP contractual water supply obligations, CVP operational flexibility, and refuge water supply. The WIIN Act limits overall

federal cost-sharing in a federally owned storage project to no more than 50 percent of total costs. These authorities provided the basis for cost assignment.

Allocated costs are assigned according to the aforementioned federal authorities. The federal cost-share of most probable construction costs for the NED Plan, compliant with the WIIN Act, is $461.1 million, representing 50 percent of the total construction costs. The nonfederal share is also $461.1 million. Appendix D – Cost Allocation documents the cost assignment analysis. The non-federal cost-share will be borne by SLDMWA and member agencies.

8.1.3 Risk and Uncertainty

Certain assumptions were made for the feasibility investigation based on engineering, economic, scientific judgment, and the availability of data and information. While this is effective in estimating relative outcomes, various risks and uncertainties could affect implementation of an authorized project. These risks and uncertainties (described in Chapter 6) are summarized below:

- Future water system operations and facilities may be affected/altered along with changes to operational constraints, hydrology, demands, and regulatory conditions in California.
- Construction cost estimates, at a feasibility level, presume inherent risks and uncertainties because of unknown future labor, market, and field conditions.
- Timing, source, and availability of funding will affect the construction schedule and cost estimates included in the Feasibility Report.
- The Secretary of Interior, acting through the Commissioner for Reclamation, shall develop the appropriate cost share agreement in accordance with WIIN Section 4007 to ensure the necessary non-Federal funding is available to initiate construction.
- Prior to award of any construction contract or beginning construction activities, a ROD must be executed along with the necessary associated activities to support initiation of construction.
- Estimation of the economic (monetized) benefits of potential project accomplishments is subject to uncertainties associated with valuation methods and assumptions.

8.1.4 Federal Interest

For an action to be implementable, there must be federal interest in the action, and it must be technically, environmentally, economically, and financially feasible, as defined by the P&Gs. The NED Plan (Investor-Directed Storage Subalternative D under the Dam Raise Alternative) provides positive NED benefits for water supply. Reclamation's interest in the action is based upon the agency's mission "to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public." Implementing any of the plans would improve water supply reliability, and operational flexibility for SLDMWA. Federal interest is emphasized through the existing authorities described in preceding sections, including the WIIN Act, SOD Act, and CVPIA.

8.1.5 Environmental Review and Regulatory Requirements

Environmental review is documented in the EIR/SEIS. In summary, the subalternatives under the Dam Raise Alternative, including the Investor-Directed Storage Subalternative D, would implement a major construction action over multiple years, with similar water quality, air quality, greenhouse gas emissions, traffic condition, terrestrial resource, and cultural resource impacts. These impacts would occur within the San Luis Reservoir SRA. The impact area for the Dam Raise Alternative and subalternatives would take place in the same location, with the same equipment, and during the same construction period as the B.F. Sisk Dam SOD Modification Project but would require additional fill materials. The EIR/SEIS identifies mitigation actions to help reduce the severity of these impacts.

Federal, state, and local agencies with permitting or approval authority are expected to use the EIR/SEIS to make decisions or issue permits for an authorized project. Permits and consultations would be required with USACE, NMFS, USFWS, SHPO, DWR, CDFW, SWRCB, California Department of Parks and Recreation (CDPR), and local San Joaquin Valley Air Pollution Control District.

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Chapter 9 Recommendations

The overall recommendation of this Feasibility Report is that the Secretary of the Interior, acting through Reclamation, participate in funding and implementing the Dam Raise Alternative, including the environmental commitments and mitigation measures identified in the planned Final 2020 EIR/SEIS. The WIIN Act, Section 4007, provides authority for the Secretary of the Interior to (1) negotiate and enter into an agreement on behalf of the United States for the design, study, and construction or expansion of any federally owned storage project and (2) provide financial assistance up to an amount equal to not more than 50 percent of the total cost. The amended Safety of Dam Act, Section 5.B, provides authority for the Secretary of Interior to (1) determine additional project benefits are necessary and in the interest of the United States, (2) determine the project is consistent with the SOD Act, and (3) determine the project is feasible. This Feasibility Report documents the necessary information required for the Secretary of the Interior to render a determination of feasibility in accordance with the amended Safety of Dam Act and the WIIN Act, Section 4007, for pursing construction and funding the B.F. Sisk Dam Raise and Reservoir Expansion Project.

9.1 Summary of the Dam Raise Alternative Plan

The Dam Raise Alternative is a connected action to the B.F. Sisk Dam SOD Modification Project and includes placing additional fill material on the dam embankment to raise the dam crest an additional 10 feet above the 12-foot embankment raise under development by the B.F. Sisk Dam SOD Modification Project. In addition to the increase in dam embankment elevation, the Dam Raise Alternative would include (1) installation of downstream stability berms and crack filters, (2) raising the existing outlet works intake towers, access bridge, and spillway intake by 10 feet, and (3) implementing seismic upgrades and raising the SR 152 embankment that crosses Cottonwood Bay. The 10-foot embankment raise at B.F. Sisk Dam would support an increase in reservoir storage capacity of 130 TAF. The 10-foot increase in San Luis Reservoir's maximum surface elevation would inundate 445 acres of new land around the shore of the reservoir (when the reservoir is full). The newly inundated lands are public lands and would not require additional land acquisitions.

The use of the expanded storage capacity would vary under the different subalternatives. Under the CVP Only Storage subalternative use of the expanded capacity would consistent with CVP storage in the existing reservoir be directed by the Reclamation's Central Valley Operations Office. The use of the expanded storage capacity under the Investor Directed Storage Subalternatives would be primarily investor-directed by the SLDMWA investor group. Investors could forego delivery of their allocated CVP Project water for delivery in subsequent year(s). This unused CVP Project water would be carried over to subsequent year(s) and continue to be stored in San Luis Reservoir until the investor requests delivery of the water, without the risk of "spill." Carried-over water in the expanded capacity would be subject to evaporation at the same rate as CVP Project water stored in San Luis Reservoir. Investors would have first priority in storing carried-over water and non-Project water in the expanded storage without the risk of "spill." Under the subalternatives evaluated in this Final Feasibility Report, the upper target quantity of carried-over water in San Luis Reservoir would depending on the subalternative, be either 180 TAF or 310 TAF. Under the Investor Directed

Storage Subalternaitves, the delivery of the carried-over water and CVP Project water would be allocated proportionally among the SLDMWA investor group at varying proportions amongst agricultural, M&I, and refuge water users depending on the subalternative.

9.1.1 Costs and Benefits

The total most probable construction cost of the Dam Raise Alternative is estimated to be $922.1 million. Total annual costs, including capital, interest during construction, and O&M, would be $30.7 million over a 100-year period at a 2.75-percent discount rate and 2020 price level.

The Dam Raise Alternative subalternatives that demonstrates economic feasibility would all provide increased water supplies to M&I and agricultural users and some would also increase supplies to refuges. In addition, the Dam Raise Alternative would provide emergency water supplies and would provide for public safety by preventing inundation of the SR 152 roadway and reducing its current seismic risk. Water supplies provided would vary by subalternative and by year type.

The estimated range of the annual monetary benefit of the Dam Raise Alternative is $7.3 million to $45.3 million. The range of the net annual economic benefit is $7.3 million to $21.1 million. The annual monetary benefits and net annual economic benefits of all the configurations of the Dam Raise Alternative are presented in Chapter 5.

9.1.2 Cost Allocation and Assignment

Costs allocated to each purpose are assigned to federal taxpayers and project beneficiaries (reimbursable) based on the specific project authorization, existing federal law, existing cost-sharing requirements, and laws and objectives of non-Federal entities, including states, counties, and nonprofit organizations. Non-Federal partners are not seeking federal up-front financing in the form of reimbursable federal funding for the implementation of this project. Table 9-1 shows as an example, an estimate of most probable construction costs assigned to beneficiaries for each project purpose for the NED Plan (Investor-Directed Storage Subalternative D of the Dam Raise Alternative). Cost assignments for the other subalternatives identified in this feasibility report as economically feasible are presented in Appendix D.

Table 9-1. Initial Construction Cost Assignment for the NED Plan by Project Purpose – Most Probable Costs (million $)

Purpose/Action	Non-Federal Assigned Percentage	Cost	Federal Assigned Percentage	Cost	Total Cost
Emergency Water Supply	100%	$420.7	0%	$0.0	$420.7
M&I Water Supply	17%	$38.3	83%	$191.8	$230.2
Agricultural Water Supply	17%	$2.0	83%	$10.2	$12.2
Transportation Safety and Reliability	0%	$0.0	100%	$259.0	$259.0
Total	**50%**	**$461.1**	**50%**	**$461.1**	**$922.1**

Notes:
General: January 2020 price levels. Federal funding for the NED Plan will be provided via the WIIN Act, which limits federal funding participation at 50 percent of the total project cost.
Key:
M&I = municipal and industrial

NED = National Economic Development
WIIN = Water Infrastructure Improvements for the Nation

Table 9-2 presents as an example, an estimate of the annual OM&R costs assigned to beneficiaries for each project purpose for the NED Plan. OM&R cost assignments for the other subalternatives identified in this feasibility report as economically feasible are presented in Appendix D.

Table 9-2. Initial OM&R Cost Assignment for the NED Plan by Project Purpose (million $/year)

Purpose/Action	Non-Federal Assigned Percentage	Cost	Federal Assigned Percentage	Cost	Total Cost
Emergency Water Supply	100%	$0.44	0%	$0.00	$0.44
M&I Water Supply	100%	$0.24	0%	$0.00	$0.24
Agricultural Water Supply	100%	$0.01	0%	$0.00	$0.01
Transportation Safety and Reliability	100%	$0.00	0%	$0.00	$0.00
Total	**100%**	**$0.20**	**0%**	**$0.00**	**$0.20**

Notes:
Cost assignment for joint OM&R associated with NED Plan facilities was assigned as 100-percent non-Federal. For this alternative, no replacement costs are assumed to be incurred over the 100-year period of record. All values are rounded for display purposes; as a result, not all totals may sum.

Key:
M&I = municipal and industrial
OM&R = operations, maintenance, and replacement (no replacement costs are included)
NED = National Economic Development

9.1.3 Non-Federal Cost-Share Partner

SLDMWA is the non-Federal cost-share partner for preparation of this Feasibility Report.

9.1.4 Funding

The WIIN Act, Public Law 114-322, Section 4007 provides authority for the Secretary of the Interior to (1) negotiate and enter into an agreement on behalf of the United States for the design, study, and construction or expansion of any federally owned storage project and (2) provide financial assistance up to an amount equal to not more than 50 percent of the total cost.

9.1.5 Approval

If federal funding under the WIIN Act is recommended by the Secretary of the Interior and is provided by Congress, the project would proceed into preconstruction and construction phases that would include the following activities.

9.1.5.1 Preconstruction Phase

Preconstruction activities include:

- Further evaluate and define operational subalternative configurations identified in this Final Feasibility Report.
- Project cost share agreement

- Environmental and cultural compliance and permitting
- Data collection
- Initial design development and cost estimating
- Coordination with the B.F. Sisk Dam Safety of Dams (SOD) Project
- Coordination and outreach

9.1.5.2 Construction Phase

Construction activities will be performed in accordance WIIN Section 4011 (f)(2). Construction and operation of the authorized plan would be subject to the requirements of federal, state, and local laws, policies, and environmental regulations. SLDMWA or Reclamation (or both) would need to obtain various federal, state, and local permits and regulatory authorizations. A list of potential permits and approvals is included in the EIR/SEIS.

9.2 Federal Role

In coordination with SLDMWA, Reclamation would take a lead role in final design and construction of the Dam Raise project components. The federal government would have the following roles and responsibilities:

- Complete final level of design.
- Process the Final EIR/SEIS, complete all federal permitting, and prepare a ROD.
- Review water right permits and contractual agreements for project integration with the CVP and SWP to enhance reliability goals of the project proponents and overall system.
- Complete a post-authorization report.
- Enter into a preconstruction cost-sharing agreement with SLDMWA and subsequent construction cost estimates.
- Construct the new project facilities, including mitigation.
- Own, operate, and maintain the completed facilities.
- Provide budget and authorization.

9.3 Non-Federal Role

SLDMWA would coordinate with Reclamation on the funding, permitting, final design, and construction of project facilities. In coordination with Reclamation, SLDMWA would lead the coordination with Caltrans on the review of the SR 152 modification component of the Recommended Plan. SLDMWA would have the following roles and responsibilities:

- Complete Caltrans Project Report to support Caltrans authorization of the SR 152 modification components.
- As the lead for CEQA compliance, process and certify a Final EIR/SEIS.

- Adopt CEQA findings and approve the project.
- Coordinate with Reclamation on the implementation of CEQA mitigation requirements identified in the Mitigation, Monitoring, and Reporting Plan.
- Enter into a preconstruction cost-sharing agreement with Reclamation and subsequent construction cost estimates.

9.4 Recommendations

It is recommended that the Secretary of the Interior complete the following actions:

- Approve the Dam Raise Alternative Plan, as outlined in this report, and submit the following determinations to Congress, per Section 4007(b)(3) of WIIN:
  - Project is feasible and in accordance with Reclamation laws
  - Proportional share of the project's benefits are federal benefits
- Request that Congress fund up to 50 percent of the total project cost.
  - Request that Congress authorize Reclamation to increase the construction cost to allow for escalation from stated price levels (January 2020) to the notice to proceed for each contract or work package, based upon Reclamation's *Construction Cost Trends* publication or similar source.
- Authorize the Commissioner of the Bureau of Reclamation to enter into a cost-sharing agreement for the construction of the Dam Raise Alternative Plan.
- Request that Congress annually appropriate funds such that completed construction is accomplished within 8 years of construction authorization to avoid cost overruns and ensure timely completion.

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Chapter 10 References

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