Cover Sheet
Final Integrated Interim Feasibility Study and Environmental Impact Statement/Environmental Impact Report

South San Francisco Bay Shoreline Phase I Study
Santa Clara County, CA

The lead agency is the U.S. Army Corps of Engineers, San Francisco District, with the U.S. Fish and Wildlife Service as the co-lead under the National Environmental Policy Act (NEPA). The joint non-Federal sponsors include the Santa Clara Valley Water District (SCVWD) and the California State Coastal Conservancy (State Coastal Conservancy), having committed to contributing 50 percent of the Interim Feasibility Study cost in the form of cash and in-kind contributions. The SCVWD is the lead agency under the California Environmental Quality Act (CEQA).

Abstract: The study area has considerable risk for tidal flooding due to having large areas of low-lying terrain protected by non- engineered dikes. The flood risk substantially increases over the next several decades due to potential sea level change. In addition to flood risk, the past creation of commercial salt harvesting ponds along southern San Francisco Bay has resulted in a loss of most of the tidal salt marsh habitat within the Study Area. These local tidal marsh losses are in addition to San Francisco estuary-wide losses of approximately 90 percent of all tidal wetlands. The purpose of the Shoreline Study is to decrease flood risk, restore tidal marsh habitat, and maintain recreational opportunities.

The Recommended Plan (CEQA Proposed Project) is a Locally Preferred Plan and achieves the project purpose through construction of an engineered flood risk management (FRM) levee, restoration of Ponds A9-15 and A18, and recreation features. The FRM levee would be 15.2 feet (North American Vertical Datum of 1988 (NAVD 88)), along existing salt pond berms – the eastern border of Pond A12 and southern borders of Ponds A13, A16, and A18 (Alviso North alignment) west of Artesian Slough and the WPCP South alignment east of Artesian Slough. Additional flood risk management features include a flood gate for the Union Pacific Railroad crossing and a tide gate closure system at Artesian Slough. Restoration at Ponds A9–A15 and A18 will consist of breaching existing salt pond berms, guided by results of monitoring and adaptive management from other South Bay restoration, to establish tidal connection with San Francisco Bay. A 30:1 ecotone will be built adjacent to the FRM levee in Ponds A12/A13 and A18, which will provide transitional habitat for species. Recreation features include two pedestrian bridges, access to an unpaved trail on the FRM levee, connection of the new levee trail to the Bay Trail network, and viewing platforms, interpretive signs, and benches. The Recommended Plan was identified above the NED/NER plan based on the non-Federal sponsor's interest in providing greater flood risk management for FEMA accreditation over the 50 year study period, and additional transitional habitat. The non-Federal sponsor agrees to pay all costs above the NED/NER plan.

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South San Francisco Bay Shoreline Phase I Study

Final Integrated Document

Final Interim Feasibility Study with Environmental Impact Statement / Environmental Impact Report

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Elements marked with an asterisk (*) provide further detail on sections required for National Environmental Policy Act compliance.

Figures

Tables

Appendices

List of Terms

°F	Fahrenheit
$\mu g/m^3$	micrograms per cubic meter
AB	Assembly Bill
ABAG	Association of Bay Area Governments
ACE	Altamont Commuter Express (in reference to rail system only)
ACE	annual chance of exceedence (in reference to Flood Risk Management)
ACHP	Advisory Council on Historic Preservation
ACTC	Alameda County Transportation Commission
ADA	Americans with Disabilities Act
AEP	annual exceedance probability
AIRS	Aerometric Information Retrieval System
ALUC	Airport Land Use Commission
APCO	Association of Public Safety Communications Officials
APE	area of potential effects
ARB	(California) Air Resources Board
ASA(CW)	Assistant Secretary of the Army for Civil Works
ATR	Agency Technical Review
ATV	all-terrain vehicle
Authority	San Francisco Bay Restoration Authority
avg	average
BAAQMD	Bay Area Air Quality Management District
BACT	best available control technology
BART	(San Francisco) Bay Area Rapid Transit
Basin Plan	San Francisco Bay Region (Region 2) Water Quality Control Plan
BCDC	(San Francisco) Bay Conservation and Development Commission
BCR	benefit-to-cost ratio
BMP	best management practice
BO	Biological Opinion
BOD	biological oxygen demand
CAA	Clean Air Act
CAAA	Clean Air Act Amendments of 1990
CAAQS	California ambient air quality standards
Cal/EPA	California Environmental Protection Agency
Cal/OSHA	California Occupational Safety and Health Administration
Caltrans	California Department of Transportation
CARE	Community Air Risk Evaluation
CBC	California Building Standards Code
CCAA	California Clear Air Act
CCC	Central California Coast
CCMP	San Francisco Estuary Project Comprehensive Conservation and Management Plan
CCP	USFWS Comprehensive Conservation Plan
CCR	California Code of Regulations
CD	Consistency Determination

CDFW	California Department of Fish and Wildlife (formerly the California Department of Fish and Game)
CE/ICA	cost-effectiveness/incremental cost analysis
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CGS	California Geological Survey
CHAP	Combined Habitat Assessment Protocol
CHMIRS	California Hazardous Material Incident Report System
CHRIS	California Historical Resource Information System
CIP	capital improvement program
City	City of San José
CLUP	City of San José Comprehensive Land Use Plan
cm	centimeters
CMA	(Santa Clara County) Congestion Management Agency
CMP	Congestion Management Program
CNDDB	California Natural Diversity DataBase
CNEL	community noise equivalent level; average sound over a 24-hour period
CNPS	California Native Plant Society
CO	carbon monoxide
CO_2	carbon dioxide
COA	Code of Accounts
CPTED	Community Policing through Environmental Design
CRAM	California Rapid Assessment Model
CRF	Capital Recovery Factor
CRHR	California Register of Historic Resources
CRPR	California Rare Plant Rank
CSCC	California State Coastal Conservancy
CSSC	California Species of Special Concern (in reference to species' state listing)
CSVR	Content Structure Value Ratio
CTR	California Toxics Rule
CVRWQCB	Central Valley Regional Water Quality Control Board
CWA	Clean Water Act
CZMA	Coastal Zone Mgmt Act of 1974
dB	decibels
dBA	decibels on the A-weighted scale
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
District	USACE San Francisco District
Division	USACE South Pacific Division
DMMO	Dredged Material Management Office

DO	dissolved oxygen
DPS	Distinct Population Segment
DQC	District quality control
DTSC	Department of Toxic Substances Control
EB	eastbound
EC	Engineer Circular
EEC	(Don Edwards) Environmental Education Center
EFH	Essential Fish Habitat
EGM	Economic Guidance Memorandum
EIA	Economic Impact Area
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ENSO	El Niño Southern Oscillation
EO	Executive Order
EQ	Environmental Quality
ER	Ecosystem Restoration
ER	Engineer Regulation (in reference to USACE regulations only)
F/EIS	feasibility study/Environmental Impact Statement
FAA	Federal Aviation Administration
FC	Federal Candidate species
FCAR	Fish and Wildlife Coordination Act Report
FE	Federally listed as Endangered
FEMA	Federal Emergency Management Agency
FESA	Federal Endangered Species Act
FHWA	Federal Highway Administration
FIFRA	Federal Insecticide Fungicide Rodenticide Act
FINDS	Facility Index System
FMP	Fisheries Management Plan
FP	Protected under Federal law (Bald and Golden Eagle Protection Act)
FRDS	Federal Reporting Data System
FRM	flood risk management
FSM	Feasibility Scoping Meeting
FT	Federally listed as Threatened
FURS	Federal Underground Injection Control
General Plan	(City of San José's) General Plan
GHGs	greenhouse gases
GIS	geographic information system
gpd	gallons per day
H:V	horizontal: vertical
H_2S	hydrogen sulfide
HAB	Habitat Accounting and Appraisal
HAPs	hazardous air pollutants
HAZMAT	Hazardous Materials
HCB	hexachlorobenze
HCM	Highway Capacity Manual
HCP	(Federal) Habitat Conservation Plan

HQUSACE	(USACE Washington) Headquarters
HEP	Habitat Evaluation Procedures
HgS	mercury sulfide
HMBP	Hazardous Material Business Plan
HOV	high-occupancy vehicle
HRS	Hazard Ranking System
HSWA	Hazardous and Solid Waste Amendments of 1984
IDC	interest during construction
IEPR	Independent External Peer Review
in/sec	inches per second
Integrated Document	Shoreline Phase I Study Integrated Interim Feasibility Study and Environmental Impact Statement/Report
ISO	International Standards Organization
ISP	South Bay Salt Pond Restoration Plan Initial Stewardship Plan
ITP	Incidental Take Permit
ka	1,000 years before present
KEC	key ecological correlates
KEF	key ecological functions
kg	kilograms
L	liter
lb	pounds
L_{dn}	day-night noise level
LEDPA	least environmentally damaging project alternative
L_{eq}	equivalent continuous noise level
L_{max}	peak noise level
LOP	level of protection
LOS	level of service
LPP	locally preferred plan
LQGs	large-quantity generators
LRT	Valley Transportation Authority (VTA) Light Rail
LUST	Leaking Underground Storage Tank
Ma	one million years before present
MAM	monitoring and adaptive management
MAMP	Monitoring & Adaptive Management Plan
MBTA	Migratory Bird Treaty Act
MeHg	methylmercury
MFA	Moffett Federal Airfield
MFCMA	Magnuson-Stevens Fishery Conservation and Management Act
mg	milligrams
mg/L	milligrams per liter
mgd	million gallons per day
mhhw	mean higher high water
mhw	mean high water
mL	milliliters
MLLW	mean lower low water
MOA	Memorandum of Agreement

mph	miles per hour
MPN	most probable number
MTC	Metropolitan Transportation Commission
MTL	mean tide level
MTS	Metropolitan Transportation System
NAAQS	national ambient air quality standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAHC	Native American Heritage Commission
NASA	National Aeronautics and Space Administration
NAVD88	North American Vertical Datum of 1988
NB	northbound
NCCP	(California) Natural Community Conservation Plan
NCM	New Chicago Marsh
NED	National Economic Development
NEPA	National Environmental Policy Act
NER	National Environmental Restoration
NESHAP	national emissions standards for hazardous air pollutants (HAPs)
NFIP	National Flood Insurance Program
NFS	non-Federal sponsors
ng	nanograms
NGO	nongovernmental organization
NHI	Northwest Habitat Institute
NHPA	National Historic Preservation Act of 1966
NMFS	National Marine Fisheries Service
NO	nitric oxide
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent (NEPA)
NOP	Notice of Preparation (CEQA)
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NRC	National Research Council of the National Academies
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTR	National Toxics Rule
NTU	nephelometric turbidity units
NWI	National Wetland Inventory
NWRS	National Wildlife Refuge System
O&M	operations and maintenance
OES	(California) Office of Emergency Services
OMRR&R	operations, maintenance, repair, replacement, and rehabilitation
OPR	Office of Planning and Research
OSE	Other Social Effects
OSHA	Occupational Safety and Health Administration

P&G	Principles and Guidelines (for Water and Land Related Resources Implementation Studies)
PAH	polycyclic aromatic hydrocarbons
Pb	lead (metal and pollutant)
PBDE	polybrominated diphenyl ether
PCB	polychlorinated biphenyl
PCE	passenger-car trips
PCP	pentachlorophenol
pcpmpl	passenger cars per mile per lane
PCS	Permit Compliance System
PCX	USACE planning center of expertise
PDT	Project Delivery Team
PED	Preconstruction Engineering and Design
PEL	probable effects level
PFMC	Pacific Fishery Management Council
pg	picograms
PG&E	Pacific Gas and Electric Company
pH	power of Hydrogen; measure of hydrogen ion concentration
PM	particulate matter
PM_{10}	particulate matter 10 micrometers in diameter or less
PM_{25}	particulate matter 10 micrometers in diameter or less
PMP	Plant Master Plan
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
PPV	peak particle velocity
PRBO	Point Reyes Bird Observatory Conservation Science (now Point Blue Conservation Science)
PRC	Public Resources Code
RCRA	Resource Conservation and Recovery Act
RECONS model	Regional Economic System model
RED	Regional Economic Development
Refuge	Don Edwards San Francisco Bay National Wildlife Refuge
RMP	(San Francisco Bay) Regional Monitoring Program
RMS	root mean square
ROD	Record of Decision
ROG	reactive organic gases
SARA	Superfund Amendments and Reauthorization Act
SB	southbound
SBSP Restoration Project	South Bay Salt Pond Restoration Project
SCVWD	Santa Clara Valley Water District
SE	State-listed as Endangered
SEL	sound exposure level
SFBAAB	San Francisco Bay Area Air Basin
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SFEI	San Francisco Estuary Institute

Shoreline Phase I Study	South SF Bay Shoreline Feasibility Study – Phase I; Alviso Ponds subarea and EIA 11
Shoreline Study	South SF Bay Shoreline Feasibility Study – Authorized in 1976; multiple pond complexes and counties
SHPO	State Historic Preservation Officer
SIA	surface impoundments
SJFD	San José Fire Department
SLC	sea level change
SMBRPs	Site Mitigation and Brownfields Reuse Programs
SMHM	salt marsh harvest mouse (*Reithrodontomys raviventris*)
SO_2	sulfur dioxide
South Bay	South San Francisco Bay – located south of the San Mateo Bridge
SP	State fully protected species
SPCCP	Spill Prevention Control and Countermeasures Plan
SR	State Route
SSC	suspended solids concentrations
SSFBS	South San Francisco Bay Shoreline
ST	State-listed as Threatened
Stat	Statute
STIP	State Transportation Improvement Program
study area	Shoreline Phase I Study Area
SWEEPS	Statewide Environmental Evaluation and Planning System
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TACs	toxic air contaminants
TCP	tetrachlorophenol
the bay	San Francisco Bay
THg	total mercury
TMDL	Total Maximum Daily Load
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TSP	Tentatively Selected Plan
TSS	total suspended solids
UDV	Unit Day Value
UPRR	Union Pacific Railroad
URBEMIS	urban emissions software
USACE	U.S. Army Corps of Engineers
USC	U. S. Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
V/C	volume-to-capacity ratio
Vector Control District	(Santa Clara County) Vector Control District
vph	vehicles per hour
vphpl	vehicles per hour per lane

vpmpl	vehicles per mile per lane
VTA	(Santa Clara) Valley Transportation Authority
VTP	Santa Clara Valley Transportation Plan
Wastewater Facility	San José–Santa Clara Regional Wastewater Facility
WB	westbound
WDR	waste discharge requirement
WMUDS	Waste Management Unit Database System
WPCP	(San José/Santa Clara) Water Pollution Control Plant (now called the San José–Santa Clara Regional Wastewater Facility)
WQO	water quality objectives
WRDA	Water Resources Development Act
WRRDA	Water Resources Reform and Development Act
Year 0	USACE baseline year for the purposes of analysis under NEPA

S.0 Approach to the Final Integrated Document, Overview of Changes to This Final Integrated Document, and Executive Summary

S.1 Approach to the Final Integrated Document

This document is the *Final Integrated Interim Feasibility Study with Environmental Impact Statement/Environmental Impact Report* (EIS/EIR; identified collectively as the *Integrated Document*) for the South San Francisco Bay Shoreline Phase I Study revising the Draft Integrated Document circulated for public review in December 2014. Forty comment letters were submitted on the Draft Integrated Document, including those from:

- Seventeen Federal, State, and local agencies
- Two for-profit businesses (Cargill and PG&E)
- Twelve nongovernmental organizations
- Nine individuals

Prior to issuing a Final Integrated Document to the public, in June 2015, the U.S. Army Corps of Engineers (USACE; Federal sponsor), the Santa Clara Valley Water District (SCVWD; non-Federal sponsor), the California State Coastal Conservancy (State Coastal Conservancy; non-Federal sponsor), and the U.S. Fish and Wildlife Service (USFWS) prepared a draft Final Integrated Document.

The comments from public and internal agency review cycles fall into 15 primary categories, including questions and concerns regarding:

- Other options for levee alignments and/or tidal flood risk options that do not include a levee structure
- Portrayal of existing and future pedestrian trail systems in and adjacent to the Shoreline Phase I Study Area (study area)
- Loss of existing loop trails within the study area and the proposed additional trails
- Residual risk of tidal flooding after the proposed levee is constructed
- Level of analysis that was conducted on fluvial flood risk in the study area and for adjacent communities
- Potential for construction impacts to listed aquatic and terrestrial species as well as other resident and migratory bird species
- Availability of design details for specific project features (e.g., the tide gate closure system at Artesian Slough)
- Phasing of restoration actions in ponds following levee construction (including either bench or ecotone)
- Analysis of sea level change as it pertains to this study

- Hydrological and hydraulic analyses that were completed as part of the study
- Potential for future phases of the Shoreline Phase I Study outside Economic Impact Area 11 (EIA11)
- Potential impacts of the proposed construction activities on current San José–Santa Clara Regional Wastewater Facility (Wastewater Facility) activities and its plans for future upgrades (as proposed in the Wastewater Facility Plant Master Plan)
- Coordination with PG&E to allow continued operations and maintenance of facilities in the study area
- Relationship of this study to the South Bay Salt Pond Restoration Project (SBSP Restoration Project) and the geographically overlapping Monitoring and Adaptive Management Plans
- Federal and non-Federal sponsors' funding and long-term maintenance responsibilities for the various study features

Appendix I *Shoreline Phase I Integrated Document Comments and Responses* includes the comments and responses. The first subsection, Appendix I1 *Public Comments and Responses on Draft Integrated Document*, includes all comment letters from and responses to public agencies, nongovernmental organizations, and community members during the 60-day public draft review cycle. Appendix I2 *USACE Comments and Responses on Draft Integrated Document* includes comments that were received and responses made during the USACE's multiple review cycles for the Draft Integrated Document, including an Independent External Peer Review and a District Quality Control review, among others.

S.2 Overview of Changes to This Final Integrated Document

The major changes to this Final Integrated Document are described below and are primarily the result of the public and USACE review processes discussed in Section S.1 *Approach to the Final Integrated Document*.

S.2.1 Section 1025 of the Water Resources Reform and Development Act of 2014

The Draft Integrated Document stated that the USFWS would be responsible for implementing ecosystem restoration and recreation features on its lands. Since the release of the Draft Integrated Document, the USACE has developed implementation guidance for Section 1025 of the Water Resources Reform and Development Act (WRRDA) 2014, which outlines processing requirements that would allow the Secretary of the Army to recommend USACE implementation on Federal lands acquired through non-Federal funds. For this project, these requirements include a memorandum of understanding between the USFWS and the non-Federal sponsors, documentation of land acquisition by the non-Federal sponsors, and other documentation supporting USACE implementation.

As a result of this change in guidance, this Final Integrated Document has been updated to reflect construction of all levee and tidal restoration features (for Ponds A9–A15 and A18) as being recommended for and collectively undertaken by all project sponsors per signed sponsor cost-share agreements (Section 9.4 *Project Cost-Sharing Agreements*).

S.2.2 Selection of a 12.5-foot NAVD 88 Levee Height for the National Economic Development Plan

The Draft Integrated Document included a tentative National Economic Development (NED) levee height of 13.5 feet in the North American Vertical Datum of 1988 (NAVD 88) and stated that the height may change based on internal USACE review. The NED levee alignment and height is included in Alternative 2. The USACE has confirmed 12.5 feet NAVD 88 as the levee height for the NED Plan. The identification of the NED Plan does not affect the recommendation of the Locally Preferred Plan, which includes a levee height of 15.2 feet NAVD 88 but changes the Federal cost share toward the Recommended Plan.

All cost tables, map references, and supporting text has been updated to reflect this change for the NED levee and Alternative 2 within this Final Integrated Document. However, footprint impact estimates from construction, as well as supporting map calculations, which would only be reduced in size for Alternative 2 by a small proportion, have not been recalculated for this Final Integrated Document; therefore, actual impacts to species habitats for the NED (Alternative 2) are anticipated to be slightly lower under Alternative 2 than the estimates provided in this document.

S.2.3 Consolidation of Project Description and Additional Details for Tide Gate Closure System at Artesian Slough

Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* was refined to include all features touched on in other document sections for each of the alternatives that were carried through the environmental review process. This was done in an effort to consolidate the project description for National Environmental Policy Act (NEPA)/California Environmental Quality Act (CEQA) readers.

Regarding the Artesian Slough tide gate closure system, many of the concerns raised about the proposed tide gate closure system centered on potential impacts to discharge from the Wastewater Facility and obstruction of flows in the slough. It is recognized that little detail was provided in the Draft Integrated Document as to how the tide gate closure system would look and operate. Much of this detail still needs to be developed based on the technical discussions with City of San José staff as to how the Wastewater Facility is expected to operate in the future.

However, the basic premise of the tide gate closure system, which is to allow regular flows in Artesian Slough and its secondary channel while blocking extreme tides that could flood adjacent upland areas, has been further clarified in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* of this Final Integrated Document. In addition, an error in the Draft Integrated Document, which referred to the possibility of "seasonal closures" of the tide gate closure system, has been removed, and discussion has been clarified to limit planned closure or near-closure of the tide gate closure system at extreme tidal and storm events only.

S.2.4 Streamlined Executive Summary

The Executive Summary found in Section S.3 *Executive Summary* has been substantially shortened per comments from internal USACE reviewers. The summary now includes brief sections with overviews of the Shoreline Phase I Study background and purpose, as well as a definition of the project area itself, but primarily focuses on an overview of the Recommended Plan, including benefits, environmental considerations, costs, agency and public coordination efforts, residual risk, and the implementation schedule.

S.2.5 Addition of Annotated Outline in Chapter 1 *Study Information*

The USACE's Planning Modernization initiative under its Civil Works Transformation program requires the USACE to develop integrated feasibility reports and NEPA documents. Integrated documents have also been required by USACE South Pacific Division policy since 2010. In order to improve the readability and navigability of the integrated document, an annotated table of contents has been added to this Final Integrated Document (Section 1.1 *Organization of This Report*). This new section provides an overview of the information included in each chapter and indicates where to find information pertaining to the USACE planning process and the NEPA/CEQA process.

S.2.6 Status of Agency Coordination Efforts

Since the release of the Draft Integrated Document in December 2014, additional required agency consultation and coordination efforts have been completed and are briefly described in this section. The locations of referenced letters and documents that are included in the appendices to this Integrated Document are also provided.

S.2.6.1 Draft USFWS Refuge Compatibility Determination for Levee Construction on Don Edwards San Francisco Bay National Wildlife Refuge Lands

Provides issuance of a right-of-way to the SCVWD to allow project sponsors to construct, operate, and maintain an engineered flood risk management (FRM) levee along the footprint of the Recommended Plan that falls on Don Edwards San Francisco Bay National Wildlife Refuge (Refuge) lands (eastern side of Ponds A12/A13 and the southern border of Pond A16). Public review and comment were solicited on the draft Compatibility Determination for 30 days, which ended on July 8, 2015(Appendix B3 *Flood Risk Management Coordination with the USFWS*). The Compatibility Determination was signed on September 4, 2015.

S.2.6.2 USFWS Biological Opinion

When the USFWS drafted the Biological Opinion (BO), it was necessary to draft separate BOs for USACE restoration efforts on the City of San José's lands (Pond A18) and USFWS restoration actions on USFWS lands (Ponds A9–A15) because implementation guidance for Section 1025 of WRRDA had not yet been released. Both BOs can be found in Appendix B8 *Endangered Species Act Compliance* and were received on April 27, 2015. Both BOs identified the same avoidance and minimization measures specific to listed species that may be present in the study area, as well as some conservation recommendations; all measures and recommendations have been incorporated into the Integrated Document and are listed in Section 4.6 *Aquatic Biological Resources* and/or Section 4.7 *Terrestrial Biological Resources*.

S.2.6.3 National Marine Fisheries Service Section 7(a)(2) Concurrence Letter and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

Similar to the USFWS BOs, the National Marine Fisheries Service (NMFS) Concurrence Letter was drafted assuming separate USACE (Pond A18) and USFWS (Ponds A9–A15) implementation of restoration actions; in both cases, the NMFS concurred with the USACE's and the USFWS's determination that the Recommended Plan was not likely to adversely affect Endangered Species Act–listed fish and designated critical habitat. Both BOs can be found in Appendix B8 *Endangered Species Act Compliance* and were received on May 19, 2015.

Under the Magnuson-Stevens Act, the NMFS determined that the proposed plan would adversely affect Essential Fish Habitat (EFH). However, the NMFS acknowledged that the effects would be localized and would be temporary and minimal in nature and that, in the long term, the proposed actions would benefit EFH by restoring tidal connectivity and creating tidal marsh in South San Francisco Bay. Therefore, the NMFS had no practical EFH Conservation Recommendations to avoid or reduce the magnitude of effects.

S.2.6.4 Regional Water Quality Control Board Letter of Support

Letter of Support was dated July 13, 2015.

S.2.6.5 Federal Aviation Administration Coordination Letter

In a letter dated May 21, 2015, the Federal Aviation Administration (FAA) requested evaluation of the "separation distance between the Air Operations Areas (nearest point of the runway) of these airports (Norman Y. Mineta San José International Airport and Moffett Federal Airfield) and the proposed habitat improvements for each alternative described in the EIS" (Appendix B9 Pertinent Correspondence). Where any project alternatives fall within 5 miles of these airports, the FAA would like an evaluation of the potential impacts to aircraft operations that could be caused by wildlife moving into or across approach or departure airspace. This Final Integrated Document includes an alternatives evaluation and of potential impacts in Chapter 4.14 Public Health and Aviation.

S.2.6.6 USACE Regulatory Process Documentation: Clean Water Act Section 404(b)(1)

Section 404 of the Clean Water Act (CWA) regulates placement of dredged or fill material into waters of the United States (Title 33, United States Code, Section 1344) and requires permits for these activities. A 404(b)(1) Evaluation was prepared and is located in Appendix B10.

S.2.6.7 USFWS Coordination Act Report

The Final Coordination Act Report was received on July 22, 2015 and is included in Appendix B7*:USFWS Coordination Act Report under the Fish and Wildlife Coordination Act.*

S.2.6.8 Change of Base Year and Period of Analysis

The Base Year, the year when it is assumed that project features would be functional and providing benefits, is 2021. Benefits and costs presented in this report were developed based upon a Base Year of 2017. This year was established early on in the study process when this year was deemed realistic/feasible and was used in the coastal and economic modeling. In reality, given funding and construction timelines, the year in which flood risk management benefits would be realized is more likely closer to 2021. A sensitivity analysis was conducted to determine whether NED Plan identification would be impacted by changing the Base Year. The 50-year period of damages/benefits/costs used to derive estimates of equivalent annual benefits, costs and net benefits were shifted to start from 2021 instead of 2017. The results showed generally uniform increases in damages, benefits and net benefits within each SLC scenario (ranging from about 5 percent under the low SLC scenario to about 13% under the high SLC scenario). This analysis showed that the NED Plan identification and selection of the Recommended Plan were not sensitive to such a change. Further, updating and revising the engineering and economic results to reflect the shifted period of analysis would take significant time, effort and cost. Therefore, the economic analysis and appendix were not revised based upon the updated base year and period of analysis.

S.2.6.9 Explanation of Price Levels

The costs shown in Chapter 3 of the Integrated document, Table 3.3-1 to Table 3.6-6 are presented at October 2013 price levels. These are planning level costs developed in fiscal year 2014 used to evaluate and compare alternatives to identify the NED/NER and LPP FRM and ecosystem restoration plans. Table 3.7-2 through Table 3.10-2 are presented at October 2014 price levels. These costs reflect updated and refined costs, incorporating a full cost and schedule risk analysis. They were used to evaluate and compare the Combined NED/NER and LPP/Recommended Plans at current price levels (in effect at the time of the Final Report submittal). The Total Project First Costs as presented in Chapter 9 (Findings and Recommended Plan), reflect the costs from the Total Project Cost Summary (TPCS) certified by the Cost Estimating Mandatory Center of Expertise and are presented at October 2015 price levels. These costs will serve as the basis for project authorization, which is anticipated in fiscal year 2016.

S.3 Executive Summary

This Final Integrated Document evaluates the Federal interest in implementing a multi-objective tidal flood risk management, ecosystem restoration, and recreation project along South San Francisco Bay in northern California. This report presents a description of existing and expected future conditions of resources related to these project purposes, formulation and evaluation of plans considered to address associated water resources–related needs in the region, analysis of the environmental effects of the Recommended Plan, project costs, and implementation issues. Throughout the report, the term *Phase I* is used in reference to the Recommended Plan because this interim feasibility study was prepared in partial response to the original study authority and it is anticipated that future interim feasibility studies will be prepared to address other geographic areas covered by the study authority, potentially resulting in the recommendation of future project phases.

S.3.1 Purpose and Need

The purpose of the South San Francisco Bay Shoreline Project is (1) to provide a higher level of tidal flood risk resiliency throughout the community of Alviso within the city of San José, California, as well as unincorporated parts of Santa Clara County, California; (2) to provide increased ecosystem functions within existing salt ponds through the restoration of tidal marsh and transitional habitats; and (3) to provide recreational opportunities associated with the restored habitat.

There is considerable risk for tidal flooding caused by having large areas of low-lying terrain that are bordered by severely degraded non-engineered dikes that were originally designed and constructed for commercial salt ponds. The dikes, which were created as early as the 1920s, were generally maintained to protect the salt pond production from tidal flooding. Currently, much of the land south of the ponds is urbanized, including much of Silicon Valley, transportation corridors, wastewater treatment plants, and other critical infrastructure. Sea level change is expected during the planning horizon for this study, and this change would exacerbate risks from tidal flooding caused by higher waters stressing the dikes. Further, there is a high probability of failure for the existing non-engineered dike system. The system was created to support commercial salt production, and it is inadequate to provide reliable tidal FRM for the urbanized areas south of the ponds.

In addition to the increased tidal flood risk, the area has lost substantial amounts of coastal wetlands. In the study area (Section S.3.3 *Study Area*), the creation of commercial salt-harvesting ponds along southern San Francisco Bay eliminated most of the tidal salt marsh habitat. These local tidal marsh losses are in addition to San Francisco Bay estuary-wide losses of approximately 90 percent of all tidal wetlands.

In 2002, the State of California and the Federal government purchased a large number of these commercial salt ponds, thereby creating an opportunity for large-scale tidal marsh restoration. The salt ponds in the project area (Ponds A9 through A15 and A18) currently have some tidal flows due to controlled water control structures. These structures restrict flows which greatly reduces sedimentation. The structures also inhibit drainage so that tidal marsh vegetation does not develop. In restoring the ponds to tidal wetlands, which would allow tidal water flow to freely enter and drain, the sediment builds up, thus allowing the pond bottom to raise high enough to drain completely during low tides, resulting in marsh vegetation.

In response to these concerns and opportunities, the USACE, the SCVWD, and the State Coastal Conservancy initiated the study in September 2005 to evaluate alternatives for tidal FRM, ecosystem restoration, and recreation.

S.3.2 Authority

This Integrated Document is being prepared in response to multiple congressional actions, the first of which occurred in 1976 when the San Francisco Bay Shoreline Study was authorized by Congress through Section 142 of the Water Resources Development Act of 1976 (WRDA; Public Law 94-587):

> The Secretary of the Army, acting through the Chief of Engineers, is authorized and directed to investigate the flood and related problems to those lands lying below the plane of mean higher high water along the San Francisco Bay shoreline of San Mateo, Santa Clara, Alameda, Napa, Sonoma and Solano Counties to the confluence of the Sacramento and San Joaquin Rivers with a view toward determining the feasibility of and the Federal interest in providing protection against tidal and fluvial flooding. The investigation shall evaluate the effects of any proposed improvements on wildlife preservation, agriculture, municipal and urban interests in coordination with Federal, State, regional, and local agencies with particular reference to preservation of existing marshland in the San Francisco Bay region.

A resolution adopted by the Committee on Transportation and Infrastructure of the U.S. House of Representatives on July 24, 2002, requested review of the 1992 Letter Report for the San Francisco Bay Shoreline Study, California (Docket 2697):

> Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, that the Secretary of the Army is requested to review the Final Letter Report for the San Francisco Bay Shoreline Study, California, dated July 1992, and all related interims and other pertinent reports to determine whether modifications to the recommendations contained therein are advisable at the present time in the interest of tidal and fluvial flood damage reduction, environmental restoration and protection and related purposes along the South San Francisco Bay shoreline for the counties of San Mateo, Santa Clara and Alameda, California.

Section 4027 of the WRDA of 2007 also authorized the South San Francisco Shoreline Study and provided direction on crediting non-Federal sponsor work and acquisition of real estate:

> (a) IN GENERAL.—The Secretary, in cooperation with non-Federal interests, shall conduct a study of the feasibility of carrying out a project for—
>
> (1) flood damage reduction along the South San Francisco Bay shoreline, California;
>
> (2) restoration of the South San Francisco Bay salt ponds (including on land owned by other Federal agencies); and
>
> (3) other related purposes, as the Secretary determines to be appropriate.

(b) REPORT.—

(1) IN GENERAL.—Not later than 3 years after the date of enactment of this Act, the Secretary shall submit to Congress a report describing the results of the study under subsection (a).

(2) INCLUSIONS.—The report under paragraph (1) shall include recommendations of the Secretary with respect to the project described in subsection (a) based on planning, design, and land acquisition documents prepared by-

(A) the California State Coastal Conservancy;

(B) the Santa Clara Valley Water District; and

(C) other local interests.

(c) CREDIT.—

(1) IN GENERAL.—In accordance with section 221 of the Flood Control Act of 1970 (42 U.S.C. 1962d-5b), and subject to paragraph (2), the Secretary shall credit toward the non-Federal share of the cost of any project authorized by law as a result of the South San Francisco Bay shoreline study—

(A) the cost of work performed by the non-Federal interest in preparation of the feasibility study that is conducted before the date of the feasibility cost sharing agreement; and

(B) the funds expended by the non-Federal interest for acquisition costs of land that constitutes a part of such a project and that is owned by the United States Fish and Wildlife Service.

(2) CONDITIONS.—The Secretary may provide credit under paragraph (1) if—

(A) the value of all or any portion of land referred to in paragraph (1)(B) that would be subject to the credit has not previously been credited to the non-Federal interest for a project; and

(B) the land was not acquired to meet any mitigation requirement of the non-Federal interest.

Lastly, Section 1025 of the WRRDA of 2014 provides discretionary authority to the Secretary to carry out authorized water-resource-development projects on other Federal lands under certain conditions:

Sec. 1025. WATER RESOURCES PROJECTS ON FEDERAL LAND

(a) IN GENERAL.—Subject to subsection (b), the Secretary may carry out an authorized water resources development project on Federal land that is under the administrative jurisdiction of another Federal agency where the cost of the acquisition of such Federal land has been paid for by the non-Federal interest for the project.

(b) MOU REQUIRED.—The Secretary may carry out a project pursuant to subsection (a) only after the non-Federal interest has entered into a memorandum of understanding with the Federal agency that includes such terms and conditions as the Secretary determines to be necessary.

(c) APPLICABILITY.—Nothing in this section alters any non-Federal cost-sharing requirements for the project.

S.3.3 Study Area

The study area (Figure S.3-1 *Alviso Pond Complex and Shoreline Phase I Study Area* and Figure S.3-2 *Shoreline Phase I Plan Formulation Process*) is located in Santa Clara County, California, along the southern shoreline of San Francisco Bay between Alviso Slough and Coyote Creek. It includes a portion of the Alviso salt ponds complex and the Refuge, the community of Alviso, and the Wastewater Facility. The study area includes areas where tidal FRM actions may be implemented (based on the 0.2-percent annual chance of exceedance floodplain) and former salt ponds owned by the U.S. Fish and Wildlife Service (USFWS) (Ponds A9–A15) and by the City of San José (Pond A18).

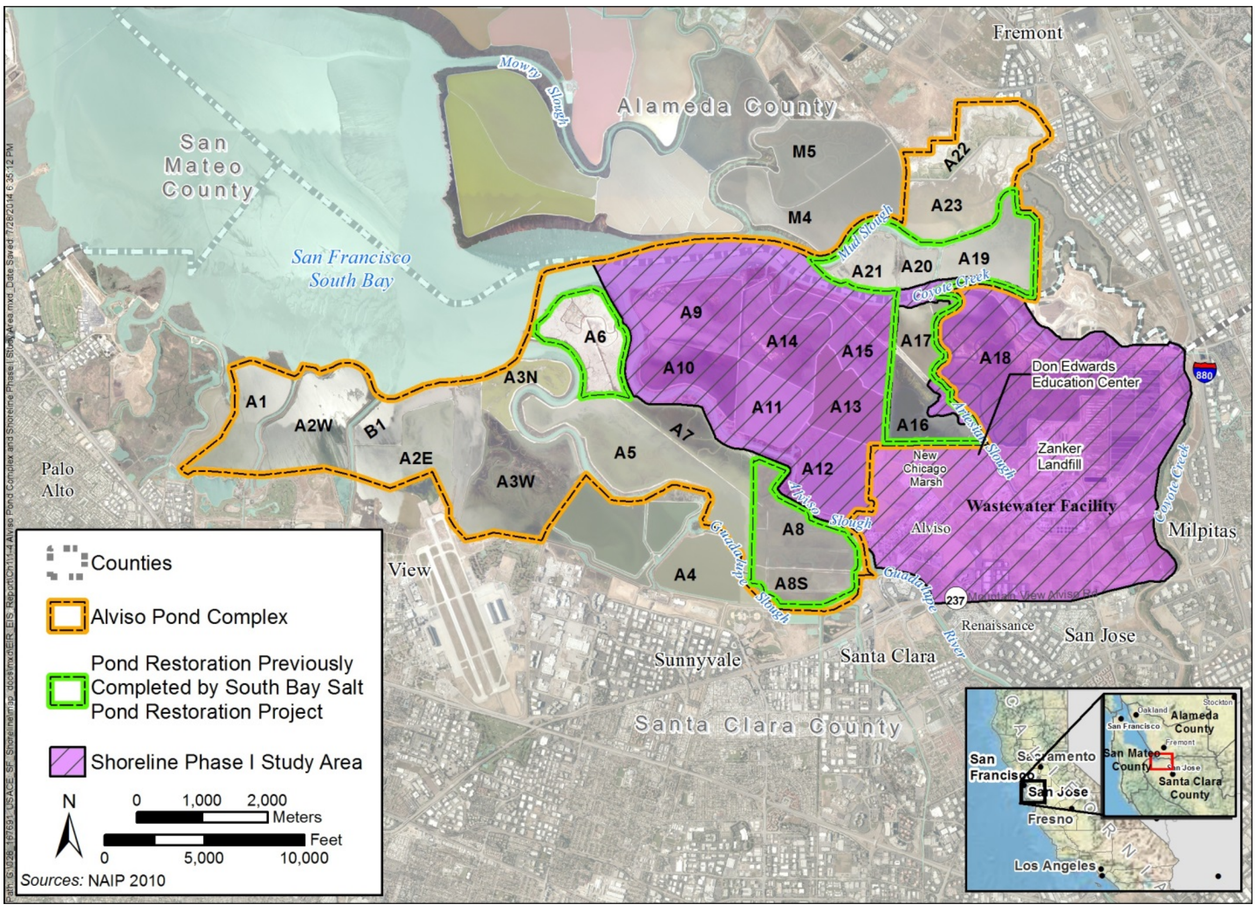

Figure S.3-1. Alviso Pond Complex and Shoreline Phase I Study Area

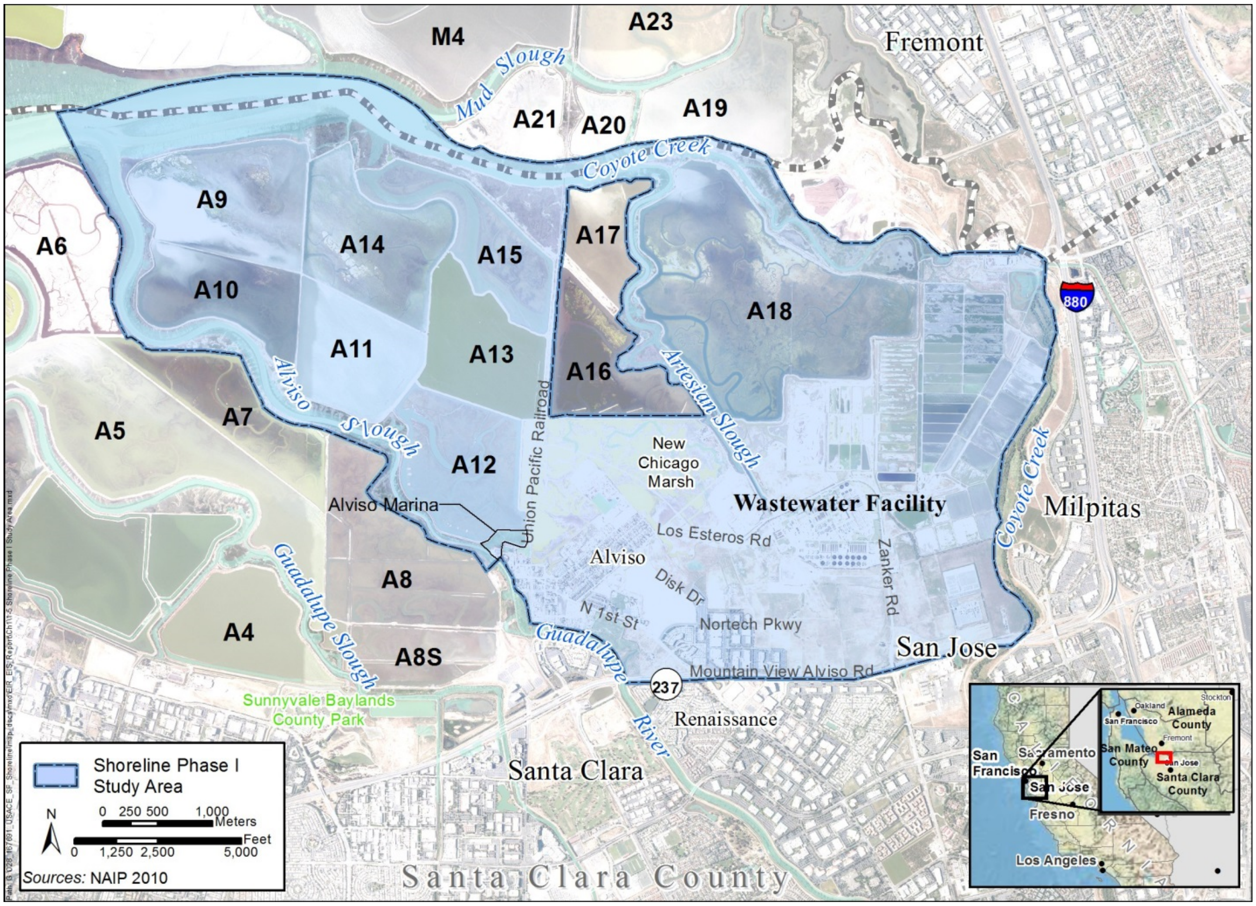

Figure S.3-2. Shoreline Phase I Plan Formulation Process

S.3.4 Prior Flood Risk Management Projects

There have been numerous studies, reports, and projects relating specifically to the study area. This section briefly describes other projects that resulted in FRM improvements.

S.3.4.1 Coyote and Berryessa Creeks Project

This project constructed channel improvements to contain flood flows up to the 1-percent annual chance of exceedance (ACE) event, thereby reducing future flood risk to public and private property from fluvial (riverine) flooding. The Lower Coyote Creek element of the Coyote and Berryessa Creeks Project extends approximately 7 miles along Coyote Creek from the confluence of Coyote Creek and the Coyote Slough at the southern tip of San Francisco Bay to the Montague Expressway in the cities of San José and Milpitas.

Reach 1 of the Lower Coyote Creek project portion included construction of an engineered levee on bay mud across a small part of the eastern side of Pond A18. The severed portion of the pond adjacent to Coyote Creek was then breached and opened to tidal action.

S.3.4.2 Guadalupe River Project

Construction of the downtown reach of the Guadalupe River Project from the Alviso County Marina Park to Interstate 280 (I-280) was completed in the summer of 2005. This project was constructed to (1) provide 1-percent ACE FRM for downtown San José's technology and commercial industries and adjacent residential neighborhoods; (2) protect and improve water quality of the river; (3) preserve and enhance the river's habitat, fish, and wildlife; and (4) provide recreational and open space opportunities.

The Upper Guadalupe River Project will provide 1-percent ACE FRM, enhance fishery and wildlife habitat, and facilitate construction of future trails by the City of San José from I-280 to Blossom Hill Road.

S.3.5 Alternative Plans and the Recommended Plan

USACE planning goals include enhancing ecological values, economic values, and social well-being. These goals were considered during the formulation of alternative plans, and project-specific objectives and constraints were established to evaluate the plans. In general, FRM objectives addressed both public safety and economic consequences of tidal flooding, ecosystem restoration objectives focused on restoring tidal marsh structure and function, and recreation objectives related to expanding recreational opportunities associated with the future restored habitat. Fluvial flood risk, from both Guadalupe River and Coyote Creek, has been addressed by other local and Federal projects.

The plan formulation strategy consisted of multiple phases where tidal FRM and ecosystem restoration options were initially separately identified, evaluated, and screened (Figure S.3-3 *Shoreline Phase I Plan Formulation Process*) and then considered in combination with recreation measures.

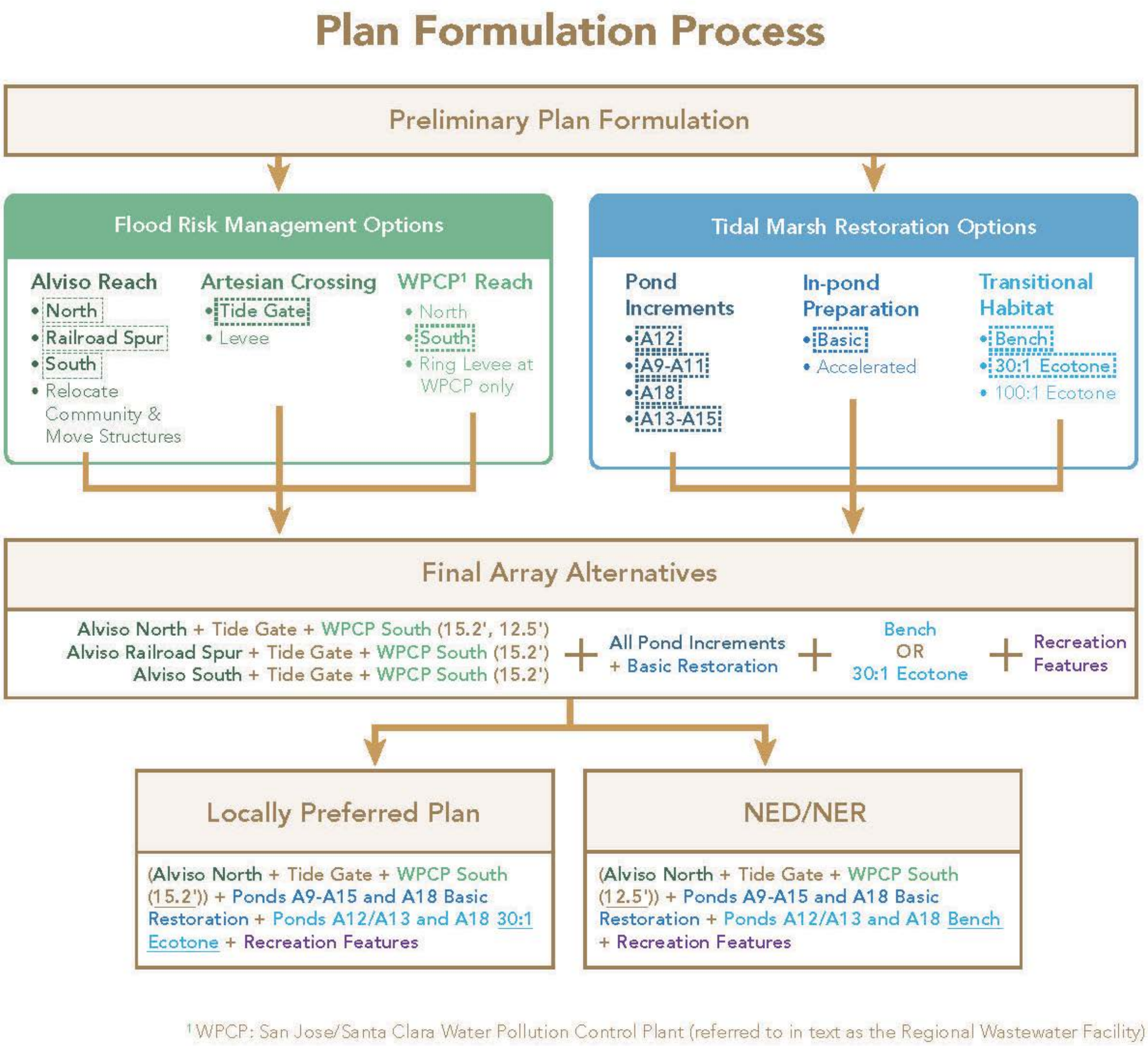

Figure S.3-3. Shoreline Phase I Plan Formulation Process

The initial screening process involved considering the potential costs, benefits, and impacts of each option and applying evaluation criteria (effectiveness, efficiency, acceptability, and completeness) defined by the 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (1983 Principles and Guidelines). The initial process identified the Federal investment (represented by the National Economic Development [NED] option for tidal FRM and the National Ecosystem Restoration [NER] option for ecosystem restoration) and informed the development of the final array of alternatives for more-detailed evaluation.

The result of the final array analysis was the identification of the combined NED/NER Plan representing the Federal investment (basis for Federal cost sharing) and the recommendation of a second plan (a Locally Preferred Plan or LPP) for congressional authorization.

The tidal FRM options included potential levee alignments at heights ranging from 10 feet to 15.2 feet using the NAVD 88 to the east and west of Artesian Slough, with measures for crossing the slough (Figure S.3-4 *Flood Risk Management Options*). Also considered was a nonstructural option of relocating structures within the community of Alviso and constructing a ring levee around the Wastewater Facility. The screening process for tidal FRM involved considering potential environmental impacts and comparing the benefits and costs of each option to eliminate any inefficient options (i.e., benefits do not exceed the costs).

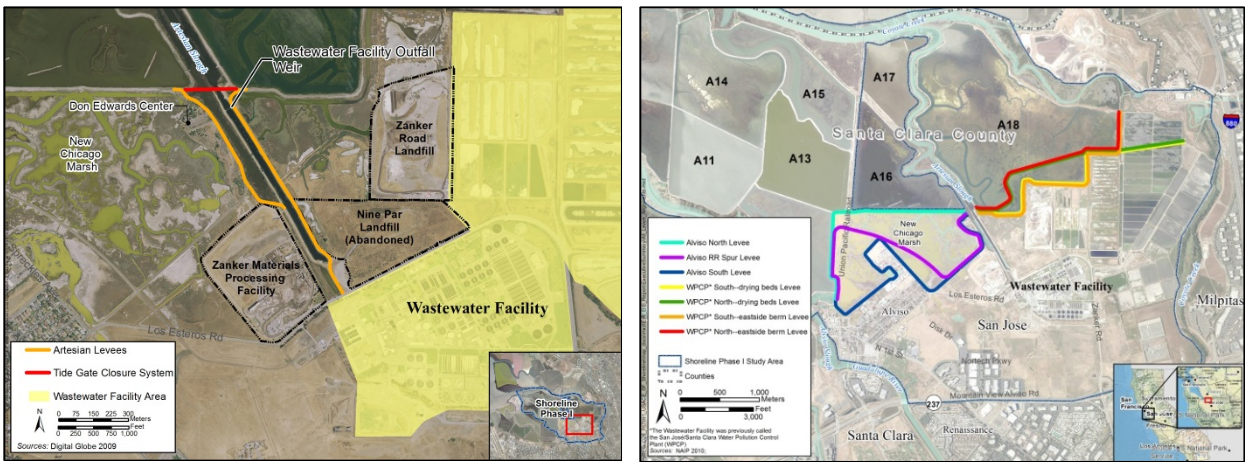

Figure S.3-4. Flood Risk Management Options

The tidal flood risk analysis considered three different rates of sea level risk during the 50-year period of analysis[1] (2017 to 2067) corresponding to an increase of 0.51 foot, 1.01 feet, and 2.59 feet under the USACE "low," "intermediate," and "high" scenarios, respectively. The USACE "high" scenario is consistent with the State of California's requirements.

As a result of the screening process, the nonstructural option was eliminated due to its costs exceeding its potential benefits, and several levee alignments to the east of Artesian Slough were eliminated due to potential environmental impacts (both "Water Pollution Control Plan [WPCP] North" options and the "WPCP South – drying beds" option). One option for crossing the slough ("Artesian levees") was also eliminated.

As required by USACE process, the option that maximizes net benefits over costs was identified as the NED Plan, representing the Federal investment. This option consists of a levee alignment including the "Alviso North" and "WPCP South – eastside berms" sections at a height of 12.5 feet NAVD 88 and a tide gate closure system crossing Artesian Slough. Additional levee alignments west of Artesian Slough ("Alviso RR Spur" and "Alviso South") and a second height (15.2 feet NAVD 88) were selected for further analysis in the final array of

[1] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

alternatives based on input from the non-Federal sponsors, the USFWS, and the public involvement process (Table S.3-1 *Final Array of Alternatives*). Each of the Alviso levee segment options includes a flood gate where it crosses the Union Pacific Railroad tracks. In addition, nonstructural measures were identified for local implementation under all alternatives; these include relocating critical utilities, emergency education for the public, establishing evacuation and flood-response plans, managing disease vectors (e.g., mosquitos), and establishing a local flood warning system.

Table S.3-1. Final Array of Alternatives

Alternatives		Tidal Flood Risk Management			Ecosystem Restoration	
Alt. No.	Summary	Alignment	Levee Height (feet NAVD 88)	Transitional Habitat	In-pond Preparation	Transitional Habitat
1	No Action – No FRM or ecosystem restoration features	None	N/A	None	None	None
2	Alviso North, Artesian Slough Tide Gate, flood gate at UPRR crossing, WPCP South with 12.5-foot levee and bench + Restoration of Ponds A9–A15 and A18	North	12.5	50-foot-wide bench	Basic	N/A
3	Alviso North, Artesian Slough Tide Gate, flood gate at UPRR crossing, WPCP South with 15.2-foot levee and 30:1 ecotone + Restoration of Ponds A9–A15 and A18	North	15.2	N/A	Basic	Ecotone with 30:1 side slopes
4	Alviso Railroad, Artesian Slough Tide Gate, flood gate at UPRR crossing, WPCP South with 15.2-foot levee and bench + Restoration of Ponds A9–A15 and A18	Railroad Spur	15.2	50-foot-wide bench	Basic	N/A
5	Alviso South, Artesian Slough Tide Gate, flood gate at UPRR crossing, WPCP South with 15.2-foot levee and bench + Restoration of Ponds A9–A15 and A18	South	15.2	50-foot-wide bench	Basic	N/A

Alt. No. = alternative number; WPCP = Water Pollution Control Plant (now referred to as the San José–Santa Clara Regional Wastewater Facility in text); N/A = not applicable; UPRR = Union Pacific Railroad

All action alternatives include the same recreation features: Artesian Slough and Union Pacific Railroad pedestrian bridges; access to levee maintenance road that follows east side of Pond A12 and south side of Ponds A13 and A16 (i.e., either the Alviso North levee for Alternatives 2 or 3, or the existing berms with bench added for Alternatives 4 or 5); access to levee maintenance road that follows the new proposed WPCP South levee segment; Bay Trail connection at east end (Coyote Creek) and Marina connection at west end; and viewing platforms, benches, and signs.

The ecosystem restoration options included varying scales of pond groupings, in-pond preparation prior to phased breaching to restore tidal action, and transitional habitat. The potential benefits of these options were calculated using the Combined Habitat Assessment Protocol (CHAP) and were compared with estimated costs using a cost-effectiveness/ incremental cost analysis. As a result of this assessment, the Federal investment in ecosystem restoration (NER Plan) was identified as including all ponds using a "basic" level of in-pond preparation prior to phased breaching and as including a "bench" transitional habitat features.

The non-Federal sponsors requested that the ecotone transitional habitat feature be included in some of the plans within the final array of alternatives.

The tidal FRM and ecosystem restoration options that were retained after the initial screening process were then combined with recreation measures to formulate a final array of multipurpose plans (Table S.3-1 *Final Array of Alternatives*). The recreation features included in all of the final array plans are two pedestrian bridges; along the Alviso section of the new proposed FRM levee, an unpaved area on top of the levee that will be accessible as a pedestrian trail (Alternatives 2 or 3) or the same footprint but along existing berm with proposed bench addition (Alternatives 4 or 5); along the WPCP section of the new proposed FRM levee, an unpaved area on top of the levee that will be accessible as a pedestrian trail; trail connections to the existing Coyote Creek trail and to the Alviso Marina (both of which would facilitate connecting to the Bay Trails network); a multi-use (paved) trail along State Route 237 (100% non-Federal sponsor funded) that could be used by pedestrians and bicyclists; and viewing platforms, interpretive signs, and benches along existing and new trail segments in the Refuge.

Alternative 2 [Figure S.3-5 *NED/NER Plan (Alternative 2)*] was identified as the NED/NER Plan after comparing final array alternative plan benefits, costs, and environmental impacts and applying other criteria (including those defined by the 1983 Principles and Guidelines). The NED/NER Plan establishes the maximum level of Federal cost sharing in the implemented project and is the default recommendation in USACE projects. The NED/NER Plan includes the Alviso North levee alignment and WPCP South levee alignment with a 12.5-foot NAVD 88 levee height and a total levee length of approximately 4 miles with a flood gate at the Union Pacific Railroad tracks and a tide gate closure system across Artesian Slough.

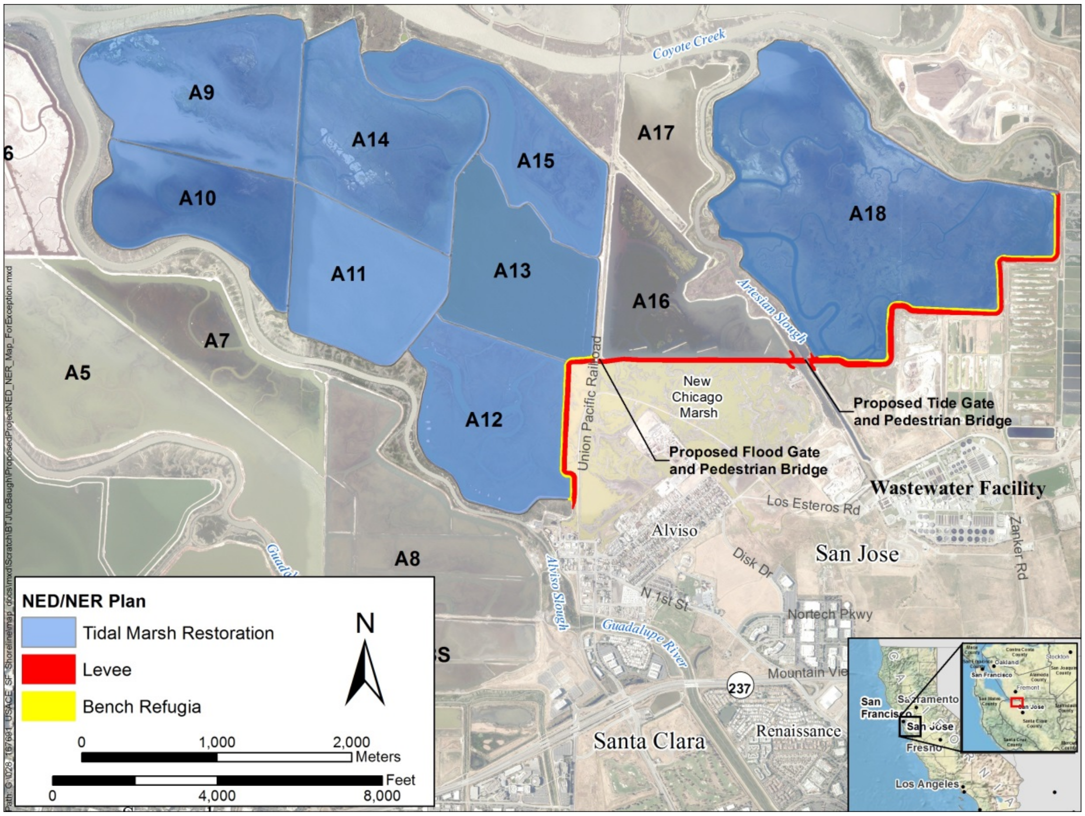

Figure S.3-5. NED/NER Plan (Alternative 2)

The plan also includes phased restoration of Ponds A9–A15 (owned by the USFWS) and Pond A18 (City of San José lands) with a bench as part of the levee construction but resulting in incidental transitional habitat. Also included as recreation features are pedestrian bridges crossing the Union Pacific Railroad tracks and Artesian Slough, viewing platforms and benches adjacent to the restored tidal marsh, and signs. The FRM levee would also be accessible to the public for recreational purposes.

The non-Federal sponsors, in consideration of local tidal FRM objectives and additional ecosystem restoration opportunities, have requested the recommendation of a LPP, Alternative 3 [Figure S.3-6 *Locally Preferred Plan (Alternative 3)*], which also meets USACE policy requirements. The Recommended Plan differs from the NED/NER Plan with respect to two features: (1) the levee is higher (15.2 feet NAVD 88 for the LPP versus 12.5 feet NAVD 88 for the NED/NER Plan) and (2) the LPP includes a larger ecotone transition zone for Ponds A12/A13 and A18, while the NED/NER Plan includes a bench.

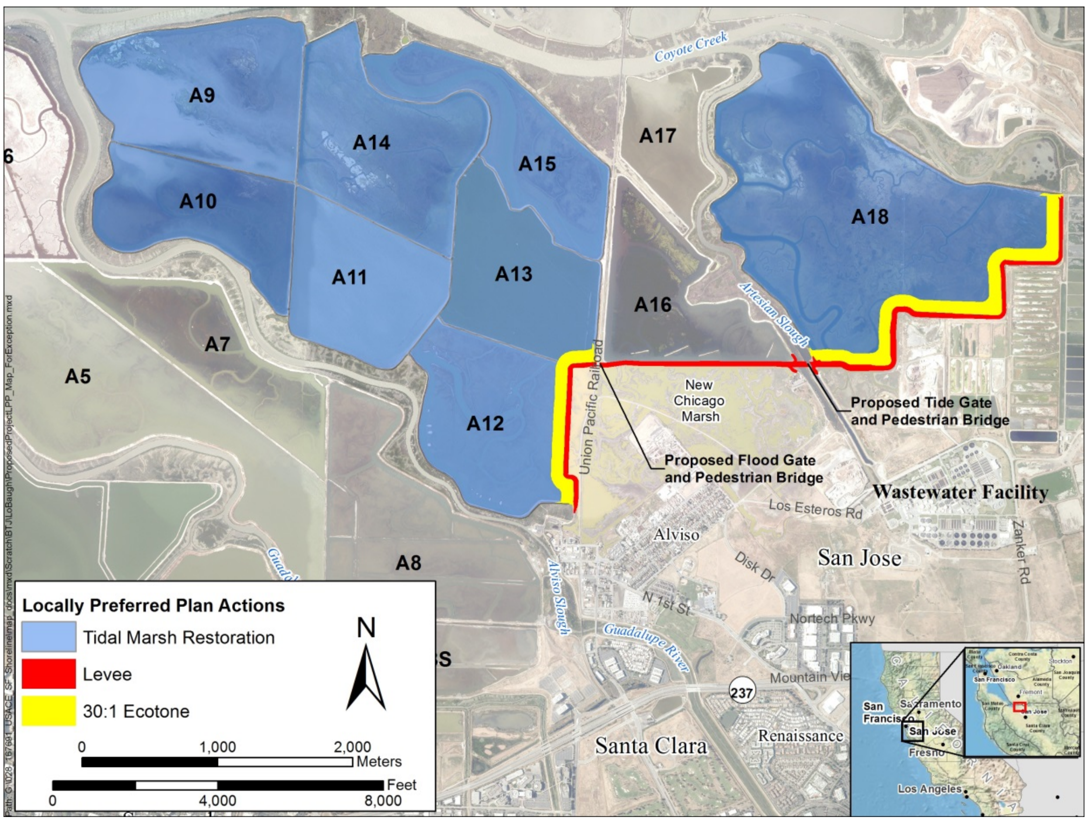

Figure S.3-6. Locally Preferred Plan (Alternative 3)

The LPP levee height was requested by the non-Federal sponsors in order to meet local requirements for FRM in Santa Clara County and to allow continued Federal Emergency Management Agency (FEMA) accreditation at the end of the study's period of analysis (the year 2067). The footprint of the LPP would be approximately 10 feet wider than the footprint of the NED/NER Plan to accommodate the additional levee height.

In order to recommend the LPP for congressional authorization, the Secretary of the Army for Civil Works [ASA(CW)] approved an exception to the policy of recommending the NED/NER Plan on August 24, 2015. Furthermore, per Section 1025 of WRRDA 2014, in order to include actions recommended on USFWS lands, the ASA(CW) must approve this recommendation, and the non-Federal sponsor and the USFWS must sign a memorandum of understanding.

S.3.6 Benefits of the Recommended Plan and Comparison with the NED/NER Plan

S.3.6.1 Flood Risk Management

The Recommended Plan would provide tidal FRM benefits to a population at risk of approximately 6,000 residents and people working in the area and would provide protection from a 1-percent annual chance of exceedance (ACE) flood through the end of the 50-year period of analysis (2017–2067), accounting for sea level change (SLC) under the USACE "high" scenario. A structure inventory conducted as part of the economic analysis for this study identified 1,140 structures (1,034 residential, 54 commercial, 42 industrial, and 9 public) in the 0.2-percent ACE floodplain under the USACE High SLC scenario that defines the study area's boundaries for the tidal flood risk assessment.

S.3.6.2 Ecosystem Restoration

The Recommended Plan would create approximately 2,900 acres of tidal marsh habitat and ecotone, thereby restoring ecological structure and function, area, and connectivity to a habitat type that has experienced close to a 90-percent loss of historic area. The restored habitat would also benefit special-status species such as the California-endemic salt marsh harvest mouse and Ridgway's rail[2], which reside almost exclusively on tidal marsh habitat.

The Recommended Plan includes an ecotone transitional habitat feature, which would be constructed bay-ward to the proposed FRM levee along Ponds A12, A13, and A18. Currently in San Francisco Bay, wetland-upland transition zones have largely disappeared from marshes. These features mimic the natural landform that once existed around the perimeter of San Francisco Bay and provide the functions of a distinct habitat that is now largely absent along southern San Francisco Bay. These habitat areas serve as high-tide refugia for State- and Federally-listed threatened and endangered species, such as Ridgway's rail, black rail, and salt marsh harvest mouse and also provide habitat for a unique suite of plant species. Adding this feature bay-ward of the levees would benefit the recovery of protected wetland species and help restore ecological functions.

[2] The newly titled (American Ornithologists' Union, July 2014) California Ridgway's rail (previously referred to as the California clapper rail) includes three subspecies: the Bay Area's California Ridgway's rail; the light-footed Ridgway's rail in Los Angeles and San Diego; and the Yuma Ridgway's rail in Arizona, Nevada, and eastern California. All three of them remain on the Endangered species list. It is part of a larger split; two rail species will now be five: king rails in the eastern U.S. and the Caribbean; clapper rails in the eastern U.S. and Cuba; mangrove rails in South America; Aztec rails in the Mexican highlands; and the West Coast Ridgway's rails. However, the new title has not yet been recognized by all USFWS offices; therefore, some appendices to this document continue to use the CA clapper rail nomenclature (e.g., Appendix B7 *USFWS Coordination Act Report*).

In addition, a large ecotone would buffer any maintenance actions that are necessary on the adjacent FRM levee. The ecotone also would allow inland migration of the restored marshes in response to sea level change.

S.3.6.3 Recreation

The recreational benefits provided by the Recommended Plan include enhanced outdoor recreational opportunities and improved access to the Refuge and adjacent restored marsh areas for tourists and residents. The proposed recreation features are estimated to increase the annual number of visitors to the Refuge by 20 percent and would create key connections in the San Francisco Bay Trail.

The cost to construct the pedestrian bridges, benches, viewing platforms, and signs is cost-shared between the USACE and the non-Federal sponsors. However, the non-Federal sponsors would also separately construct, at 100 percent non-Federal cost, the multi-use trail along State Route 237. The cost of the multi-use trail improvements is not included in the Recommended Plan’s cost estimate.

Operations, maintenance, repair, replacement, and rehabilitation (OMRR&R) of recreational features would be the sole responsibility of the non-Federal sponsors. The average annual cost of the recreation features in October 2014 price levels would be $263,000, and the average annual benefits would be $291,000, resulting in net annual benefits of $28,000 and a benefit-to-cost ratio of 1.1 to 1.

S.3.6.4 Comparison of Costs and Benefits of the NED/NER Plan and Recommended Plan

Investment costs, annual costs, and annual benefits with cost allocation for the proposed project are displayed in Table S.3-2 *Comparison of Total Annual Benefits and Costs for NED/NER Plan and LPP*, which addresses the NED and numeric aspects of the Environmental Quality (EQ) account in the 1983 Principles and Guidelines’ “accounts” for reporting benefits and impacts. The intent of the system of accounts is to provide decision-makers with plan ranking based on the advantages and disadvantages of each plan. Both the NED and the LPP levee options are strongly economically justified.

The average annual habitat units shown in Table S.3-2 *Comparison of Total Annual Benefits and Costs for NED/NER Plan and LPP* show a slight decline for the LPP relative to the NED/NER Plan. This is because the CHAP model used to evaluate ecosystem outputs rates habitats more highly when they have more wildlife diversity. The ecotone, which is the distinctive ecosystem restoration feature of the LPP, would provide important refugial habitat for several marsh wildlife species including two listed species. However, in doing so it would provide less habitat for a number of fish species that use lower and mid-elevation portions of tidal marshes. The net result is a slightly lower CHAP output with the ecotone than without it. Note that these fish species would already gain a great deal of new habitat value from the NER measures and only small additional habitat value from removing the ecotone from the project.

Table S.3-2. Comparison of Total Annual Benefits and Costs for NED/NER Plan and LPP [1,2]

	NED/NER Plan			Locally-Preferred Plan		
NED ACCOUNT - FLOOD RISK MANAGEMENT						
Investment Costs						
FRM First Costs	$74,718,000			$90,186,000		
Interest During Construction	$3,738,180			$4,512,052		
Total	**$78,456,180**			**$94,698,052**		
Annual Cost						
Interest and Amortization	$3,269,838			$3,946,755		
Annual Maintenance Cost	$538,000			$538,000		
Total Annual Cost (Rounded)	**$3,808,000**			**$4,485,000**		
USACE SLC Scenario	**Low**	**Intermediate**	**High**	**Low**	**Intermediate**	**High**
Annual Benefits	$18,914,000	$23,551,000	$40,443,000	$18,932,000	$23,573,000	$42,137,000
Net Annual FRM Benefits	$15,106,000	$19,743,000	$36,635,000	$14,447,000	$19,088,000	$37,652,000
Benefit to Cost Ratio	4.97	6.18	10.62	4.22	5.26	9.40
EQ ACCOUNT (NER PLAN - ALL PONDS)						
Investment Costs						
ER First Costs	$28,624,000			$74,790,000		
Interest During Construction	$4,688,951			$12,251,490		
Total	**$33,312,951**			**$87,041,490**		
Average Annual Cost (Rounded)	**$1,388,000**			**$3,628,000**		
Average Annual Habitat Units	**48,508**			**48,308**		
Cost per Habitat Unit	**$29**			**$75**		
NED ACCOUNT - RECREATION						
Investment Costs						
Recreation First Costs	$6,212,000			$6,212,000		
Interest During Construction	$95,516			$95,516		
Total	**$6,307,516**			**$6,307,516**		
Average Annual Cost	**$262,900**			**$262,900**		
Annual Recreation Benefits	**$290,600**			**$290,600**		
Net Annual Recreation Benefits	**$27,700**			**$27,700**		
Recreation B/C Ratio	**1.11**			**1.11**		

[1] October 2014 price levels, 3.375% discount rate, and a 50-year period of analysis.
[2] Some numbers have been rounded and might be slightly different than those shown in the appendices.

This finding contradicts the current scientific understanding of the value of upper marsh transitional habitats in tidal marshes. As stated in an independent external peer review comment received on the Draft Integrated Document:

> The CHAP model outputs (i.e., results) were generally unable to demonstrate that additional costs associated with accelerating salt pond restoration or adding 30:1 ecotone transitional habitat to the Bay side of the new Flood Risk Management (FRM) levees would result in additional environmental outputs. As such, ecotone construction was not included in the NER plan. As stated in the draft Integrated Document, the non-Federal sponsors have determined that the ecotone with the 30:1 side slopes is preferable to the levee bench refugia

measure based on habitat objectives associated with the South Bay Salt Pond Restoration Project (SBSPRP) and current understanding of the benefits provided by broad transitional tidal habitats.

Therefore, the ecotone was included in the Recommended Plan in recognition that the CHAP model, in tallying up raw habitat values, does not provide a strategic analysis of the value of providing specific types of habitat diversity in an overall landscape. Scientists have arrived at a larger consensus that goes beyond habitat value calculations to put higher value on scarce marsh habitats that insulate developed areas from evolving and transitioning marsh habitats.

S.3.7 Environmental Considerations

All practicable means to avoid or minimize adverse environmental effects were incorporated into the Recommended Plan. A monitoring and adaptive management plan is included in this Final Integrated Document. Temporary short-term impacts to air quality, the noise environment, aesthetic resources, vegetation, and disturbances to and displacement of fish and wildlife resources to other nearby habitat are expected from operation of construction equipment in lands designated for staging, access, and construction.

Table S.3-3 *Environmental Quality and Other Social Effects Comparison of NED/NER Plan and LPP* compares the NED/NER Plan and the LPP using qualitative aspects of the Environmental Quality (EQ) and Other Social Effects (OSE) accounts defined in the 1983 Principles and Guidelines to show the positive and negative effects of each plan.

Table S.3-3. Environmental Quality and Other Social Effects Comparison of NED/NER Plan and LPP

Characteristic	NED/NER Plan	LPP
Environmental Quality Account		
Water Quality	Negative short-term impacts from temporary increase in salinity in sloughs and potential remobilization of mercury in ponds and sloughs; positive long-term effects for ponds as system equilibrates with the restoration of tidal marsh habitat; levees would provide flood protection, thereby preventing potential wastewater contamination. There is little to no relationship between sediment concentrations of total or methyl mercury and mercury in biota. A complex set of biogeochemical processes mediate the methylation and uptake of methylmercury into biological tissues. Since levels in biota cannot be predicted or modeled from concentrations in water or sediment, regulatory agencies generally require assessment of mercury in biological samples, such as fish. The non-Federal sponsors will monitor mercury levels in local aquatic species to determine whether there are any effects on biota.	
Air Quality/Greenhouse Gases	Minor negative construction-related impacts	Moderate negative construction-related impacts
Aquatic Habitat Value	Minor negative construction-related impacts; positive long-term effects with restoration of tidal marsh habitat	
Marsh Habitat Value	Substantial positive long-term effects; establishment of marsh communities in ponds takes longer to develop than for LPP	Substantial positive mid- and long-term effects; ecotone provides for early evolution of marsh communities in ponds
Upland Habitat Value	Minor negative temporary construction-related impacts	
Threatened and Endangered Species	Substantial positive effects over the long term	Substantial positive mid- and long-term effects
Cultural Resources	Potential disturbance to unknown sites	
Noise	Minor negative temporary construction-related impacts	
Aesthetics	Minor negative temporary construction-related impacts	
Other Social Effects Account		
Public Health and Safety	Would reduce potential public health and safety risks associated with flooding	Similar effects to NED/NER Plan, but greater risk reduction
Public Facilities and Services	Long-term benefit to San José–Santa Clara Regional Wastewater Facility by providing increased flood protection (greater for LPP than for NED/NER Plan). Potential reduced need for emergency response related to flood incidents, potential short-term rail service interruption effects during construction, and potential short-term utility service interruption effects during construction.	
Recreation and Public Access –Trail System	Short-term nuisance effects (noise, dust, and access) during construction; increase in recreation features such as pedestrian bridges, benches, and viewing platforms	
Traffic and Transportation	Short-term adverse effects on intersection function and freeway operation during construction	
Displacement of People and Businesses	No impact in the short term; depending on magnitude of sea level change, some people and businesses could be displaced in the long term (greater potential with NED/NER Plan than with LPP)	

S.3.8 Cost Estimate

The apportionment of costs is based upon the costs detailed in the Total Project Cost Summary (TPCS) for the NED/NER Plan and LPP as certified by the USACE Cost Engineering Mandatory Center of Expertise in May 2015. Note that the costs as presented above in Table S.3-2 *Comparison of Total Annual Benefits and Costs for NED/NER Plan and LPP* are presented at October 2014 (Fiscal Year 2015) price levels to be consistent with the price level of the benefits. The total project first costs (TPFC) in the TPCS are escalated and presented at October 2015 (Fiscal Year 2016) price levels. The cost estimate and apportionment analysis below is based upon the total project first cost estimates at October 2015 price levels. The estimated total project first cost (at October 2015 price levels) for the LPP is $173.9 million, including FRM, ecosystem restoration, and recreation features (Table S.3-4 *Estimated Costs of Recommended Plan*).

Table S.3-4. Estimated Costs of Recommended Plan

MCACES Account	Description	Total First Cost
Lands, Easements, Relocations, Right-of-Way, and Disposal Sites		
01	Real Estate	$13,493,000
02	Utility Relocations	$587,000
Construction, Flood Risk Management		
11	Flood Risk Management	$67,299,000
16	Bank Stabilization	$1,535,000
Construction, Ecosystem Restoration		
06	Ecotone Transitional Habitat	$35,944,000
06	Pond Restoration	$5,765,000
06	Monitoring	$984,000
06	Adaptive Management	$6,276,000
Construction, Recreation		
14	Recreation	$4,848,000
Other Costs		
30	Preconstruction Engineering and Design	$24,842,000
31	Construction Management	$12,327,000
	Estimated Total Project First Cost	$173,900,000

MCACES = Micro Computer Assisted Cost Estimating Software

A summary of cost-sharing responsibilities is presented in Table S.3-5 *Summary of Cost-Sharing Responsibilities*. Federal costs for FRM and ecosystem features are capped at 65 percent of the total project first cost of the NED/NER Plan; the non-Federal sponsor would be responsible for 35 percent of the costs set by the NED/NER Plan and 100 percent of the project costs above the NED/NER Plan. Cost sharing for recreation features is 50 percent Federal and 50 percent non-Federal.

However, as shown in Table S.3-5 *Summary of Cost-Sharing Responsibilities*, the total lands, easements, rights-of-way, relocations, and disposal sites (LERRDs) costs for the NER Plan are approximately 42 percent of total NER Plan costs. Table S.3-5 *Summary of Cost Sharing Responsibilities* does not adjust the non-Federal portion for the NER Plan to reflect reimbursement for LERRDs in excess of 35 percent of total NER Plan costs. The non-Federal sponsors have waived their right to seek such reimbursement. Therefore, the non-Federal cost shown in Table S.3-5 *Summary of Cost-Sharing Responsibilities* for the NER Plan is 42 percent rather than 35 percent.

Table S.3-5. Summary of Cost-Sharing Responsibilities [a]

Cost-Sharing Responsibility	Federal	Non-Federal	Total
NED/NER Plan Cost Sharing			
Flood Risk Management (FRM)			
Project Features/Construction	$56,937,000		$56,937,000
Lands, Easements, Rights-of-Way, Relocations, and Disposal Sites (LERRDs) [b]		$2,012,000	$2,012,000
Preconstruction Engineering and Design	$11,470,000		$11,470,000
Construction Management	$5,738,000		$5,738,000
Monitoring	$0		$0
Adaptive Management	$0		$0
Subtotal	$74,145,000	$2,012,000	$76,157,000
Additional Cash Contribution	–$24,643,000	$24,643,000	
Total (FRM)	$49,502,000	$26,655,000	$76,157,000
Percentage of Total (FRM) [c]	65%	35%	
Ecosystem Restoration			
Project Features/Construction	$5,765,000		$5,765,000
LERRDs		$11,967,000	$11,967,000
Preconstruction Engineering and Design	$2,624,000		$2,625,000
Construction Management	$1,213,000		$1,213,000
Monitoring	$984,000		$984,000
Adaptive Management	$6,276,000		$6,276,000
Subtotal	$16,862,000	$11,967,000	$28,829,000
Cash Contribution	$0	$0	
Total (ER)	$16,862,000	$11,967,000	$28,829,000
Percentage of Total (ER) [d]	58%	42%	
Recreation			
Project Features/Construction	$4,848,000		$4,848,000
Preconstruction Engineering and Design	$977,000		$977,000
Construction Management	$489,000		$489,000
Subtotal	$6,314,000		$6,314,000

Table S.3-5. Summary of Cost-Sharing Responsibilities [a]

Cost-Sharing Responsibility	Federal	Non-Federal	Total
Cash Contribution	–$3,157,000	$3,157,000	
Total (Recreation)	$3,157,000	$3,157,000	$6,314,000
Percentage of Total (Recreation)	50%	50%	
Subtotal (NED/NER Plan Cost Sharing)[e]	$69,521,000	$41,779,000	$111,300,000
Additional LPP Costs			
Flood Risk Management (FRM)			
Project Features/Construction		$11,897,000	$11,897,000
LERRDs		$104,000	$104,000
Preconstruction Engineering and Design		$2,475,000	$2,475,000
Construction Management (FRM)		$1,237,000	$1,237,000
Monitoring		$0	$0
Adaptive Management		$0	$0
Subtotal (FRM)		$15,713,000	$15,713,000
Ecosystem Restoration			
Project Features/Construction		$35,944,000	$35,944,000
LERRDs		$-3,000	$-3,000
Preconstruction Engineering and Design		$7,296,000	$7,296,000
Construction Management		$3,650,000	$3,650,000
Monitoring		$0	$0
Adaptive Management		$0	$0
Subtotal (ER)		$46,887,000	$46,887,000
Subtotal (Additional LPP Costs)	$0	$62,600,000	$62,700,000
GRAND TOTAL– PROJECT COSTS	$69,521,000	$104,379,000	$173,900,000

[a] Based on October 2015 (Fiscal Year 2016) price levels, 3.375% interest rate, and a 50-year period of analysis.

[b] Non-Federal interests must provide all LERRDs and a minimum cash contribution of 5% of the total project cost.

[c] Based on the tidal nature of the flood risk, the cost sharing for flood risk management features is per the Coastal Storm Damage Reduction mission (65% maximum Federal, 35% non-Federal).

[d] Cost sharing for ecosystem restoration is typically 65% Federal, 35% non-Federal, with the non-Federal sponsor receiving reimbursement for LERRDs in excess of 35%. However, the non-Federal sponsor has agreed to waive the right to reimbursement for LERRDs costs in excess of 35% of ecosystem restoration project costs.

[e] The proposed multi-use trail along SR 237 is not included in the cost-share amount. The non-Federal sponsors are responsible for funding and constructing this feature.

S.3.9 Implementation Schedule

Depending on the dates of congressional authorization and appropriation, construction activities could start as early as 2018. The approval and construction phases of the project are listed below and illustrated in Figure S.3-7 *Construction, Monitoring, and Adaptive Management Schedule*.

Division Commander’s Notice	August 2015
Chief of Engineers Report	December 2015
Feasibility Report Transmittal to Congress	June 2016
USACE and Sponsor Sign Design Agreement	To be determined 2016
Preconstruction Engineering and Design	2016–2017
Levee Construction	2018-2021
Habitat Restoration	2018–2031

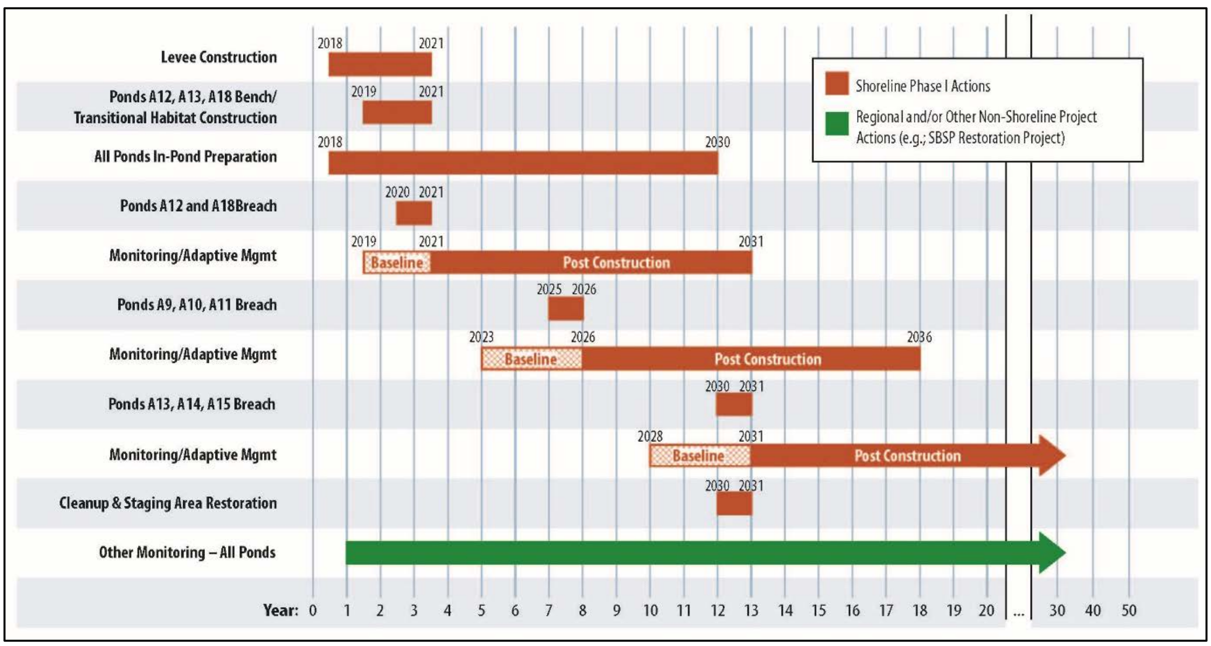

Figure S.3-7. Construction, Monitoring, and Adaptive Management Schedule

S.3.10 Coordination with Agencies and the Public

The public involvement program for the Proposed Project included ongoing stakeholder coordination and opportunities to comment on the scope and content of the Draft Integrated Document. Ongoing public involvement for the Shoreline Phase I Study occurred through a stakeholder forum originally convened for the SBSP Restoration Project. Forum meetings occurred once a year and were open to the public. This Integrated Document considers information that has been presented by the stakeholder forum and is applicable to the Recommended Plan.

Agency representatives involved in the Recommended Plan also participated in the Alviso and Santa Clara County Working Group, which provides study progress updates to and collects comments from interested stakeholders. The following sections describe the project scoping phase and opportunities to comment on the content of this report.

S.3.10.1 Public Coordination

S.3.10.1.1 Scoping

The USACE and the USFWS (NEPA co-lead agencies) and the State Coastal Conservancy and the SCVWD (CEQA lead and cooperating agencies, respectively) initiated a 30-day scoping process for the Proposed Project with release of the Notice of Intent/Notice of Preparation (NOI/NOP) on January 6, 2006. Comments from this period provided information for consideration during planning, requested agency inclusion in document distribution, and/or provided information on aviation safety.

Pursuant to the NEPA [40 CFR 1506.6(c)] and the CEQA (14 CCR §21083.9), the project sponsors held a public scoping meeting on January 25, 2006, in, Milpitas, California. Meeting presentations and materials provided an overview of the Shoreline Phase I Study, an overview of the process, and an explanation of the relationship between the Shoreline Phase I Study and the SBSP Restoration Project. The project sponsors provided opening remarks, gave brief presentations, and provided a question-and-answer period. The project sponsors also received scoping comments by U.S. mail and by e-mail.

After the geographic footprint was reduced and the SCVWD took over as the CEQA lead agency, the SCVWD issued a revised NOP on September 8, 2014. The NOP was open for a 30-day period for agencies and the public to comment on the revised project scope and the document content.

S.3.10.1.2 Draft Integrated Document

Agencies, non-governmental organizations, and members of the public were given time to comment on the content and findings of the Draft Integrated Document by submitting written comments during the required NEPA 60-day comment period. The project partners also held a public meeting during the NEPA public comment period to collect comments on the Draft Integrated Document. The meeting, which was held January 14, 2015, focused on the draft report to present the findings of the Integrated Document. At this meeting, the public was able to provide comments on and express views about the study results.

S.3.10.2 Agency Involvement

The Shoreline Phase I Study Project Delivery Team (PDT) included representatives from the USACE San Francisco District (NEPA co-lead agency and Federal sponsor), the USFWS (NEPA co-lead agency), the SCVWD (CEQA lead agency and local sponsor), and the State Coastal Conservancy (CEQA responsible agency and local sponsor).

The PDT coordinated with other agencies and organizations as it prepared the Draft Integrated Document. Other participants included:

- City of San José
- City of Sunnyvale (Water Pollution Control Plant)
- Federal Emergency Management Agency
- National Aeronautics and Space Administration
- SBSP Restoration Project Stakeholder Forum
- SBSP Restoration Project Management Team
- USACE South Pacific Division
- USACE Sacramento District
- USACE Los Angeles District
- California State Historic Preservation Officer, California Office of State History
- San Francisco Bay Conservation and Development Commission
- National Oceanic and Atmospheric Administration Fisheries Service (also known as National Marine Fisheries Service)
- U.S. Coast Guard
- San Francisco Bay Regional Water Quality Control Board
- State Lands Commission
- California Department of Fish and Wildlife
- Bay Area Air Quality Management District
- Federal Aviation Administration

S.3.11 Areas of Controversy and Unresolved Issues

The planning of the Shoreline Study and choice of Recommended Plan relied extensively on existing scientific and local knowledge of the Study Area (such as information gathered through the SBSP Restoration Project implementation process) from the primary defining of the problems and opportunities to the evaluation of alternatives and estimation of restoration performance. While the Recommended Plan is based on a wealth of knowledge, concerns and controversies were documented through the planning process. The monitoring and adaptive management plan provides an approach to address controversies and risk (unresolved issues) and provides a method to inform ongoing project adjustments with the intent to improve project performance.

S.3.11.1 Areas of Controversy

Loss of Pond Habitat. The loss of pond habitats due to the creation of tidal marsh was extensively debated during the 5 year programmatic planning effort of the South Bay Salt Pond Restoration Project (SBSP Restoration Project; 2003–2008). The SBSP Restoration Project environmental documentation stated that the preferred alternative included up to 90 percent of the project area be restored to tidal marsh in order to make up for the overwhelming loss of the historic tidal wetland resources. However, the project documentation also stated that several strategies would be incorporated into the project to address impacts to the pond-specialist species.

The first major strategy is to enhance a carefully selected group of existing ponds to improve their productivity, creating what are called "enhanced managed ponds." These are ponds that have lower salinity levels, better ability to manage water levels and flows with new water-control structures, and islands for roosting and nesting.

The second strategy for the SBSP Restoration Project to prevent significant impacts to pond species is the adaptive management process. Conversion of ponds to tidal wetlands will happen over time, in phases, with monitoring and applied studies being incorporated into the process.

Based on these results, if undesired impacts appear, then corrective action would be taken or, possibly, the conversion of ponds to tidal wetlands would stop. Since the Shoreline Phase I Study is closely coordinated with the SBSP Restoration Project planning effort, a similar approach was adopted to address the impacts of converting pond habitats to tidal wetlands. The ecosystem restoration actions would be implemented in phases with monitoring and close integration with the adaptive management program of the SBSP Restoration Project.

Other Areas of Controversy. Throughout the process of developing the final Integrated Document, the USACE and non-Federal sponsors worked together and with other stakeholders to resolve other issues raised during the public participation process, including:

- Cost-sharing responsibility for elements of the Recommended Plan;
- Management compatibility for areas that are owned and managed by different parties, such as SCVWD and USFWS management of adjacent areas owned by each;
- Work windows intended to protect special-status species yet allow restoration to proceed;
- Design details, such as levee dimensions, ecotone size, and the Artesian tide gate configuration;
- Ecosystem restoration phasing and coordination with ongoing implementation of the SBSP Restoration Project;
- Long-term operation and maintenance details, such as levee maintenance and ecosystem management programs that are compatible; and
- Third-party requirements to maintain access to and/or through the study area, such as PG&E access to its facilities in the study area.

S.3.11.2 Unresolved Issues

Long-term conditions in the Proposed Project area are dependent factors that are out of the control of the project proponents. For example, climate change could result in SLC that could influence the success of ecosystem restoration. Seismic activity could cause sudden, short term effects that might affect long-term conditions in the Refuge and surrounding areas. The monitoring and adaptive management plan includes management triggers and a detailed protocol for implementing management changes as a means to support long-term management flexibility. However, the extent to which the adaptive management will be able to address large scale or extensive changes associated with unknown factors such as sea level change and seismic activity is uncertain.

As noted throughout the Integrated Document, there is some uncertainty as to how various environmental resources would respond to long-term changes brought about by the Shoreline Phase I Project and the SBSP Restoration Project. As implementation of the project progresses, adaptive management would guide the selection of the final mix of habitats. Since project construction would occur over more than 14 years, later phases would reflect lessons learned from earlier actions. Adaptive management may also result in corrective measures being implemented for earlier phases.

The EIR for the Plant Master Plan for the Wastewater Facility includes a levee alignment between Pond A18 and plant property that is not the same alignment discussed in the Integrated Document. However, in the final adopted version of Plant Master Plan, the City did not adopt a specific levee alignment. Rather, the Plan Master Plan outlines a vision of flood protection and restoration to be implemented in partnership with other agencies. The project proponents of the Shoreline Phase I Project will continue to work with the City of San José and the regulatory agencies to coordinate the two plans and develop a final alignment that serves both while minimizing adverse effects.

The Recommended Plan would result in impacts to air quality, the noise environment, aesthetic resources, the historic landscape, vegetation, and disturbances to and displacement of fish and wildlife resources to other nearby habitat. The Integrated Document includes measures to reduce potential adverse impacts. However, even with the application of these measures, some adverse impacts remain unavoidable (see Section 5.4.2 Unavoidable Adverse Impacts [NEPA and CEQA]). The impact to waters of the state and waters of the United States (due to ecotone and levee fill) will create permitting challenges for regulatory agencies.

S.3.12 Risks and Uncertainty

S.3.12.1 Increased Sea Level Change

In accordance with ER 1100-2-8162, alternatives were formulated and evaluated for potential adaptation during and beyond the feasibility study period of analysis in consideration of the three SLC scenarios. Alternatives evaluated can be adapted by a variety of measures (e.g., levee raise or floodwall within existing footprint) to address future SLC risk levels and plan performance in a manner that is consistent with existing USACE engineering methods and standards.

Tidal flood damage analysis was completed utilizing HEC-FDA. The model uses several inputs including water surface profiles, a levee failure function, flood plain assets, and depth-damage relationships. The effort also required that the existing complex configuration of outer dikes, managed ponds, and inner dikes be simplified into a single line of flood protection.

The results of the re-analysis indicated that there was economic justification for a FRM project under all SLC scenarios. The analysis also showed that the annual exceedance probability (also referred to as *annual chance of exceedance* in main report), or probability of flooding in any given year for the study area is 32 percent. While the analysis demonstrated high confidence in the economic justification for a project, the high annual exceedance probability did not correlate with past performance in that there has been no substantial documented purely tidal flooding. The high annual exceedance probability was believed to be associated with uncertainty in modeling inputs, effectiveness and limitations of HEC-FDA at modeling the study area, and assumptions that simplified the failure mode of the dike-pond system. Corrective actions proposed included more advanced modeling, refinement of model inputs, or multi-variant sensitivity analyses. However, all strategies were judged unlikely to improve the confidence of a reported annual exceedance probability, or quantify the impact of the potential sources of error noted above.

A rigorous review of all model inputs was conducted. A simplified sensitivity analysis was conducted by augmenting the levee failure function to “prevent” levee failures from occurring below a 10-year event. This analysis showed that there was still strong economic support for an FRM project and that the annual exceedance probability could be reduced substantially (i.e., 8 percent) to roughly correspond to past performance of the dike pond system. However, a correlation with past performance could not be achieved without making the outer dike unrealistically reliable at preventing flooding. The levee failure function was confirmed to be reasonable and to reflect sound engineering judgment. It was concluded that uncertainties in all model inputs, the effectiveness of the model as an appropriate tool for diked and leveed communities below the ambient water level, and assumptions applied to the failure mode contributed to lowered confidence in the predicted annual exceedance probability.

Present day conditions and the anticipated future conditions in the project area lead to the conclusion that there will be a significant risk of flooding because of the condition and maintenance of the existing dikes. While the past performance against tidal flooding appears to have been adequate, the historic margin of safety has likely been low. The system of dikes is not engineered and was historically maintained by filling and grading areas of lost elevation or cross section width. Reaches of the existing outer dike have narrow elevated sections of the crest suggesting grading or piling of material to prevent overtopping. It is likely that several overtopping events may have been narrowly avoided with this type of maintenance.

Continuance of the same maintenance paradigm is likely unsustainable beyond the near term. Neither the availability of borrow or the volume of borrow can be considered static. Likewise, the practice of modifying reaches of dike crest or cannibalizing higher reaches to prevent against overtopping in lower reaches is finite. This paradigm proved successful in the past, but its continued use will begin to increase the likelihood of levee failure in newly narrowed or lowered reaches. This “new” risk is exacerbated by activities that have restored hydraulic connectivity to previous isolated ponds during salt production.

The completed analysis includes inherent risks with communicating flood risk via the tidal flood damage analysis for the existing without and future-without-project conditions. The reduced level of confidence in the reported annual exceedance probability can be attributed to multiple factors that define the complexity of the dike-pond system and floodplain in the study area. While an annual exceedance probability of 32 percent may appear to substantially overstate the flood risk for the study period, there is reason to believe that existing flood risk to the Alviso economic impact area is fundamentally different than what past performance would otherwise indicate.

S.3.12.2 Near-Term versus Future Pond Restoration

There are two primary reasons for starting tidal habitat restoration in the study area: lead time for tidal marsh formation and contribution toward recovery of listed species.

Time for Marsh Formation. The first reason for starting tidal habitat restoration soon in the study area is to give the sedimentation process in breached ponds enough lead time to bring the pond bottoms up to marsh elevation prior to the acceleration of SLC later in the century. All of the ponds in the interim study area lie within the zone of subsidence created by groundwater withdrawals during the middle decades of the 20^{th} century. Although all these ponds formerly consisted of tidal marshes, subsidence after their diking for salt production lowered their elevations by several feet or more.

Once tidal marshes have begun to form in the former ponds, the rate of sedimentation will increase as the vegetation slows the water, catches sediment, and retains it. A key factor in making tidal marsh restoration work in this area is breaching the ponds early enough to allow sedimentation to bring the pond bottoms up to marsh elevation before the start of rapid SLC. Once SLC is occurring at a sufficient and accelerating rate, sedimentation in breached ponds could fall behind the rate of SLC, and the marsh would be unable to form even as the pond bottom continues to rise with sediment accumulation. If a much lower estimate of SLC is assumed, then this issue would seem to be less acute. In principle, restoration could be deferred for a few decades while the sea level changes slowly, after which the project could be constructed. If this approach (deferring restoration) is taken, however, it then raises the problem of determining whether SLC is occurring slowly or rapidly. Reliably demonstrating a sustained new trend in SLC would take a number of years.

In addition to the uncertainties around SLC, the other part of the equation for adequate marsh accretion rates is the amount of suspended sediments in San Francisco Bay. Current levels are quite high in the study area, and recently restored marshes are benefiting from those levels as evidenced by high accretion rates. Recent research from the U.S. Geological Survey (USGS), however, indicates that San Francisco Bay is becoming less turbid and that current levels of suspended sediments are not likely to remain the same in coming decades.

Recovery of Listed Species. The Federally- and State-listed salt marsh harvest mouse and the Ridgway's rail (formerly identified as the California clapper rail, and still referred to by the USFWS as clapper rail) are endangered because of degradation and loss of habitat. Thus, restoration of adequate habitat for these species to allow for even partial recovery is a high priority. Further, given that tidal marsh restoration in this area can require 10 to 40 years' lead time to create large areas of suitable habitat for these two species, an early start to habitat restoration is considered very important.

Existing habitat-restoration projects within and near the interim study area are slowly improving the situation for these two species. Nevertheless, these projects will not provide adequate contiguous restored habitat acreage to meet the requirements for recovery for these two species in this portion of San Francisco Bay (the Guadalupe Slough–Warm Springs marshes segment), as stated in the *Final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California* (USFWS 2013). Only a large, contiguous tidal restoration would achieve this goal for the Guadalupe Slough–Warm Springs marshes segment, if conditions are sufficient to form suitable acreage and characteristics of tidal marsh in the restored areas.

S.3.12.3 Sediment Dynamics

The movement and availability of sediment in the waters of southern San Francisco Bay are uncertain. The habitat evaluation modeling assumed that a certain quantity of sediment would be available to convert the ponds into tidal marsh habitat. Based on these results, the team determined that the habitat restoration effort for the suite of ponds west of Artesian Slough (Ponds A9 through A15) needed to begin with Pond A12; local sediment dynamics would not allow this pond to convert to tidal marsh if the other ponds closer to the bay were converted first.

S.3.12.4 Climate Change

Extreme changes in climate could result in conditions that cannot support the types of habitat restored, thereby reducing the effectiveness of the restoration plan. After project construction, the non-Federal sponsors may need to adjust the use of vegetative plantings under routine operation and maintenance. The non-Federal sponsor would also decide whether a post-authorization change or Section 408 process is necessary to make substantial adjustments to the project.

S.3.12.5 Seismic Activity

The greater San Francisco Bay Area is one of the most seismically active regions in the United States. Significant earthquakes that occur in the San Francisco Bay Area are generally associated with tectonic movement along the well-defined, active fault zones of the San Andreas fault, which is located approximately 7 miles west of the study area. The Hayward fault, another major active fault, is located about 2 miles east of the study area.

The USGS 2007 Working Group on California Earthquake Probabilities has reported that it is a near certainty (93-percent chance) that at least one magnitude-6.7 earthquake or greater will occur in northern California within the next 30 years, with a 63-percent chance of occurrence in the San Francisco Bay Area. Among the faults in the region, the Hayward fault is the most likely source, with a 31-percent chance of producing a magnitude-6.7 or greater seismic event within the next 30 years.

Seismic hazards in study area will continue to be a concern. Strong ground shaking and liquefaction of saturated loose granular soils during an earthquake may cause damaging lateral spreading or ground settlement within the study area. To compensate for the seismic hazard, all of the levees under consideration were designed with 3:1 horizontal-to-vertical side slopes. This inclination is generally recognized as good practice for mitigating some of the risk associated with earthquakes. In addition, all of the alternatives studied included either a bench or an ecotone, which would further increase levee stability.

S.3.12.6 Mercury and Methylmercury Bioavailability as a Result of Pond Breaches

The extent to which the ecosystem restoration and management actions might result in an increase in bioavailable mercury in the food chain is uncertain, although design features would incorporate results from the current SBSP Restoration Project mercury studies to best manage changes in the water chemistry.

Bioaccumulation of mercury is a primary concern for species that are higher in the food web. During project implementation, the SBSP Restoration Project will monitor the regional effects of restoration actions both within and outside the adjacent Shoreline Phase I Study Area for the presence and movement of mercury in the ecosystem. Unsatisfactory effects, as defined by the permit issued by the Regional Water Quality Control Board to the SBSP Restoration Project, would result in either remedial actions or halting the restoration effort under the adaptive implementation concept.

S.3.12.7 Model Limitations and Errors in Analysis

Future conditions are inherently uncertain. The forecast of the future condition is limited by existing science and technology. The future condition described in this study is based on an analysis of historical trends and the best available information. Some variation between the forecast condition and reality is certain. Restoration features were developed in a risk-aware framework to minimize the degree to which these variations would affect planning decisions, but errors in analysis or discrepancies between the forecasted and actual condition could affect the effectiveness of plans.

No model can account for all relevant variables in a system. The interpretation of model outputs must consider the limitations, strengths, weaknesses, and assumptions inherent in model inputs and framework. Inaccurate assumptions or input errors could change benefits predicted by models used in this study. The potential for substantial changes caused by errors has been reduced through technical review, sensitivity analyses, and quality assurance procedures. There is inherent risk, however, in reducing complex natural systems into the results of mathematic expressions driven by the simplified interaction of key variables.

The CHAP model was used to assess environmental benefits, however, there were limitations as to what could be entered into the model and evaluated. This is discussed in further detail in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*.

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C.0 California Environmental Quality Act Summary

C.1 Summary

This document includes an Environmental Impact Report (EIR) analyzing the environmental effects of the Shoreline Phase I Project. The project would provide tidal flood protection between Coyote Creek and the Guadalupe River, allow for the restoration of approximately 2,000 acres of former salt ponds to tidal marsh, and allow for recreational features.

This EIR has been prepared in compliance with the California Environmental Quality Act (CEQA) to provide an objective analysis to be used by the CEQA lead agency (the Santa Clara Valley Water District, or SCVWD), as well as other agencies and the public, in their considerations regarding the implementation, rejection, or modification of the project as proposed. The EIR itself does not determine whether the project will be implemented or not; it serves only as an informational document in the local planning and decision-making process. The purpose of the EIR process is to develop and assess a recommended plan and alternatives for the project and to avoid and mitigate significant adverse effects on environmental resources while aiming to achieve the primary project objectives.

C.2 Proposed Project

The SCVWD's preferred alternative, which is the Locally Preferred Plan (Alternative 3), would include engineered levees along the western and northern outer levees of New Chicago Marsh along the existing margins of Ponds A12, A13, and A16 (Alviso North alignment) and would follow the San José–Santa Clara Regional Wastewater Facility (Wastewater Facility) levee that runs west to east in a stair-step pattern along the north border (Water Pollution Control Plan [WPCP] South alignment) to protect against the 1-percent annual chance of exceedance (ACE) tidal event with anticipated sea level change; a tide gate closure system across Artesian Slough; restoration of Ponds A9, A10, A11, A12, A13, A14, A15, and A18; a transitional habitat slope of 30:1 in Ponds A12/A13 and A18; multi-use trails on top of the new proposed flood risk management levee with connection to the Bay Trail network; viewing platforms and benches, and trail upgrades to be made to an existing segment of the Bay Trail system along State Route 237.

The tidal flood-protection components would be constructed between 2018 and 2021. Restoration of the ponds and recreation elements would take place between 2020 and 2031 with monitoring and adaptive management occurring throughout the period.

C.3 Anticipated Environmental Impacts

Table C.3-1 *Summary of Project Impacts* summarizes the project's potential for impacts on the environment and a list of avoidance and minimization measures that would be implemented as part of the project, along with the mitigation measures identified to avoid or minimize identified significant impacts. For a complete description of potential impacts and recommended mitigation measures, please refer to the specific discussions in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures*.

Table C.3-1. Summary of Project Impacts

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
GEO-1: Expose People or Structures to Potential Substantial Adverse Effects During Seismic Events	AMM-GEO -1: Public warning signs AMM-GEO-3: Levee Design	S	M-GEO-1: Worker Seismic Safety	LTS
GEO-2: Expose people or structures to tsunami or seiche	AMM-GEO -1: Public warning signs AMM-GEO-4: Stop Work After Seismic Activity	LTS	None	LTS
GEO-3: Result in substantial soil erosion or the loss of topsoil in or adjacent to the study area	AMM-GEO-2: Reuse soils AMM-GEO-5: Channel Tidal Flow AMM-GEO-6: Prepare SWPPP	LTS	None	LTS
LND-1: Physically divide the community of Alviso		NI	None	NI
LND-2: Conflict with land use policies	AMM-LND-1: Minimize Disturbance AMM-LND-2: Removal Materials	LTS (Alt 2,3) S (Alt 4, 5)	None (Alt 2,3) M-LND-2: New Chicago Marsh Protection (Alt 4) None Available (Alt 5)	LTS (Alt 2,3,4) S (Alt 5)
LND-3: Conflict with the adopted Santa Clara Valley Habitat Plan	AMM-LND-1: Minimize Disturbance AMM-LND-2: Removal Materials	LTS	None	LTS
HYD-1: Alter existing drainage patterns in a manner that would result in scour that could cause substantial erosion or siltation	None	S	M-HYD-01a: levee maintenance will be adjusted or levee improvements implemented If excessive scour occurs of the levee crown or sides. M-HYD-01b: Fabric and/or rock armoring will be installed for excessive scour at the levee toe. M-HYD-01c: Develop and implement plan to protect UPRR bridge crossing of Coyote Creek	LTS
HYD-2: Increase the risk of flooding that could cause injury, death, or substantial property loss	AMM-HYD-1: Flood Warnings	B	None	B
HYD-3: Conduct excavation activities, fill placement, construction dewatering, and structure building in a manner that could affect adjacent existing levees (geotechnical issues)	None	LTS	None	LTS
HYD-4: Place non-flood risk hazard reduction structures within the 1-percent ACE flood hazard area that would impede or redirect flood flows	None	NI	None	NI

Table C.3-1. Summary of Project Impacts

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
WAT-01 violate any water quality standard or waste discharge	AMM-WAT-1: Staging Area AMM-WAT-2: Fuel Management Plan AMM-WAT-4: Pond Construction Timing AMM-WAT-5: Hazardous Spill Plan AMM-WAT-6: Seasonal Restrictions AMM-WAT-7: Minimize Footprint AMM-WAT-8: Clean Equipment AMM-WAT-9: Site Maintenance AMM-WAT-11: Protect Hazardous Sites AMM-WAT-12: Use of On-Site Material AMM-WAT-14: Water Quality Parameters AMM-WAT-15: Water Quality Baseline AMM-WAT-19: Minimize In-water Construction AMM-WAT-20: Turbidity Control AMM-WAT-21: Stormwater Runoff Control AMM-WAT-22: Stormwater Management Plan AMM-WAT-23: Use of Clean Fill AMM-WAT-24: Prepare SWPPP AMM-WAT-25: No Treated Wood AMM-WAT-26: Equipment Staging and Fueling AMM-WAT-27: Hazardous Spill Plan AMM-WAT-28: Prevent Equipment Leaks AMM-WAT-29: Stabilize Construction Areas AMM-WAT-30: Invasive Plant Prevention			
• Turbidity around breaches	AMM-WAT-3: Turbidity Management Plan AMM-WAT-10: In-Stream Sediment Control	LTS	None	LTS
• Increased water temperature	None	LTS	None	LTS
• Metals	None	LTS	None	LTS
• Salinity effects on waters near Ponds A12, A13, and A15	None	S	M-WAT-1a: Salinity Control	LTS
• Reduced DO levels in Pond A12	AMM-WAT-16: Dissolved Oxygen	S	M-WAT-1b: Dissolved Oxygen Control.	LTS
• Long-term suspension and mobilization of mercury-laden sediments and greater levels of MeHg	AMM-WAT-17: Mercury in Sentinel Species	LTS	None	LTS
• Algae composition	AMM-WAT-18: Control of Nuisance Algae	LTS	None	LTS

Table C.3-1. Summary of Project Impacts

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
WAT-2: Substantially alter existing drainage patterns	AMM-WAT-13: Sediment Accretion Areas	LTS	None	LTS
ABR-1: Substantial adverse effect on any special-status species	AMM-ABR-1: Seasonal Restrictions AMM-ABR-2: Biological Monitor AMM-ABR-3: Vibratory Piling AMM-ABR-4: In Water Sediment Control AMM-ABR-5: Screen Pumps AMM-ABR-7: Notification of Mortality Events AMM-ABR-8: Adequate Depth of Channels AMM-ABR-9: Salvage Natural Materials AMM-ABR-10: Prepare SWPPP AMM-ABR-11: Biological Monitoring AMM-ABR-12: Water Structure Materials AMM-WAT-27: Hazardous Spill Plan AMM-WAT-28: Prevent Equipment Leaks	LTS	None	LTS
ABR-2: Conflict with the provisions of the Santa Clara Valley Habitat Plan	None	NI	None	NI
TBR-1: Effects on sensitive natural communities	None	LTS	None	LTS

Table C.3-1. Summary of Project Impacts

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
TBR-2: Effects on special status species	AMM-TBR-1: Notification of Mortality AMM-TBR-2: Seasonal Restrictions AMM-TBR-3: Conduct Preconstruction Surveys AMM-TBR-4: Stage Outside Sensitive Habitats AMM-TBR-5: Minimize Footprint AMM-TBR-6: Install Exclusionary Fencing AMM-TBR-7: Biological Monitor AMM-TBR-8: Restore Disturbed Areas AMM-TBR-12: Worker Awareness AMM-TBR-13: Closure of Trails for Bird Species AMM-TBR-14: Interpretive Signs AMM-TBR-15: No Dogs in Refuge AMM-TBR-16: Cleaning of Equipment AMM-TBR-17: Hazardous Spill Plan AMM-TBR-18: Construction Site Maintenance AMM-TBR-19: Speed Limit AMM-TBR-20: Vehicle Staging and Fueling AMM-TBR-21: Vehicle and Equipment Maintenance AMM-TBR-22: Stormwater Management Plan AMM-TBR-23: Use of Clean Fill			
Salt Marsh Harvest Mouse	None	S	M-TBR-2a: Construction Avoidance Measures for Salt Marsh Harvest Mouse	LTS
Salt Marsh Wandering Shrew	None	S	M-TBR-2a: Construction Avoidance Measures for Salt Marsh Harvest Mouse	LTS
Western Snowy Plover	AMM-TBR-9: Pond Levels for Snowy Plover	S	M-TBR-2b: Construction Avoidance Measures for western snowy plovers, M-TBR-2c: Compensatory Measures for western snowy plover	LTS
Burrowing Owl	None	S	M-TBR-2d: Pre-construction Surveys and Passive Relocation of Burrowing Owls	LTS
Ridgway's Rail	None	S	M-TBR-2e: Construction Avoidance Measures for Ridgway's Rails	LTS

Table C.3-1. Summary of Project Impacts

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
Nesting Birds	AMM-TBR-3: Conduct Preconstruction Surveys	S	M-TBR-2f: Construction Avoidance Measures for Nesting Birds	LTS
Sensitive Plants	None	S	M-TBR-2h: Conduct Focused Protocol-level Surveys for Congdon's tarplant	LTS
TBR-3: Effects on Wildlife Movement, Habitat Connectivity, Habitat Fragmentation, and Biodiversity	None	LTS (Alt 2,3,5) S (Alt 4)	None	LTS (Alt 2,3,5) S (Alt 4)
TBR-4: Effects on Population and Habitat Trends	AMM-TBR-10: Least Tern Breeding Buffer AMM-TBR-11: Pond Levels for Least Tern AMM-TBR-24: Cordgrass Monitoring	LTS (Alt 2,3) S (Alt 4,5)	M-TBR-3: Hydrologic Upgrades to Alviso Railroad Spur Levee	LTS (Alt 2,3) S (Alt 4,5)
TBR-5: Policy and Plan Conflicts	None	LTS (Alt 2,3) S (Alt 4,5)	None (Alt 2,3) None available (4,5)	LTS (Alt 2,3) S (Alt 4,5)
HAZ-01: Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials or through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment	AMM-HAZ-1: Avoid Hazardous Site AMM-HAZ-2: Compliance with Federal and State Regulations AMM-HAZ-3: Prepare Health and Safety Plan	S	M-HAZ-01: Discovery of Undocumented Hazardous Materials	LTS
HAZ-02: Emit hazardous emissions or involve the handling of hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school	AMM-HAZ-1: Avoid Hazardous Site AMM-HAZ-2: Compliance with Federal and State Regulations AMM-HAZ-3: Prepare Health and Safety Plan	LTS	None	LTS
HAZ-03: Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment	AMM-HAZ-1: Avoid Hazardous Site AMM-HAZ-2: Compliance with Federal and State Regulations AMM-HAZ-3: Prepare Health and Safety Plan AMM-HAZ-4: Records Review Prior to Construction	S	M-HAZ-03: Construction Near Hazardous Sites	LTS
HAZ-04: Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan	AMM-HAZ-3: Prepare Health and Safety Plan	LTS	None	LTS

Table C.3-1. Summary of Project Impacts

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
TRN-1: Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulations system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit; or conflict with congestion management program standards and goals for freeway segments.	AMM-TRN-1: Work Hours	LTS	None	LTS
TRN-2: Substantially increase hazards related to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., slow-moving construction equipment)	AMM-TRN-3: Traffic Control Plan	LTS	None	LTS
TRN-3: Result in inadequate emergency access to areas that are near the project and that rely on the same transportation facilities	AMM-TRN-3: Traffic Control Plan	LTS	None	LTS
TRN-4: Conflict with the City of San José, Santa Clara County, or Alameda County adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities	AMM-TRN-2: Coordination with Railroad	LTS	None	LTS
AIR-1: Violate any air quality standard or contribute substantially to an existing or projected air quality violation	AMM-AIR-1: Dust Control Measures AMM-AIR-2: Limit Idling Time AMM-AIR-3: Prepared SWPPP AMM-AIR-5: Cleaner Construction Equipment AMM-AIR-6: Use Electrical Power where Possible	S	None	S
AIR-2: Expose sensitive receptors to substantial pollution concentrations	AMM-AIR-2: Limit Idling Time AMM-AIR-5: Cleaner Construction Equipment AMM-AIR-6: Use Electrical Power where Possible	LTS	None	LTS
AIR-3: Conflict with or obstruct implementation of the applicable air quality plan	None	LTS	None	LTS
AIR-4: Create objectionable odors affecting a substantial number of people	AMM-AIR-2: Limit Idling Time	LTS	None	LTS

Table C.3-1. Summary of Project Impacts

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
AIR-5: Conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases	AMM-AIR-4- Greenhouse Gas BMPs	LTS	None	LTS
REC-1: Limit or impede existing recreational uses in the project area such as trails, access to the bay, and environmental education	AMM-REC-1: Incorporate Existing Trails AMM-REC-2: Landscape Displays AMM-REC-3: Bay Trail Connection	LTS	None	LTS
REC-2: Increase the use of existing neighborhood and regional parks or other recreation facilities such that substantial physical deterioration of the facility would occur or be accelerated	None	LTS	None	LTS
REC-3: Require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment.	None	LTS	None	LTS
AES-1: A substantial short-term negative aesthetic effect on the existing visual character or quality of the pond areas during construction	AMM-AES-1: Stabilize Disturbed Areas	LTS (Alt 2,3) S (Alt 4,5)	None	LTS (Alt 2,3) S (Alt 4,5)
AES-2: A substantial, demonstrable negative aesthetic effect on scenic vistas such as those associated with the Alviso Marina and the Refuge	None	LTS	None	LTS
AES-3: Create a new source of glare that would adversely affect views in the area	None	LTS	None	LTS
AES-4: Have a substantial long-term negative aesthetic effect on the existing visual character or quality of the pond areas	None	LTS (Alt 2,3) S (Alt 4,5)	None (Alt 2,3) None available (Alt 4,5)	LTS (Alt 2,3) S (Alt 4,5)
NOI-1: Expose people to or generate noise levels in excess of standards established in the City of San José's municipal code for land inside the city limits or the Santa Clara County Code standards for land in unincorporated areas of Santa Clara County	AMM-NOI-1: Work Hours AMM-NOI-3: Noise Best Management Practices	S	M-NOI-1	LTS
NOI-2: A substantial temporary or periodic increase in ambient noise levels in the project vicinity due to construction activities	AMM-NOI-1: Work Hours AMM-NOI-2: Wildlife Buffers AMM-NOI-3: Noise Best Management Practices	S	M-NOI-1	LTS
NOI-3: Expose people to or generate excessive ground-borne vibration or ground-borne noise levels	None	LTS		LTS

Table C.3-1. Summary of Project Impacts

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
NOI-4: A substantial permanent increase in ambient noise levels or vibration in the project vicinity above existing levels without the project	None	LTS		LTS
NOI-5: Exposure of people residing or working in the study area to excessive aircraft-generated noise levels	None	No Impact		No Impact
HEA-1: Create a significant hazard to the public through exposure to disease vectors	None	LTS	None	LTS
HEA-2: Create a substantial increase in the need for vector (mosquito) management	AMM-HEA-1: Coordinate with Vector Control District	LTS	None	LTS
CUL-1: Cause a substantial adverse change in the significance of a historical or archaeological resource as defined in CEQA Guidelines Section 15064.5 or 36 CFR 800.5 of the ACHP's implementing regulations	AMM-CUL-1: Avoid Cultural Resources	S	M-CUL-1	LTS
CUL-2: Cause a disturbance of human remains, including those interred outside of formal cemeteries	AMM-CUL-2: Discovery of Remains	LTS	None	LTS
UTL-01: Police and emergency services	AMM-UTL-2: Flood Warning Signs	LTS	None	LTS
UTL-02: Construction waste and landfill capacity	AMM-UTL-: Reuse Materials	LTS	None	LTS
UTL-03: Construction of new or expanded utilities	AMM-UTL-3: Relocate Utilities	LTS	None	LTS
UTL-04: Power transmission lines and tower	None	LTS	None	LTS
UTL-05: Interfere with rail transportation or operations	None	LTS	None	LTS
UTL-06: Water use impacts	None	LTS	None	LTS

NI = No Impact
LTS = less than significant
S = significant
B = beneficial
NA = not applicable
DO = dissolved oxygen

SWPPP = Stormwater Pollution Prevention Plan
MeHg = Methylmercury
BMPs = Best Management Practices
CEQA = California Environmental Quality Act
CFR = Code of Federal Regulations
ACHP = Advisory Council on Historic Preservation

C.4 Unavoidable Adverse Impacts

Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures* describes the potentially significant project-related effects on the built and natural environments. The analyses in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures* identify a number of potentially significant effects associated with the action alternatives; most of those effects could be reduced to a less-than-significant level with the application of mitigation. The action alternatives would result in the following unavoidable adverse effects:

- **Incompatibility with the *New Chicago Marsh Water Management Plan*** (Section 4.3 *Land Use and Planning*) – Alternative 5 only
- **Loss/disruption of marsh habitat in New Chicago Marsh** (Section 4.7 *Terrestrial Biological Resources*):
  - Levee bisecting New Chicago Marsh effect on wildlife movement and habitat connectivity – Alternative 4 only
  - Levee alignment leaving all or part of New Chicago Marsh subject to tidal flooding effect on population and habitat trends – project and cumulative impact for Alternatives 4 and 5
  - Incompatible with biological components of *New Chicago Marsh Water Management Plan* – Alternatives 4 and 5
- **Violate air quality standard for nitrogen oxides and reactive organic gases** (Section 4.10 *Air Quality/Greenhouse Gases*) – All action alternatives
- **Short-term negative effect on visual character** (Section 4.12 *Aesthetics*) – Alternatives 4 and 5
- **Long-term negative effect on visual character from Alviso** (Section 4.12 *Aesthetics*) – project and cumulative impact for Alternatives 4 and 5
- **Cumulative loss of pond habitat used by pond-specialist bird species** (Section 4.7 *Terrestrial Biological Resources*) – all action alternatives
- **Cumulative temporary increase in noise levels** (Section 4.13 *Noise*) – all action alternatives

C.5 Potential Areas of Controversy

The loss of pond habitats due to the creation of tidal marsh was extensively debated during the 5-year programmatic planning effort of the South Bay Salt Pond Restoration Project (SBSP Restoration Project; 2003–2008). The SBSP Restoration Project environmental documentation stated that the preferred alternative included up to 90 percent of the project area be restored to tidal marsh in order to make up for the overwhelming loss of the historic tidal wetland resources. However, the project documentation also stated that several strategies would be incorporated into the project to address impacts to the pond-specialist species.

- The first major strategy is to enhance a carefully selected group of existing ponds to improve their productivity, creating what are called “enhanced managed ponds.” These are ponds that have lower salinity levels, better ability to manage water levels and flows with new water-control structures, and islands for roosting and nesting.
- The second strategy for the SBSP Restoration Project to prevent significant impacts to pond species is the adaptive management process. Conversion of ponds to tidal wetlands will happen over time, in phases, with monitoring and applied studies being incorporated into the process.

Based on these results, if undesired impacts appear, then corrective action would be taken or, possibly, the conversion of ponds to tidal wetlands would stop. Since the Shoreline Phase I Study is closely coordinated with the SBSP Restoration Project planning effort, a similar approach was adopted to address the impacts of converting pond habitats to tidal wetlands. The ecosystem-restoration actions would be implemented in phases with monitoring and close integration with the adaptive management program of the SBSP Restoration Project.

C.6 Issues to Be Resolved

The draft EIR for the Plant Master Plan for the San José–Santa Clara Regional Wastewater Facility includes a levee alignment between Pond A18 and plant property that is not the same alignment discussed in this report. However, in the final adopted version of the San Jose/Santa Clara Water Pollution Control Plant’s Plant Master Plan (PMP, November 2013), the City did not adopt a specific levee alignment. Rather, the Plan outlines a vision of flood protection and restoration to be implemented in partnership with other agencies. The PMP can be found here: www.sanjoseca.gov/DocumentCenter/View/38425. The Project Description section of the PMP EIR, states “The levee alignment shown in the proposed site plan is subject to change as the Shoreline study is in the planning phase. Therefore, the levee alignment segment traversing the active biosolids lagoons is identified as tentative. The role of the PMP is to accommodate the levee, which will be designed and constructed by other agencies. City staff will continue to work with the Shoreline Study agencies in the development of the levee.” The project proponents of the Shoreline Phase I Project will continue to work with the City of San José and the regulatory agencies to coordinate the two plans and develop a final alignment that serves both while minimizing adverse effects.

As noted throughout this report, there is some uncertainty as to how various environmental resources would respond to long-term changes brought about by the Shoreline Phase I Project and the SBSP Restoration Project. The Shoreline Phase I Project includes an extensive Monitoring and Adaptive Management Plan (Appendix F *Shoreline Study Monitoring and Adaptive Management Plan for Ecosystem Restoration*). As implementation of the project progresses, adaptive management would guide the selection of the final mix of habitats. Since project construction would occur over more than 14 years, later phases would reflect lessons learned from earlier actions. Adaptive management may also result in corrective measures being implemented for earlier phases.

1.0 Study Information

The U.S. Army Corps of Engineers (USACE) is conducting a flood risk management and ecosystem restoration feasibility study for the South San Francisco Bay (South Bay) shoreline. Pursuant to the National Environmental Policy Act of 1969, as amended (NEPA), and the California Environmental Quality Act of 1970, as amended (CEQA), the USACE and the U.S. Fish and Wildlife Service (USFWS) are acting as the co–lead agencies under the NEPA, and the Santa Clara Valley Water District (SCVWD) is acting as the lead agency under the CEQA. Additionally, the California State Coastal Conservancy (State Coastal Conservancy) serves as a non-Federal cost-share partner and CEQA Responsible Agency for this project. A CEQA Responsible Agency is a State agency other than the lead agency that is responsible for carrying out or approving a project and complying with the CEQA.

This chapter provides basic background information for the study. It describes the overall study methodology and relates the steps in the USACE planning process to the organization of the report. In addition, it provides information on the integration of both the NEPA and the CEQA and similarly provides a roadmap to locate topics of concern specific to these processes.

1.1 Organization of This Report

This report is divided into the following 12 chapters:

- Chapter 1 – Study Information
- Chapter 2– Need for and Purpose of Action
- Chapter 3 – Alternative Plan Formulation, Evaluation, Comparison, and Selection
- Chapter 4 – Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures
- Chapter 5 – NEPA/CEQA Considerations and Other Required Analyses
- Chapter 6 – Public Involvement, Review, and Consultation
- Chapter 7 – List of Preparers
- Chapter 8 – Compliance with Applicable Laws, Policies, and Plans
- Chapter 9 – Findings and Recommended Plan
- Chapter 10 – Conclusions and Recommendations
- Chapter 11 – References
- Chapter 12 – Glossary and Index

Comments on the Draft Integrated Document are contained in Appendix I *Shoreline Phase I Integrated Document Comments and Responses*. This Final Integrated Document is also supported by other appendices, which are:[1]

- Appendix A: National Environmental Policy Act and California Environmental Quality Act Supporting Documentation
  - Appendix A1: Public Comments Received at Scoping Meeting on January 25, 2006
  - Appendix A2: Shoreline Notice of Preparation Comment Letters (2006 and 2014)
  - Appendix A3: Shoreline Phase I Construction Traffic Access Route Plan
  - Appendix A4: Transportation Level of Service Calculations
  - Appendix A5: Criteria Pollutants
  - Appendix A6: 2010 Census Data – Racial and Ethnic Distribution of Study Area
  - Appendix A7: 2010 Census Data – 5-Year Income Estimates for Study Area
  - Appendix A8: Coastal Zone Management Act Consistency Determination
- Appendix B: Supporting Planning and Environmental Documentation and Information
  - Appendix B1: Shoreline Study Preliminary Alternatives and Landscape Evolution Memo
  - Appendix B2: Environmental Benefits Analysis (CHAP) Summary and Model Outputs
  - Appendix B3: Flood Risk Management Coordination with the USFWS
  - Appendix B4: Draft Memorandum Regarding Shoreline Study Ecosystem Restoration Phasing Alternatives (Ponds A9–A15)
  - Appendix B5: Biological Resources: Species Scientific Names, California Natural Diversity DataBase Report, and California Rare Plant Ranks Report
  - Appendix B6: South San Francisco Bay Shoreline Study Existing Biological Conditions Report
  - Appendix B7: USFWS Coordination Act Report under the Fish and Wildlife Coordination Act
  - Appendix B8: Endangered Species Act Compliance
  - Appendix B9: Pertinent Correspondence
  - Appendix B10: Clean Water Act Section 404(b)(1) Analysis
  - Appendix B11: Recovery Plan Criteria for Downlisting and Delisting for California Sea Blite, Salt Marsh Harvest Mouse, and Ridgway's Rail

[1] The order of Integrated Document appendices has been modified since publication of the Draft Integrated Document. The appendices section of this document includes a table that shows the appendix identifier used in the draft document.

  - Appendix B12: Environmental Justice Appendix
- Appendix C: Economics
- Appendix D: Hydrology and Hydraulics
  - Appendix D1: Coastal Engineering and Riverine Hydraulics Summary
  - Appendix D2: Tidal Flood Risk Analysis Summary Report
- Appendix E: Civil Design and Cost Engineering
  - Appendix E1: Civil Design
  - Appendix E2: Basis of Cost Estimate Memorandum
- Appendix F: Shoreline Study Monitoring and Adaptive Management Plan for Ecosystem Restoration
- Appendix G: Geotechnical Investigation and Analysis, South San Francisco Bay Shoreline Study, F3 Milestone, without Project
- Appendix H: Real Estate Plan
- Appendix I: Public Comments and Responses on Draft Integrated Document

The chapter headings and order in this report generally follow the outline of an Environmental Impact Statement/Environmental Impact Report (EIS/EIR). Information specific to the Recommended Plan (Proposed Project) is located throughout the document. This rest of this section provides detail regarding the organization of this Integrated EIS/EIR (Integrated Document).

1.1.1 Chapter 1 – Study Information

This chapter provides an annotated outline and general information regarding the project scope and terminology used in the document. Significant information provided in this chapter includes:

- **Section 1.3** *USACE Study Authority for Shoreline Study* and **Section 1.4** *NEPA/CEQA/USACE Statutory Basis for This Document*: overviews of the USACE study authority and NEPA/CEQA/USACE statutory bases for this report;
- **Section 1.5** *Project Background and Physical Study Area Setting*: a summary of the history of the Shoreline Study and parameters considered in determination of the Phase I study area, which is the subject of this Integrated Document;
- **Section 1.6** *NEPA/CEQA/USACE Integrated Document Project-Specific Terminology*: a list of project-specific NEPA/CEQA/USACE terms used in this Integrated Document;
- **Section 1.7** *Study Sponsors, Participants, and Other Coordination*: a list of study sponsors and other participants and a description of agency coordination conducted to date;

- **Section 1.8** *USACE Planning Process Summary*: a summary of the USACE planning process;
- **Section 1.9** *Scope of The Shoreline Phase I Analysis*: a description of the scope of analysis; and
- **Section 1.10** *History of Investigations in the Study Area* and **Section 1.11** *Documents Incorporated by Reference*: a history of investigations in the area, including existing programs, and documents incorporated by reference.

1.1.2 Chapter 2 – Need for and Purpose of Action

This chapter includes details of the Federal and non-Federal purpose and need, problems and opportunities, planning objectives, planning constraints, and other planning considerations (USACE Planning Step 1). It also describes the need for and purpose of the Action under NEPA requirements. An EIS must briefly specify the underlying purpose and need to which the lead agency is responding in proposing the action and the alternatives (40 CFR 1502.130). Significant information provided in Chapter 2 *Need for and Purpose of Action* includes:

- **Section 2.1** *Need for the Project*: a description of the project need;
- **Section 2.2** *Federal Objectives* and **Section 2.3** *Non-Federal Sponsors' Objectives and Public Concerns*: lists of Federal objectives and non-Federal and local sponsor objectives for the project;
- **Section 2.4** *Problems and Opportunities*: detailed information about problems in the study area and opportunities to address those problems; and
- **Section 2.5** *Project Planning Objectives*, **Section 2.6** *Planning Constraints, and* **Section 2.7** *Other Planning Considerations*: lists of project planning objectives, planning constraints, and other planning considerations.

1.1.3 Chapter 3 – Alternative Plan Formulation, Evaluation, Comparison, and Selection

This chapter presents the process by which alternative plans that address the planning objectives were developed and screened (USACE Planning Step 3), alternative plans were compared and evaluated (USACE Planning Steps 4 and 5), and the initial Tentatively Selected Plan, now the Recommended Plan, was selected (USACE Planning Step 6; also known as the Proposed Project under CEQA and Proposed Action under NEPA). Significant information provided in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* includes:

- **Section 3.1** *USACE Planning Process*: a summary of the plan formulation and initial alternatives development processes;
- **Section 3.2** *Plan Formulation*: detailed information about assumptions for the future without-project condition (i.e., future no action alternative);

- **Section 3.3** *Future Without-Project Condition*: a list of the management measures that were considered to meet the project planning objectives and the screening results that indicate which measures were carried forward in the plan development process;
- **Section 3.4** *Management Measures*: a detailed description of the flood risk management element of plan formation, with focus on two distinct levee segments, and of the evaluation and screening process using the *Principles and Guidelines for Water and Land Related Resources Implementation Studies* (P&G; completeness, effectiveness, efficiency, and acceptability). Includes detail about developing and screening the National Economic Development (NED) plan and identifying the locally preferred option for flood risk management;
- **Section 3.5** *Flood Risk Management Options*: a detailed description of the ecosystem restoration element of plan formulation and screening using the P&G, with focus on different levels of effort for in-pond preparation, different types of transitional habitat, and monitoring and adaptive management. Includes detail about developing and screening the options using a cost-effectiveness and incremental cost analysis and identifying a NED plan for ecosystem restoration;
- **Section 3.6** *Ecosystem Restoration Plan Formulation*: describes how screening results for flood risk management and ecosystem restoration were considered and assembled to identify a final array of alternative plans;
- **Section 3.7** *Final Array of Alternatives*: provides detailed information about flood risk management and ecosystem restoration elements that are part of alternatives in the final array, a construction schedule, and features that would avoid or reduce adverse environmental effects associated with construction of any of the final array alternative plans;
- **Section 3.8** *Action Alternatives Component Details*: a comparative analysis of the final array of alternatives. Focuses on NED, Environmental Quality (which includes a National Ecosystem Restoration [NER] analysis), Regional Economic Development costs, and the four P&G criteria (completeness, effectiveness, efficiency, and acceptability);
- **Section 3.9** *Evaluation and Comparison of the Final Array of Alternatives*: identifies the NED/NER plan, the Recommended Plan (details about the Recommended Plan [Proposed Project] and implementation particulars are included in Chapter 9 *Findings and Recommended Plan*), the least environmentally damaging practicable alternative (LEDPA), and the CEQA environmentally superior alternative; and
- **Section 3.10** *Plan Selection*: describes the NED/NER Plan, Recommended Plan, LEDPA, and CEQA Environmentally Superior Alternative.
- **Section 3.11** *Risks and Uncertainty*: provides detail about specific risks to and uncertainty that could affect the plan and how the risk and uncertainty could affect plan implementation.

1.1.4 Chapter 4 – Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures

This chapter is the longest chapter of the Integrated Document and includes a substantial amount of information. It provides an overview of the approach to the environmental analyses and a summary of resources considered but not found to be significant in the study area. It describes the affected environment for the resources studied. Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures* describes the methods used to analyze environmental consequences associated with the plan alternatives, summarizes the environmental consequences of the alternatives, identifies mitigation measures for adverse effects, and reviews the cumulative impacts by resource area (USACE Planning Steps 2, 4, and 5).

Section 4.1 *Approach to the Environmental Analysis* is an introductory section that sets the stage for the rest of Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures*. This section includes a description of how the chapter is organized, the criteria used to determine the significance and type of environmental effects, and the study area and potential project footprint. Section 4.1 *Approach to the Environmental Analysis* provides detailed descriptions of the physical setting, the expected future without-project condition for resources in the study area, major characteristics of the study area's natural and human resources, and resources found to be potentially significant in the study area. Section 4.1 *Approach to the Environmental Analysis* also describes the cumulative impacts setting that is used for all of the resource-specific cumulative impacts analyses. Finally, Section 4.1 *Approach to the Environmental Analysis* describes climate change assumptions and modeling considerations.

The rest of the Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures* sections (Section 4.2 *Geology, Soils, and Seismicity* through Section 4.16 *Public Utilities and Service Systems*) focus on these elements of the resources listed in Table 1.1-1 *Resources Evaluated in Detail in Chapter 4 Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures* that could be affected by the plan alternatives.

Each resource discussion in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures* includes two main sections:

- An **Affected Environment** section, which contains subsections for the resource-specific regulatory setting, physical setting, and baseline condition; and
- An **Environmental Consequences** section, which contains subsections for resource-specific avoidance and minimization measures incorporated into the alternatives, a description of the impact analysis methods and significance thresholds, impact evaluation results for the No Action Alternative and for the action alternatives, mitigation measures (if appropriate), a description of the residual impacts, a description of resource-specific cumulative effects, and a summary of project effects.

Table 1.1-1. Resources Evaluated in Detail in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures*

Section in Chapter 4	Topics	Page Number
4.2	Geology, soils, and seismicity	4-39
4.3	Land use and planning	4-53
4.4	Hydrology and flood risk management	4-85
4.5	Surface water and sediment quality	4-127
4.6	Aquatic biological resources	4-183
4.7	Terrestrial biological resources	4-259
4.8	Hazards and hazardous materials	4-401
4.9	Transportation	4-427
4.10	Air quality/greenhouse gases	4-467
4.11	Recreation	4-501
4.12	Aesthetics	4-531
4.13	Noise	4-567
4.14	Public health	4-591
4.15	Cultural resources	4-603
4.16	Public utilities and service systems	4-633

1.1.5 Chapter 5 – NEPA/CEQA Considerations and Other Required Analyses

This chapter provides information and analyses related to environmental justice, a summary of key cumulative impacts, growth-inducing impacts, and other NEPA/CEQA required analyses, such as declaration of any unavoidable adverse impacts, irreversible and irretrievable commitments of resources, compliance with CEQA Appendix F *Energy Conservation*, and the relationship of short-term uses and long-term productivity.

1.1.6 Chapter 6 – Public Involvement, Review, and Coordination

This chapter includes a description of the public involvement process, including scoping activities and a summary of public concerns, and the overall Integrated Document distribution and circulation.

1.1.7 Chapter 7 – List of Preparers

This chapter provides a list of individuals primarily responsible for preparation of this Integrated Document.

1.1.8 Chapter 8 – Compliance with Applicable Laws, Policies, and Plans

This chapter summarizes compliance with applicable Federal, State, and local polices and regulations.

1.1.9 Chapter 9 – Findings and Recommended Plan

This chapter details the Recommended Plan (USACE Planning Step 6). Significant information provided in Chapter 9 *Findings and Recommended Plan* includes:

- **Section 9.1** *Shoreline Phase I Study Findings*: summarizes the findings associated with the Recommended Plan;
- **Section 9.2** *Plan Description*: describes the Recommended Plan features; real estate considerations for the Recommended Plan; and operations, maintenance, repair, replacement, and rehabilitation associated with the Recommended Plan;
- **Section 9.3** *Plan Accomplishments and Impacts, in Comparison with the NED/NER Plan*: describes how the Recommended Plan would address the project planning objectives and problems and opportunities and identifies the resource-specific accomplishments;
- **Section 9.4** *Plan Cost and Cost Sharing*: describe the planning and financial conditions that apply to implementing the Recommended Plan;
- **Section 9.5** *Plan Implementation*: describes the steps needed to implement and responsibilities (including cost-sharing responsibilities) for implementing the Recommended Plan;
- **Section 9.6** *Local Actions for Flood Risk Management*: identifies complementary flood risk management actions that could be included in the future floodplain management plan for the study area;
- **Section 9.7** *Risk*: describes future uncertainties associated with the Recommended Plan; and
- **Section 9.8** *Consistency with Other USACE Initiatives*: describes the consistency of the Recommended Plan with other USACE directives.

1.1.10 Chapter 10 – Conclusions and Recommendations

This chapter includes a formal letter of recommendation from a USACE officer to Congress with any proposed funding modifications and details of the funding co-share between the USACE and the non-Federal funding sponsors.

1.1.11 Chapter 11 – References

This chapter lists the references used during preparation of this report.

1.1.12 Chapter 12 – Glossary and Index

This chapter provides definitions for some key terms used in this document and an alphabetized list of selected words with reference to the page(s) on which each term is discussed within this Integrated Document.

1.1.13 Recommended Plan Specifics

Specific information about details included as part of the Recommended Plan can be found in many different chapters of this Integrated Document, as follows:

- The formulation strategy is described in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*, Section 3.1 *USACE Planning Process*.
- The formulation and components of the Recommended Plan are described in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*, Section 3.4 *Management Measures*, and Section 3.5 *Flood Risk Management Options*.
- Management measures that are included as part of the Recommended Plan (Proposed Project) are shown in Table 3.6-1 *Costs and Outputs of Restoration Measures* which is included in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*, Section 3.6 *Ecosystem Restoration Plan Formulation*.
- The USACE economic evaluations that support the Recommended Plan are described in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*.
- The environmental effects associated with the Recommended Plan are described throughout Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures*.
- The costs associated with the Recommended Plan are included in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* and Chapter 9 *Findings and Recommended Plan*. Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*, Section 3.8 *Cost Estimate*, Table 3.9-1 *Final Array of Alternatives: Features and Costs (October 2014 Price Levels)* shows costs by plan element in comparison to the other plan alternatives. Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*, Section 3.9.2 *Associated Evaluation Criteria* describes the Recommended Plan costs. Recommended Plan costs are further detailed in Chapter 9 *Findings and Recommended Plan*, Section 9.5 *Plan Implementation*, Table 9.5-1 *Comparison of Total Annual Benefits and Costs for NED/NER and LPP*.
- Implementation responsibilities are described in Chapter 9 *Findings and Recommended Plan*, Section 9.6 *Local Actions for Flood Risk Management*.

1.2 Purpose of Document

The purpose of this report is two-fold: (1) to present the findings of an Interim Feasibility Study that was completed to investigate and determine whether there is a Federal interest in providing flood risk management and ecosystem restoration improvements in the Alviso Ponds area of South San Francisco Bay, and (2) to fulfill the Federal (NEPA) and State (CEQA) requirements for environmental review of alternative actions. This document will be referred to as an Integrated Document moving forward, inclusive of both the Interim Feasibility Study and NEPA/CEQA environmental review aspects of the chapters.

Chapter 2 *Need for and Purpose of Action* discusses in detail the underlying purpose of and need for the project to which the USACE, the State Coastal Conservancy, and the SCVWD are responding in proposing the alternatives presented in this Integrated Document, including the Recommended Plan (Proposed Project). In summary, the USACE, the State Coastal Conservancy, and the SCVWD have identified needs for flood risk management and ecosystem restoration. The purposes of the project, expressed in objectives in Section 2.5 *Project Planning Objectives*, are as follows:

- Reduce the risk to public health, human safety, and the environment due to tidal flooding along the South Bay shoreline in Santa Clara County.
- Reduce potential economic damages due to tidal flooding in areas near the South Bay shoreline in Santa Clara County.
- Restore ecological function and habitat quantity, quality, and connectivity in the study area for native plant and animal species, including special-status species such as steelhead trout, Ridgway's rail, and salt marsh harvest mouse.
- Community support (local and statewide) has advanced development of a fourth planning objective to provide opportunities for public access, environmental education, and recreation in the study area.

1.3 USACE Study Authority for Shoreline Study

This report is being prepared in response to multiple congressional actions, the first of which occurred in 1976 when the San Francisco Bay Shoreline Study was authorized by Congress through passage of the Water Resources Development Act of 1976 (WRDA; Public Law [PL] 94-587). Section 142 of this act reads:

> 1. The Secretary of the Army, acting through the Chief of Engineers, is authorized and directed to investigate the flood and related problems to those lands lying below the plane of mean higher high water along the San Francisco Bay shoreline of San Mateo, Santa Clara, Alameda, Napa, Sonoma and Solano Counties to the confluence of the Sacramento and San Joaquin Rivers with a view toward determining the feasibility of and the Federal interest in providing protection against tidal and fluvial flooding. The investigation shall evaluate the effects of any proposed improvements on wildlife preservation, agriculture, municipal and urban interests in coordination with Federal, State, regional, and local agencies with particular reference to preservation of existing marshland in the San Francisco Bay region.

2. A resolution adopted by the Committee on Transportation and Infrastructure of the U.S. House of Representatives on July 24, 2002, requested review of the 1992 Letter Report for the South San Francisco Bay Shoreline Study (Shoreline Study), California (Docket 2697):

> Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, that the Secretary of the Army is requested to review the Final Letter Report for the San Francisco Bay Shoreline Study, California, dated July 1992, and all related interims and other pertinent reports to determine whether modifications to the recommendations contained therein are advisable at the present time in the interest of tidal and fluvial flood damage reduction, environmental restoration and protection and related purposes along the South San Francisco Bay shoreline for the counties of San Mateo, Santa Clara and Alameda, California.

3. Section 4027 of WRDA 2007 also authorized the South San Francisco Shoreline Study as well as provided direction on crediting non-Federal sponsor work and acquisition of real estate:

> (a) IN GENERAL-The Secretary, in cooperation with non-Federal interests, shall conduct a study of the feasibility of carrying out a project for-
>
> (1) flood damage reduction along the South San Francisco Bay shoreline, California;
>
> (2) restoration of the South San Francisco Bay salt ponds (including on land owned by other Federal agencies); and
>
> (3) other related purposes, as the Secretary determines to be appropriate.

(b) REPORT -

(1) IN GENERAL - Not later than 3 years after the date of enactment of this Act, the Secretary shall submit to Congress a report describing the results of the study under subsection (a).

(2) INCLUSIONS.-The report under paragraph (1) shall include recommendations of the Secretary with respect to the project described in subsection (a) based on planning, design, and land acquisition documents prepared by-

(A) the California State Coastal Conservancy;

(B) the Santa Clara Valley Water District; and

(C) other local interests.

(c) CREDIT -

(1) IN GENERAL - In accordance with section 221 of the Flood Control Act of 1970 (42 U.S.C. 1962d-5b), and subject to paragraph (2), the Secretary shall credit toward the non-Federal share of the cost of any project authorized by law as a result of the South San Francisco Bay shoreline study-

(A) the cost of work performed by the non-Federal interest in preparation of the feasibility study that is conducted before the date of the feasibility cost sharing agreement; and

(B) the funds expended by the non-Federal interest for acquisition costs of land that constitutes a part of such a project and that is owned by the United States Fish and Wildlife Service.

(2) CONDITIONS.-The Secretary may provide credit under paragraph (1) if-

(A) the value of all or any portion of land referred to in paragraph (1)(B) that would be subject to the credit has not previously been credited to the non-Federal interest for a project; and

(B) the land was not acquired to meet any mitigation requirement of the non-Federal interest.

Lastly, Section 1025 of the Water Resources Reform and Development Act (WRRDA) of 2014 provides discretionary authority to the Secretary to carry out authorized water resource development projects on other Federal lands under certain conditions:

> Sec. 1025. WATER RESOURCES PROJECTS ON FEDERAL LAND.
>
> (a) IN GENERAL —Subject to subsection (b), the Secretary may carry out an authorized water resources development project on Federal land that is under the administrative jurisdiction of another Federal agency where the cost of the acquisition of such Federal land has been paid for by the non-Federal interest for the project.
>
> (b) MOU REQUIRED—The Secretary may carry out a project pursuant to subsection (a) only after the non-Federal interest has entered into a memorandum of understanding with the Federal agency that includes such terms and conditions as the Secretary determines to be necessary.
>
> (c) APPLICABILITY—Nothing in this section alters any non-Federal cost-sharing requirements for the project.

Following the 2002 study authority, the reconnaissance phase of the study was initiated in 2004. This phase of the study resulted in the finding that there was a Federal interest in continuing the study into the feasibility phase. The SCVWD and the State Coastal Conservancy, as the non-Federal partners, and the USACE initiated the feasibility phase of the study in 2005. The feasibility phase study cost was shared equally between the USACE (50 percent) and the non-Federal partners (combined 50 percent). This report presents the results of both phases of the study to date for this refined footprint (Section 1.5 *Project Background and Physical Study Area Setting*); additional interim studies are anticipated for the remaining geographic area as defined in the congressional guidance.

1.4 NEPA/CEQA/USACE Statutory Basis for This Document

The USACE and the USFWS, as NEPA co-lead agencies, and the SCVWD as the CEQA lead agency, have prepared a joint project-level integrated Feasibility Report and EIS/EIR (i.e., Integrated Document) to address the potential impacts of the Shoreline Phase I Study on San Francisco South Bay, California. This study phase has been identified as the "Shoreline Phase I Study." This document is prepared in accordance with the following guidance:

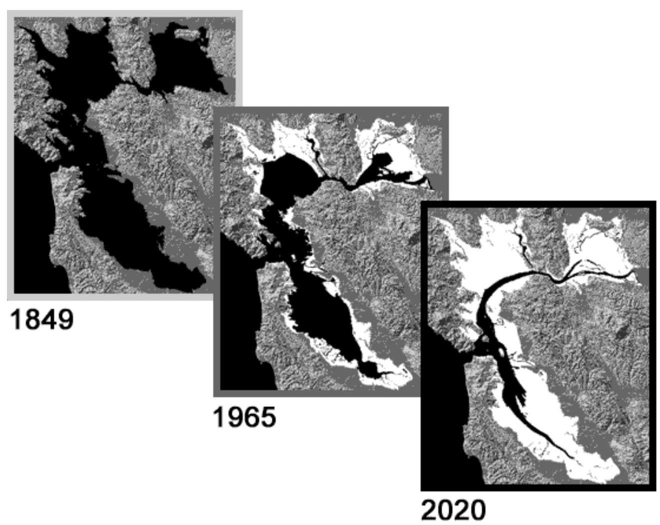
1. NEPA and the Council on Environmental Quality's (CEQ) NEPA regulations (42 United States Code [USC] 4321; 40 Code of Federal Regulations [CFR] 1500 et seq.). Under the NEPA, Federal agencies are required to develop an EIS to evaluate the environmental effects of an action, including feasible alternatives, and identify mitigation measures to minimize adverse effects when they propose to carry out, approve, or fund a project that may have a significant effect on the environment.
2. CEQA (California Public Resources Code [PRC] Section 21000, et seq.). The CEQA requires preparation of an EIR when an agency action, such as approval and implementation of the Shoreline Phase I Project, may have a significant impact on the environment. An EIR is a document describing and analyzing the significant environmental effects of a project and discussing ways to mitigate or avoid the effects. Pursuant to PRC §15126.6(a) of the CEQA Guidelines, an EIR shall describe a range of reasonable alternatives that would feasibly attain most of the basic project objectives but would avoid or substantially lessen any of the significant impacts of the project, and evaluate the comparative merits of the alternatives.
3. The elements and process of a USACE Feasibility Study are defined in legislation and in USACE guidance. The process is performed within the purview of several statutes (e.g., Water Resources Planning Act of 1965, multiple Water Resources Development Acts, Flood Control and Rivers and Harbors Acts, the NEPA, National Historic Preservation Act of 1966, etc.); an Executive Order (EO; *Principles and Guidelines for Water and Land Related Resources Implementation Studies* [P&G]); USACE Engineer Regulation (ER) 1105-2-100, *Planning Guidance Notebook*; and other applicable planning policies. The purpose of a Feasibility Study is to "identify, evaluate, and recommend to decision-makers an appropriate, coordinated, implementable solution to the identified water resources problems and opportunities" (ER 1105-2-100, Appendix G, p. G-22). At this stage, the Feasibility Study focuses on evaluation of alternatives to reach a single recommended plan for more detailed design.

1.5 Project Background and Physical Study Area Setting

Natural salt ponds once existed in the tidal marshes of San Francisco Bay. Salt was harvested from these ponds by Native Americans and early Spanish and Mexican settlers but was of a poor quality and an uncertain quantity from year to year. Beginning in the 1850s, shallow areas of San Francisco Bay and tidal marshes were diked to expand the number of ponds and to commercially produce salt through solar evaporation (BCDC 2005). Natural conditions present in the Bay Area, such as a dry climate, adequate open area for ponds, and prevailing summer winds to aid in evaporation, as well as a regional economic market to support sales, made the area viable for production.

The solar salt production process takes several years and includes multiple stages of processing. The first stage consists of an intake pond, where bay water is taken into the salt pond system in the dry months when bay salinity is highest. The next stage consists of a series of “evaporator” ponds (circulation ponds), where the water (now referred to as brine) increases in salinity through evaporation as it progresses through the ponds. When the brine becomes fully saturated with salt, the brine is pumped into “pickle” ponds for storage and then into numerous crystallizers where the salt (sodium chloride) precipitates from solution into the crystallized form of common salt. This raw salt is mechanically harvested and sent to processing plants.

Degradation and expansive land conversion taking place throughout the bayland ecosystem first received widespread attention through public response to a U.S. Department of Commerce report published in the late 1950s based on studies done by the USACE called the “2020 Plan.”



In identifying the without-project condition, the plan forecasted extensive filling of San Francisco Bay to provide more land for development. Local citizens reacted to this forecast by organizing the Save the San Francisco Bay Association (Save the Bay) to advocate for greater protection of the bay.

At the urging of this organization, State legislation—the McAteer-Petris Act—was passed in 1965 to establish the San Francisco Bay Conservation and Development Commission (BCDC) as a temporary State agency. The BCDC was charged with preparing a plan for the long-term use of the bay and regulating development in and around the bay while the plan was being prepared. The San Francisco Bay Plan, which was completed in January 1969, includes policies on issues critical to the wise use of the bay ranging from ports and public access to design and transportation.

In August 1969, the McAteer-Petris Act was amended to make the BCDC a permanent agency and to incorporate the policies of the Bay Plan into State law. The BCDC is the federally designated State coastal management agency for the San Francisco Bay segment of the California coastal zone. This designation empowers the BCDC to use the authority of the Federal Coastal Zone Management Act (CZMA) to ensure that Federal projects and activities are consistent with the policies of the Bay Plan and State law. Among other things, the BCDC is currently responsible for developing rules and regulations prohibiting big bay-fill projects and for permitting any proposed projects that can affect the bay.

Soon after, in 1972, the Don Edwards San Francisco Bay National Wildlife Refuge (Refuge) was established on roughly 20,000 acres of active (currently used in solar salt production) and former (inactive; no longer used for salt production) salt ponds. The Refuge, which includes most of the former salt ponds in the Alviso complex, was established "… for the preservation and enhancement of highly significant habitat … for the protection of migratory waterfowl and other wildlife, including species known to be threatened with extinction, and to provide opportunity for wildlife-oriented recreation and nature study …" (86 Statute [Stat] 399, dated June 30, 1972).

1.5.1 The South San Francisco Bay Shoreline Study

The Shoreline Study was originally authorized by Congress in 1976 to assess the need for flood risk management in the South Bay. In 1992, the USACE found that it could not, within its policy guidelines, economically justify developing a Federal flood risk management project along the South San Francisco Bay shoreline, mainly because it determined that Cargill (previously Leslie) Salt would continue to maintain its existing (and non-engineered) salt pond dikes due to economic interests. Although these salt pond dikes were not engineered or built for the purpose of flood risk management, they provided incidental flood risk management for the neighboring communities. However, in 2003, the Federal and State governments acquired 15,100 acres of active salt ponds in the South Bay from Cargill Salt (which had purchased the land from Leslie Salt) and began planning a restoration project that would ultimately affect the utility of those salt pond dikes as flood risk management structures. As a result, the U.S. House of Representatives requested that the USACE review its previous study on flood risk management in San Francisco Bay and expand the study's scope to include environmental restoration and protection as well as tidal and fluvial flood risk management.

The USACE completed an initial reconnaissance analysis in September 2004, which determined that, due to the current and future anticipated conditions in the South Bay, it was likely that a Federal flood risk management and ecosystem restoration project would be justified. The decision was made to phase the planning effort because of the large geographic extent of the South San Francisco Bay area; the complexity of the hydrology, hydraulics, and combined flood risk management and ecosystem restoration components; and in anticipation of Federal and non-Federal funding availability. The geographic area was generally split into three primary study areas: Ravenswood Ponds and San Mateo County, Alviso Ponds and Santa Clara County, and Eden Landing (also Alameda County; Figure 1.5-1 *South San Francisco Bay Shoreline Interim Feasibility Study Areas*). Each of the Interim Feasibility Studies, independent in utility and not reliant on other study areas' proposed actions, would address flood risk management, ecosystem restoration, recreation, and other project purposes specific to each area.

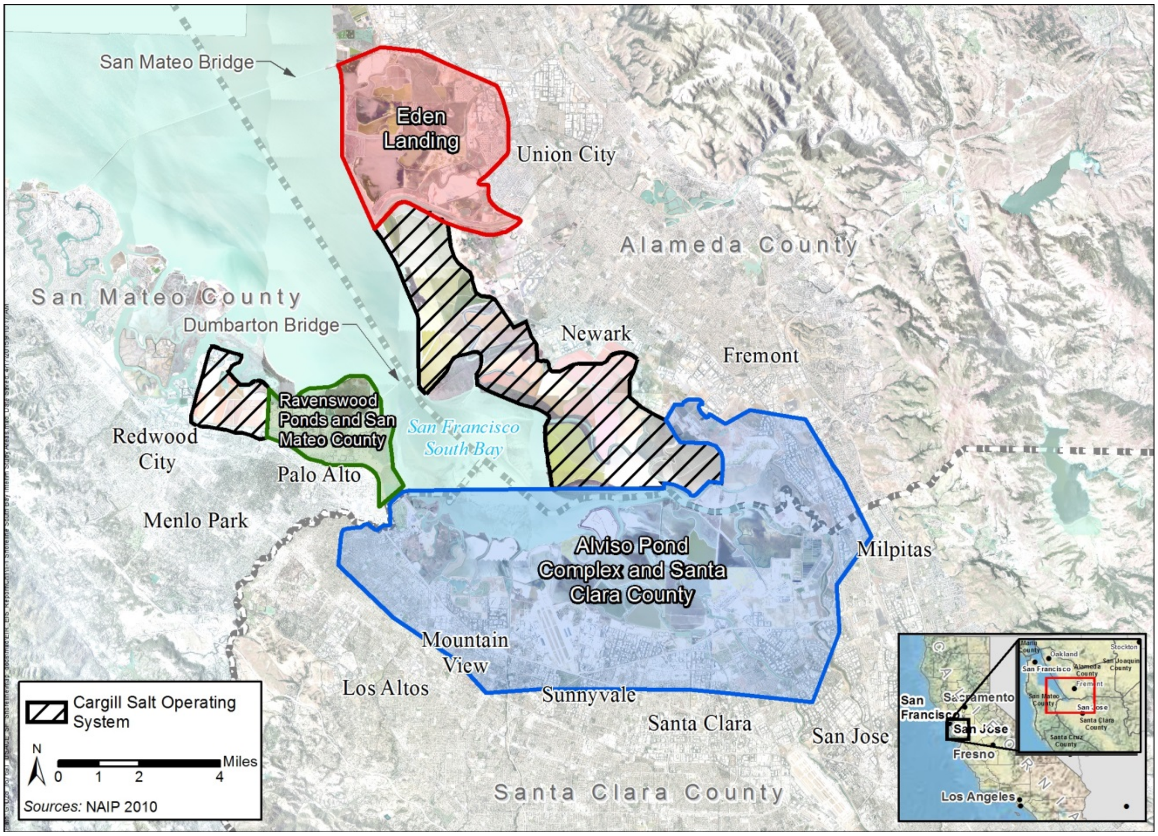


Figure 1.5-1. South San Francisco Bay Shoreline Interim Feasibility Study Areas

On October 24, 2005, the USACE, the USFWS, the SCVWD, and the State Coastal Conservancy initiated the South San Francisco Bay Shoreline Interim Feasibility Study (2005 Shoreline Study).

At this planning stage, the 2005 Shoreline Study area covered the southern portion of the South Bay, including the entire Alviso pond complex and other lands and waters stretching from southwest Fremont to Palo Alto (Figure 1.5-2 *Alviso Ponds Complex and 2005 Shoreline Study Area*). A subset of this larger area, the Alviso pond complex, includes approximately 9,000 acres of former salt production ponds and 15 miles of shoreline between Palo Alto and southwest Fremont. It consists of 25 ponds (many of which are managed by the USFWS as part of the Refuge) and resides at the bay's southern extremity in Santa Clara and Alameda Counties. To the south and east, this 2005 Shoreline Study area extended beyond the former salt ponds to include all lands subject to inundation from a 0.2-percent annual chance of exceedance (ACE; also referred to as *annual exceedance probability* in Appendix C *Economics*) tidal flooding event (also known as the 500-year flood) under the predicted future condition with sea level change (SLC).

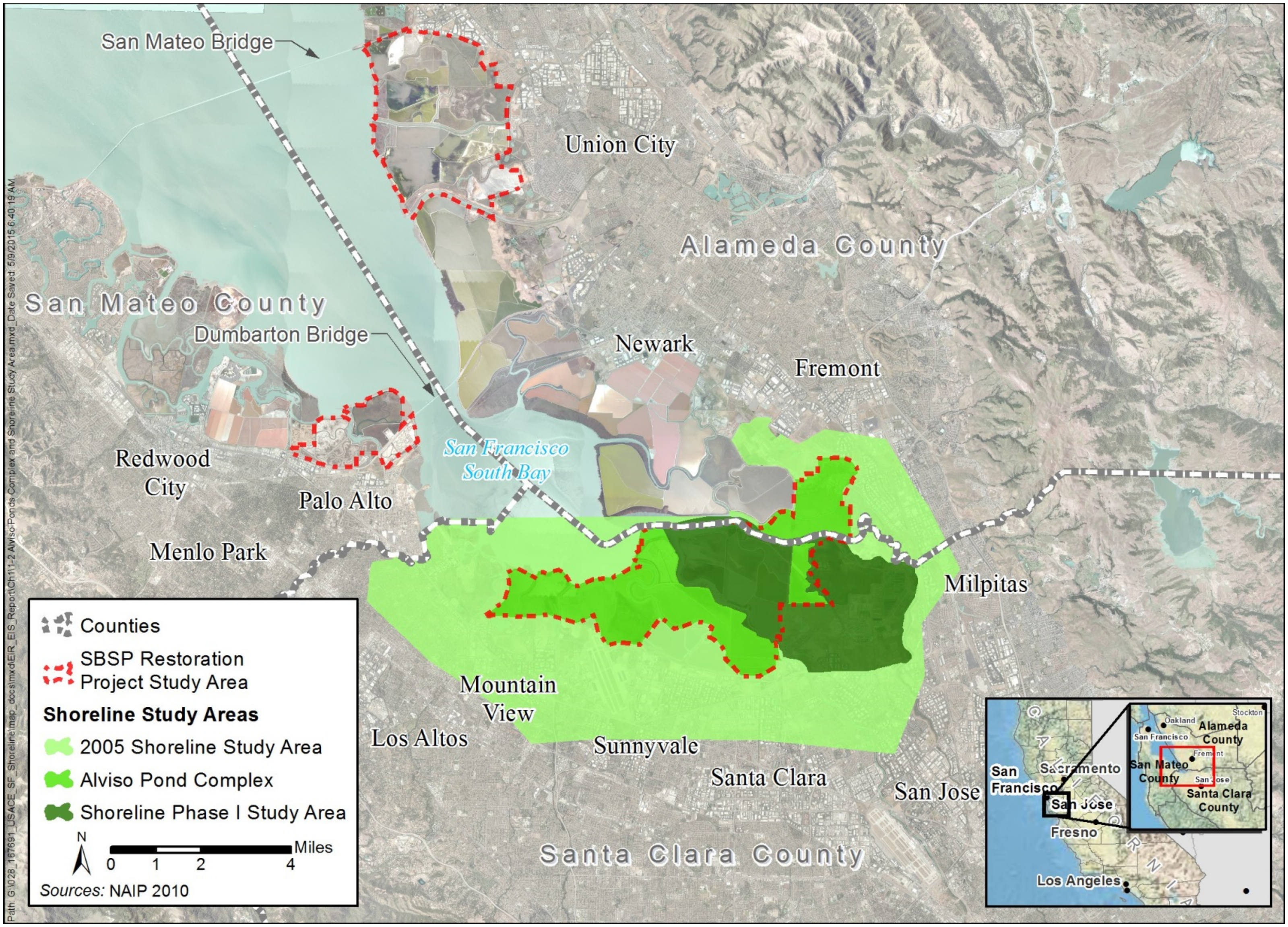


Figure 1.5-2. Alviso Ponds Complex and 2005 Shoreline Study Area

1.5.2 Annual Chance of Exceedance

This report uses the term ACE to describe the likelihood associated with individual storm and flood events. The ACE is the reciprocal in percentage terms of what is often referred to as the "return period" or "level of protection" (LOP). The return period of an annual maximum flood event is X years if its magnitude is equaled or exceeded once, on the average, every X years. For example, a 100-year return period (or LOP) means that, on average, it is expected that a storm of that magnitude or greater would occur once every 100 years. The inclusion of the phrase "on average" means that it is possible to have more than one (or zero) 100-year events over any number of years—or even in the same year.

The return period and LOP descriptors have in recent years been supplanted by ACE because it is believed that describing the chance of occurrence in annual percentage terms is more precise and less prone to misinterpretation. In this report, what has previously been known as the "100-year" storm or flood event is described as having an ACE of 1 percent.

Table 1.5-1 *Annual Chance of Exceedance Conversion to Other Commonly Used Flood Occurrence Descriptors* provides conversions for other return periods to corresponding ACE percentages that will be used in this report; for readers familiar with ACE ratios rather than percentages, the table also provides corresponding ratios for reference.

Table 1.5-1. Annual Chance of Exceedance Conversion to Other Commonly Used Flood Occurrence Descriptors

ACE Percentage (%)	Return Period (in years)	ACE ratio
4	25	1/25
2	50	1/50
1	100	1/100
0.5	200	1/200
0.2	500	1/500

1.5.3 South San Francisco Bay Shoreline Phase I Study

The USACE San Francisco District (District) completed the Shoreline Study Feasibility Scoping Meeting (FSM) milestone in September 2010. In 2011, subsequent to completion of the FSM submittal to Headquarters, the District and non-Federal sponsors agreed to proceed with the Shoreline Feasibility Study following a phased project implementation approach (referred to as the "refined project footprint following 2011 rescoping" in other sections). Lessons learned from completing this interim study phase could then be applied to the remaining study areas more expeditiously under future interim feasibility studies. The District selected Economic Impact Area 11 (EIA 11; Figure 1.5-3 *South San Francisco Bay USACE Economic Impact Areas*) to be the first area of focus. This area, also known as the Alviso subarea, is located within Santa Clara County and consists of the area between the mouth of the Guadalupe River (to the west) and the mouth of Coyote Creek (to the east) and extends south to include both the community of Alviso and the San José–Santa Clara Regional Wastewater Facility (Wastewater Facility).

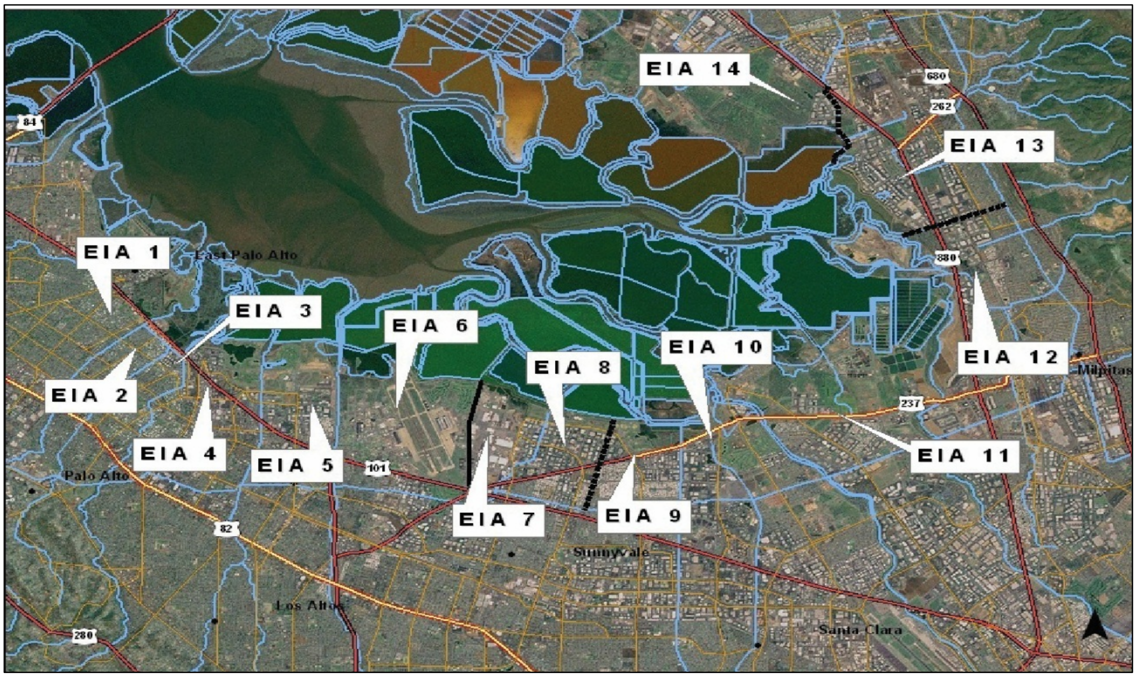


Figure 1.5-3. South San Francisco Bay USACE Economic Impact Areas

The District and non-Federal sponsors considered several factors when setting priorities to select the first EIA to implement in the phased approach. Early without-project flood risk analysis identified four of 14 USACE South Bay EIAs (Figure 1.5-3 *South San Francisco Bay USACE Economic Impact Areas*) that showed the greatest potential for future flood risk: EIAs 2 and 3 (Palo Alto area), EIA 7 (Sunnyvale area), and EIA 11 (Alviso area). However, since any of the EIAs could be implemented independent of each other without impacting the other EIAs by increased flood risk or precluding future restoration, the District and the non-Federal sponsors considered a variety of environmental and feasibility factors when deciding which EIA to implement first. The study partners chose EIA 11 to be the first for the following reasons:

1. The Alviso and Palo Alto areas both exhibit high future flood risk to public safety. However, the Palo Alto area could be covered under the ongoing San Francisquito Creek General Investigation Study, whose geographic scope overlaps that of the Shoreline Study.

2. The bottom elevations of the Alviso ponds are generally lower than other complexes around the bay due to subsidence from historical groundwater withdrawals. These ponds will require a greater amount of time to reach marsh plain elevations from natural sedimentation processes and therefore should be restored as soon as possible. Yet, restoration of these ponds is problematic because breaching has the potential to

greatly increase the tidal flood risk in the Alviso area. By providing coastal flood protection, these high-priority ponds can be restored sooner and take advantage of natural sedimentation processes before bay sediment levels decline. Implementing EIA 11 allows the restoration of ponds that should be the highest priority.

3. The Alviso area has the greatest amount of environmental benefit in the form of tidal wetland restoration compared to any other EIA. There are close to 3,000 acres of former solar salt production ponds between the Alviso Slough/Guadalupe River and Coyote Creek that could be restored to tidal wetlands, whereas the other three candidate EIAs include much smaller potential restoration actions. Restoration of nearly 3,000 acres of former salt ponds represents a major opportunity for restoration of tidal habitats in San Francisco Bay and recovery of ecological functions and habitat for Threatened and Endangered species.

This revised study area (hereafter referred to as the Shoreline Phase I Study Area, or study area) is described and shown below (Figure 1.5-4 *Alviso Pond Complex and Shoreline Phase I Study Area*).

Implementation of a Shoreline Phase I project between Coyote Creek and Alviso Slough/Guadalupe River does not require future actions to occur elsewhere and does not restrict future alternatives for other areas in the broader footprint covered by the 1976 study authority and 2002 study resolution (e.g., a Shoreline Phase II project covering FRM along the shoreline of other counties adjacent to South San Francisco Bay or restoration of additional former salt ponds within the Alviso, Ravenswood, or Eden Landing Pond complexes). The FRM and ecosystem restoration activities in the Shoreline Phase I area would provide life safety benefits and economic and environmental outputs absent other actions and thus would have "independent utility", justifying the separate planning process and recommendation for Congressional authorization. Tidal FRM features proposed in Shoreline Phase I project would tie into existing fluvial flood protection systems on Guadalupe River and Coyote Creek and would not affect the current fluvial level of protection. Hydrological modeling that was completed as part of the preliminary Shoreline Phase I Study analysis indicates that the coastal flood protection features of the Shoreline Phase I effort are independent to adjacent areas.

The Shoreline Phase I Study is closely coordinated with the ongoing implementation of the South Bay Salt Pond Restoration Project (SBSP Restoration Project), which is managed by the State of California, the USFWS, and local entities. The Shoreline Phase I Study and the SBSP Restoration Project will be implemented as separate projects, each having its own independent utility and neither dependent on the other to achieve their purpose and need, as defined in separate environmental review processes; however, much of the Shoreline Phase I Study Area falls within the broader area initially studied on a programmatic level by the SBSP Restoration Project.

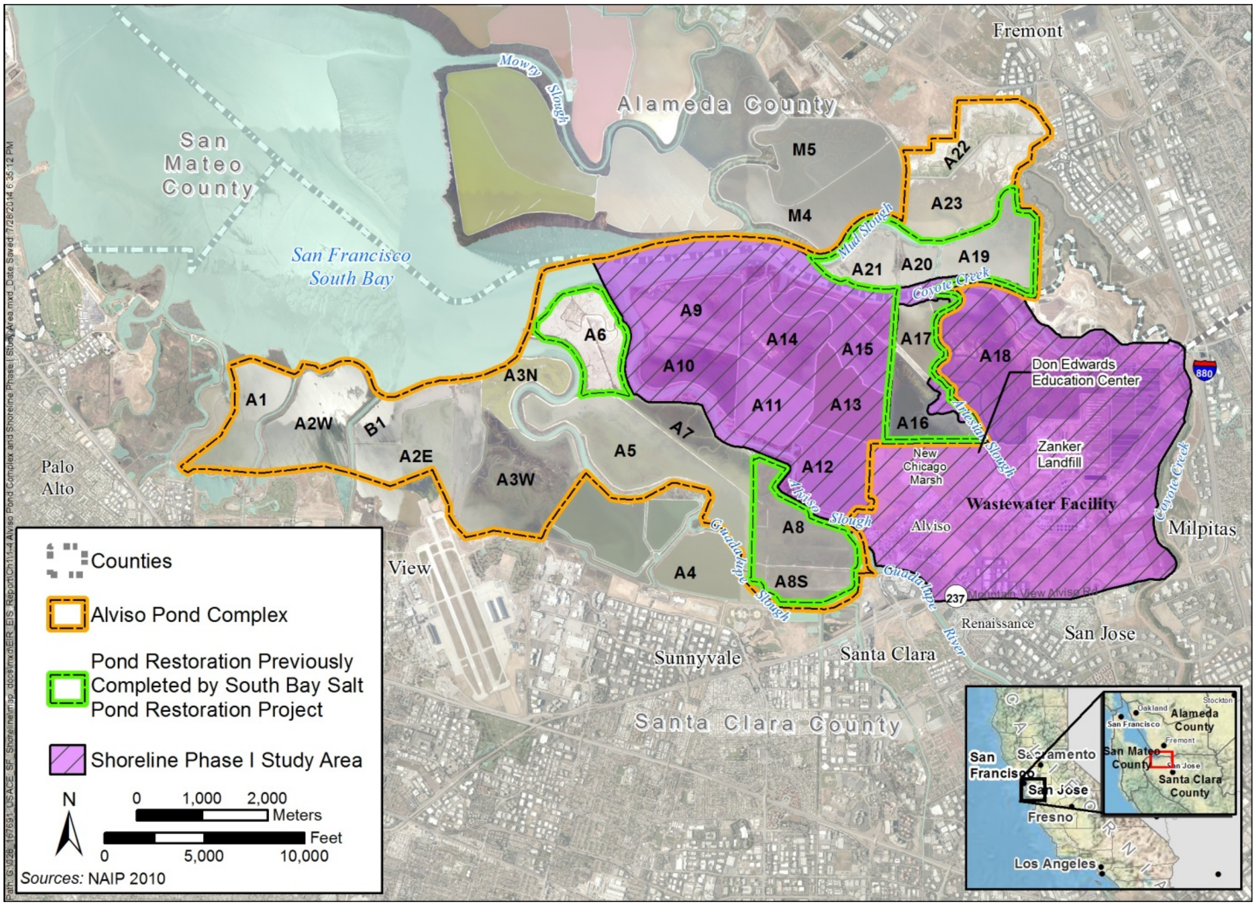


Figure 1.5-4. Alviso Pond Complex and Shoreline Phase I Study Area

A final SPSP Restoration Project EIS/EIR, including both programmatic and project-specific (Phase I) actions, was released in December 2007 (EDAW et al. 2007). The total SBSP Restoration Project area comprises 15,100 acres of former salt ponds and adjacent habitats in the South Bay that the USFWS and the California Department of Fish and Game (CDFG; now known as the California Department of Fish and Wildlife [CDFW]) acquired from Cargill Inc. in 2003. The SBSP Restoration Project study area extends from Eden Landing on the east bank and the Ravenswood Ponds in San Mateo and State Route (SR) 92 in the city of Hayward south along both sides of the bay to its southern end, and includes adjacent areas that may be flooded by the bay and/or that may offer opportunities for restoration of tidal and related habitats.

The USFWS owns and manages the 8,000-acre Alviso pond complex, within which are located New Chicago Marsh (NCM) and 2,100 acres of ponds (Ponds A9–A15; Figure 1.5-4 *Alviso Pond Complex and Shoreline Phase I Study Area*) included in the current Shoreline Phase I Study Area. Pond A18 (about 860 acres), owned by the City of San José, is also included in the Shoreline Phase I Study Area, although it is not included in the SBSP Restoration Project study area and is not covered in the SBSP Restoration Project Programmatic EIS/EIR. Although Pond A18 was not considered in the SBSP Restoration Project, primarily due to not being a USFWS-managed property, the actions being proposed for the pond are similar to those proposed for the rest of the Alviso Complex ponds, and the addition to the Shoreline Phase I Study Area is consistent with the goals for the greater South Bay tidal restoration.

1.5.4 Current Pond Management

The Shoreline Phase I Study Area condition is influenced and guided by the SBSP Restoration Project Initial Stewardship Plan (ISP), which describes operations and maintenance of the Alviso Ponds before a long-term restoration plan is implemented for the entirety of the Alviso Pond Complex. Tidal marsh restoration is one option for restoration of Ponds A9 through A15; these ponds could remain as ponds if the results of monitoring and adaptive management show that the conversion of these ponds to tidal marsh results in adverse effects on shorebirds and waterfowl. Pond A4, owned by the Santa Clara Valley Water District (SCVWD), and Pond A18, owned by the City of San Jose, are not part of the SBSP Restoration Project; therefore, the condition of these ponds was assessed through coordination with the respective landowner.

In general, the following elements of the ISP define the physical setting of the Shoreline Phase I Study Area:

- Circulation of bay waters through reconfigured pond systems and release of pond contents into the bay. New water-control features were installed, consisting of intake structures, outlet structures, and additional pumps to maintain the existing shallow, open-water habitat. Generally, an attempt was made to maintain the conditions of existing levees and water-control structures through basic maintenance and repair activities. Information collected during the ISP period, however, was used to determine the need for modifications to existing structures to achieve ISP objectives. Implementing any maintenance, repair, or modification activity was contingent on funding availability during the ISP period. The pond complex, previously managed as a single system, was subdivided into several systems within which water would circulate. (Smaller systems allow faster circulation of water, and thus shorter pond residence time, resulting in less evaporation and, therefore, reduced salt concentration.)
- Management of a limited number of ponds as seasonal ponds (ponds are allowed to fill with rainwater in the winter and to dry down in the summer), to reduce management costs and optimize habitat for the Threatened western snowy plover.
- Management of different summer and winter water levels in a limited number of ponds to reduce management costs and optimize habitat for migratory shorebirds and waterfowl.
- Restoration of a limited number of ponds to full tidal influence, under the “Island Pond Restoration” (Ponds A19, A20, and A21).
- Management of several ponds within the Alviso system as higher-salinity “batch ponds,” where salinity levels will be allowed to rise to support specific wildlife populations.

1.5.5 South Bay Salt Pond Restoration Project – Phase I and II

SBSP Restoration Project Phase I construction started in 2008; the final SBSP Restoration Project Phase I restoration actions were initiated in 2011 at Alviso Complex Ponds A16 and A17 and have since been completed. Since both Ponds A16 and A17 have been restored as part of SBSP Restoration Project Phase I implementation, they are not being considered for additional action under the Shoreline Phase I Project (Figure 1.5-4 *Alviso Pond Complex and Shoreline Phase I Study Area*). SBSP Restoration Project Phase II implementation is expected to begin in about 2017 (for more information about Phase II, see Section 1.8 *USACE Planning Process Summary*). SBSP Restoration Project Phase I and Phase II actions are included in the Shoreline Phase I Study future no-action condition (see Section 1.6.1 *No Action Alternative* and Section 1.10.2 *South Bay Salt Pond Restoration Project*).

The planning process for the Shoreline Phase I Study is being coordinated with SBSP Restoration Project actions. The two efforts both have flood risk management, ecosystem restoration, and recreation objectives; this Integrated Document incorporates by reference appropriate sections of the 2007 SBSP Restoration Project Programmatic EIS/EIR (see Section 1.11 *Documents Incorporated by Reference*).

The SBSP Restoration Project has assumed during its Phase II planning that the Ponds A9–A15 system would be restored by the Shoreline Phase I Project. Since restoration has to be done in conjunction with addressing the tidal flood risk, it would be extremely challenging for the SBSP Restoration Project to undertake restoration of these ponds and successfully address the tidal flood risk with just the resources of the existing SBSP Restoration Project partners. The Shoreline Phase I Study is consistent with the larger planning effort conducted by the SBSP Restoration Project because it allows the SBSP Restoration Project to meet its goal of restoring Ponds A9–A15 sooner while not putting the surrounding community at risk.

A list of actions that could be considered for feasibility in any of the Shoreline Study phases would generally be similar to the type of actions proposed under Alternatives B and C of the SBSP Restoration Project (EDAW et al. 2007). A comparison of the flood risk management actions reasonably expected to be proposed in this and future Shoreline Study phases, and the actions proposed under the SBSP Restoration Project (Alternatives B and C), are presented in Table 1.5-2 *Comparison of Potential Flood Risk Management Actions Included in the Shoreline Phase I Study and Actions Proposed by the SBSP Restoration Project*. As shown, both projects are expected to involve flood risk management improvements, with the primary difference between the two projects being that the Shoreline Phase I Project (and other future Shoreline Study phases) is anticipated to include a broader array of flood risk management actions that are not proposed in the SBSP Restoration Project (EDAW et al. 2007). Ecosystem restoration and recreation activities that could be proposed under either project would be expected to overlap as well.

Table 1.5-2. Comparison of Potential Flood Risk Management Actions Included in the Shoreline Phase I Study and Actions Proposed by the SBSP Restoration Project

Types of Activities	Shoreline Study	SBSP Restoration Project
Relocate homes/businesses in flood-prone areas	√	No
Create flood risk management plan	√	No
Increase channel capacity to improve conveyance (e.g., sediment dredging)	√	√
Construct flood risk management levees and setback levees	√	√
Construct/improve inboard former salt pond levees	√	√
Breach levees along tidal creeks	√	√
Construct flood walls	√	No
Install erosion-control measures (e.g., riprap)	√	√

Source: EDAW et al. 2007

1.6 NEPA/CEQA/USACE Integrated Document Project-Specific Terminology

The Shoreline Phase I Integrated Document is a joint document intended to address the CEQA and NEPA environmental assessments and the USACE feasibility study requirements for analyzing the potential impacts of a project on the social, natural, and economic environments. All measures required for compliance with other applicable environmental statutes, such as the Federal and California Endangered Species Acts (the FESA and the CESA, respectively), the Clean Air Act (CAA), the Clean Water Act (CWA), the Fish and Wildlife Coordination Act (FWCA), the CZMA, and the National Historic Preservation Act (NHPA), among others, are also considered during the environmental impact review process.

Although many concepts are common to the CEQA and the NEPA as well as to the USACE feasibility study process, the laws and guidance documents sometimes use different terminology for similar concepts. The terminology described in Table 1.6-1 *Distinct CEQA, NEPA, and USACE Terminology* represents distinct procedures and/or content and, therefore, is used in this document according to the appropriate legal context.

Table 1.6-1. Distinct CEQA, NEPA, and USACE Terminology

California Environmental Quality Act	National Environmental Policy Act	USACE ER 1105-2-100 Planning Guidance
Environmental Impact Report A report to identify significant effects on the environment, alternatives to the project, and the manner in which significant effects can be mitigated or avoided.	Environmental Impact Statement A report prepared by a Federal agency when a major Federally proposed action could significantly affect the quality of the human environment.	Feasibility Report Project authorization is conducted in two study phases: reconnaissance and feasibility. The objective of the feasibility study is to investigate and recommend solutions to water resources problems. Results are presented in a feasibility report that includes documentation of environmental compliance (p. 4-1).
Notice of Preparation (NOP) Notice sent by lead agency to alert government agencies and others with an interest in the project that there is intent to prepare an EIR for the project.	Notice of Intent (NOI) Published in the Federal Register by the lead Federal agency signaling the initiation of the EIS process.	Project Authorization Studies are undertaken in response to either a study-specific resolution (e.g., House Committee resolution or public law) or a general authority from Section 216 of the Flood Control Act of 1970 or Section 2 of the Fish and Wildlife Coordination Act of 1958.
Notice of Completion/Notice of Availability Public notification that a draft EIR has been completed and is available for review.	U.S. Environmental Protection Agency (USEPA) Filing/Federal Register Notice and Agency/Public Review Notice that a draft EIS has been completed and is available for review.	No further public notification is needed at public release of draft document beyond that already required for environmental compliance.
Notice of Determination/Findings Notice filed by a public agency after it approves a project; notice will include brief description and location of project, whether it will have a significant effect on the environment, and whether mitigation measures were made a condition of the approval.	Record of Decision Identifies the selected alternative, presents a basis for the decision, specifies the “environmentally preferable alternative,” and provides information on the adopted means to avoid, minimize, and compensate for environmental impacts.	Final Feasibility Report Identifies the selected alternative and is submitted with cost estimates, legal review, environmental documentation, and other materials to Federal Office of Management and Budget as a decision document to assess project viability, and to Congress as an authorization document for project authorization.
Responsible Agency State or local public agency that proposes to carry out or approve a project for which a State lead agency is preparing an EIR.	Cooperating Agency Federal, state, or local agency that accepts obligation to contribute staff, participate in the NEPA process (including scoping), develop analyses for which it has particular expertise, and fund its own participation in the EIS process.	Project Sponsors A project sponsor may be a State, a Native American (Indian) Nation, a quasi-public organization chartered under state laws (e.g., a flood risk or water management district), an interstate agency, or a nonprofit organization. Each project sponsor must sign a Feasibility Cost Sharing Agreement committing to share in some proportion of the Feasibility Study cost.
Project Objectives A statement of objectives to help the lead agency develop a reasonable range of alternatives to evaluate in the EIR and aid decision-makers in preparing findings. The underlying purpose of the project should be included.	Purpose and Need Specifies the underlying purpose and need to which the agency is responding in proposing the alternatives, including the proposed action.	Planning Objectives The water and related land resource problems and opportunities identified in a study are structured as specific planning objectives to provide focus for the formulation of alternatives. Each objective represents desired positive change(s) in the without-project condition.

In some instances, the similarity between the terminologies used under the respective laws is nearly indistinguishable. For this Integrated Document, the document authors determined that one set of terminology would be used for chapter and section headings. This is intended to improve the readability and reduce the use of unnecessary jargon. A key to the corresponding CEQA, NEPA, and USACE feasibility study terminology used in the Integrated Document is presented in Table 1.6-2 *Corresponding CEQA, NEPA, and USACE Terminology*.

Table 1.6-2. Corresponding CEQA, NEPA, and USACE Terminology

California Environmental Quality Act	National Environmental Policy Act	USACE ER 1105-2-100 Planning Guidance	Used in This Document for Chapter/Section Headings	General Description
Physical Condition/ Environmental Setting (CEQA baseline)	Affected Environment	Existing Condition	Affected Environment	Existing physical environmental conditions used to establish the project's baseline year for impact analyses
CEQA Baseline (Physical Setting) – Alternatives are compared to existing baseline conditions to determine comparative levels of adverse and beneficial effects	NEPA Baseline condition (2018) - Alternatives are compared to assumed baseline condition at the start of construction (2018) to determine comparative levels of adverse and beneficial effects	Corps Planning Base-Year Condition (2018) - same as NEPA Baseline	Baseline	Pre-project physical conditions as they exist at the time of NOP issuance in 2014 (CEQA) and as they are anticipated to exist at the start of construction (NEPA)
Environmental Effects	Environmental Consequences	Environmental Consequences	Environmental Consequences	Expected direct and indirect environmental effects, including cumulative, of each alternative and their significance to the respective resource's project area
Proposed Project	Proposed Action	Recommended Plan or Tentatively Selected Plan	Recommended Plan	Lead agencies' preferred alternative from the range of alternatives evaluated in the Integrated Document
No Project Alternative	No Action Alternative/Future No Action – Alternatives are compared to future conditions assuming no project to determine comparative levels of adverse effects	Future Without-Project Condition, No Action Alternative, or No Action Plan	No Action Alternative	Conditions under which the project will not proceed; future circumstances without the project

In Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures* of this document, the environmental effects of each alternative are evaluated and are then compared to the baseline condition (2014 for the CEQA and 2018 for the NEPA; CEQA mandated) and the future No Action Alternative condition (NEPA mandated; Alternative 1). This document also includes a provision for the No Project Alternative and assesses resource-specific cumulative impacts for each alternative. Presented below are the definitions and assumptions of each of these conditions.

1.6.1 No Action Alternative

The No Action Alternative (No Action) represents the expected future condition if the Recommended Plan is not approved and there is no change from the current management direction or the level of management intensity. The No Action Alternative is the NEPA benchmark for assessing environmental effects, including the cumulative impacts, of the Proposed Project.

Essentially, the No Action Alternative demonstrates the future consequences of not meeting the need for the Recommended Plan.

1.6.2 No Project Alternative

Under the CEQA, the No Project Alternative is not the benchmark for assessing the significance of impacts of the Recommended Plan (Proposed Project) and alternatives; the benchmark is the baseline year (2014). The CEQA Guidelines §15126.6 (e)(1) state that "The 'no project' alternative analysis is not the baseline for determining whether the proposed project's environmental impacts may be significant, unless it is identical to the existing environmental setting analysis which does establish the baseline." The No Project Alternative, then, is the circumstances under which the project does not proceed [CEQA Guidelines §15126.6 (e)(3)(B)] and, like the No Action, assumes the continuation of existing Refuge management plans, policies, and operations into the future. Additionally, impacts should be analyzed "projecting what would reasonably be expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services" [CEQA Guidelines §15126.6 (e)(3)(C)].

Similar to the No Action Alternative, although not identified as the baseline, the No Project Alternative does allow decision-makers to compare the future condition without the Proposed Project to the future condition with the Proposed Project and use the results as one more tool for alternative selection.

For this report, because the No Project Alternative (CEQA) and the No Action Alternative (NEPA) include the same project assumptions, from this point forward in this document, the No Action Alternative also represents the No Project Alternative.

1.6.3 Cumulative Impact Assumptions

Under the CEQA, cumulative impacts are defined as two or more individual effects on environmental resources, that, when considered together, are considerable or compound or increase other environmental impacts (CEQA Guidelines §15355). The focus with CEQA cumulative impacts is whether the Proposed Project's incremental contribution to any significant cumulative impact is cumulatively considerable and thus significant in and of itself

[CEQA Guidelines §15065(a)(3)]. The related past, present, and reasonably foreseeable probable future projects and programs to be considered in the cumulative impacts analysis are usually separate and distinct, often with different lead entities.

Under the NEPA, CEQ regulations define cumulative impacts as the impact on environmental, human, and community resources that results from the incremental impact of the Proposed Action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or persons undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time (40 CFR 1508.7, 1508.25).

A more detailed discussion of how this Integrated Document evaluates cumulative impacts is presented in Section 4.1.8 *Cumulative Impacts Setting*.

1.7 Study Sponsors, Participants, and Other Coordination

The USACE, in cooperation with the USFWS and the non-Federal sponsors, the SCVWD and the State Coastal Conservancy, have performed this study to determine whether there is a Federal interest in constructing a project with flood risk management, ecosystem restoration, and recreation components in the Alviso subarea of the larger Shoreline Study Area and, if so, to identify a project to recommend to Congress for authorization. The roles of each agency that has an interest in the Shoreline Phase I Project are discussed below.

1.7.1 U.S. Army Corps of Engineers

As the only Federal cost-sharing sponsor for the Shoreline Phase I Study process, the USACE is also a co-Federal lead with the USFWS for the Shoreline Phase I Study NEPA process. As stated in ER 1105-2-100:

> Federal interest in water resources development is established by law. Within the larger Federal interest in water resource development, the USACE is authorized to carry out projects in seven mission areas: navigation, flood damage reduction, ecosystem restoration, hurricane and storm damage reduction, water supply, hydroelectric power generation and recreation. Wherever possible and subject to budgetary policy, projects shall combine these purposes to formulate multiple purpose projects. In carrying out studies to address problems and take advantage of opportunities within these mission areas, every effort should be made to formulate alternative plans that reasonably maximize the economic and environmental value of watershed resources. In addition, every effort shall be made to be responsive to National, State, and local concerns by considering the full range of programs available to provide solutions in a timely and cost-effective manner.

Upon initiation, the USACE developed a Vertical Team for the Shoreline Phase I Study that consisted of USACE staff at the District, South Pacific Division (Division), and Washington Headquarters (Headquarters) levels. The purpose of the USACE Vertical Team is to provide an internal USACE vehicle for identifying, investigating, and resolving technical and policy issues associated with the study. Issues that cannot be resolved at the District level are elevated to the

Division and potentially to Headquarters. The District leads the investigation of the issue, identifies options for resolving the issue, and recommends a solution to the Division and Headquarters Vertical Team members for their concurrence.

1.7.2 U.S. Fish and Wildlife Service

The USFWS is not a cost-sharing sponsor of the Shoreline Phase I Study but is involved in management and execution of the study as a major landowner in the study area and is also a co-Federal lead for the Shoreline Phase I Study NEPA process. The USFWS owns and manages the Refuge, which includes most of the former salt-production ponds within the greater Alviso complex. As part of the 2003 Federal and State acquisitions of former salt-production ponds from Cargill, the USFWS was granted ownership of the ponds to add them to the Refuge. The Refuge is the first urban National Wildlife Refuge established in the United States dedicated to preserving and enhancing wildlife habitat, protecting migratory birds, protecting Threatened and endangered species, and providing opportunities for wildlife-oriented recreation and nature study for the surrounding communities.

The USACE has developed implementation guidance for Section 1025 of the WRRDA 2014, which outlines processing requirements that would allow the Secretary of the Army to recommend USACE implementation on Federal lands acquired through non-Federal funds. For this project, these requirements include a memorandum of understanding between the USFWS and the non-Federal sponsors, documentation of land acquisition by the non-Federal sponsors, and other documentation supporting USACE implementation.

1.7.3 Non-Federal Sponsors

The Shoreline Phase I Study's non-Federal sponsors are the State Coastal Conservancy and the SCVWD. As the non-Federal sponsors, these two entities signed a Feasibility Cost Sharing Agreement jointly committing to provide 50 percent of the Feasibility Study cost (the SCVWD at 41 percent and the State Coastal Conservancy at 9 percent) in the form of cash and in-kind contributions.

1.7.3.1 California State Coastal Conservancy

The State Coastal Conservancy, which was established in 1976, is a State agency that uses innovative techniques to purchase, protect, restore, and enhance coastal resources and to provide shore access to the public. The State Coastal Conservancy works in partnership with local governments, other public agencies, nonprofit organizations, and private landowners. Besides acting as a non-Federal sponsor of the project, the State Coastal Conservancy is also a responsible agency under the CEQA.

The state legislature created the State Coastal Conservancy to serve as an intermediary among government, citizens, and the private sector in recognition that creative approaches would be needed to preserve California's coast and San Francisco Bay lands for future generations. The State Coastal Conservancy's non-regulatory, problem-solving approach complements the work of the California State Coastal Commission, a distinct agency that regulates land use along the coast and issues development permits. In addition, the State Coastal Conservancy coordinates its work with the BCDC, the federally designated State coastal management agency for the San Francisco Bay segment of the California coastal zone.

1.7.3.2 Santa Clara Valley Water District

The SCVWD is acting as both the CEQA lead for the Shoreline Phase I Study as well as one of the non-Federal sponsors. The SCVWD is the primary water resource agency for Santa Clara County. It supplies wholesale water, provides flood risk management, and serves as environmental steward for clean, safe creeks and healthy ecosystems. The mission of the SCVWD is "a healthy, safe, and enhanced quality of living in Santa Clara County through watershed stewardship and comprehensive management of water resources in a practical, cost-effective, and environmentally sensitive manner for current and future generations."

The SCVWD was created by an act of the state legislature in 1951 and operates as a State Special District with jurisdiction throughout Santa Clara County, California. The SCVWD serves approximately 1.8 million people in 15 cities—Campbell, Cupertino, Gilroy, Los Altos Hills, Milpitas, Monte Sereno, Morgan Hill, Mt. View, Palo Alto, San José, Santa Clara, Saratoga, and Sunnyvale—and the towns of Los Altos and Los Gatos. The SCVWD's main services include:

- Providing clean, safe, reliable water to Santa Clara County's 1.8 million residents
- Protecting Santa Clara Valley residents and businesses from flooding and flood consequences
- Implementing creek restoration and wildlife habitat projects and pollution prevention initiatives

1.7.4 Agency Roles and Coordination

Federal agencies preparing NEPA documentation and analyses are mandated under the NEPA to cooperate with other Federal agencies, state and local governments, and other agencies with jurisdiction by law or special expertise (40 CFR 1501.6). Similarly, the USACE Planning Guidance Notebook (ER 1105-2-100) states that "Civil Works studies and projects should be in compliance with all applicable Federal environmental statutes and regulations and with applicable State laws and regulations where the Federal government has clearly waived sovereign immunity." The report goes on to explain that integration of the USACE planning process with the Federal and State processes is intended to "…. reduce process overlap and duplication," while also providing that "well-defined study conditions and well-researched, thorough assessments of environmental, social, and economic resources affected by the proposed activity are incorporated into planning decisions" (ER 1105-2-100, p. 2-16). This guidance allows the USACE to investigate water resource problems and recommend appropriate actions on Federal lands, but the USACE must recommend that the land-owning agency implement such actions if it possesses the authority to do so.

Roles of responsible agencies and trustee agencies are described under the CEQA. Responsible agencies are those that have discretionary approval power over a project, such as the granting of a permit, lease, or other approval, or approval of funding (Title 14, California Code of Regulations, Section 15381). Trustee agencies under the CEQA are State agencies that, while they may not have discretionary approval over a project, have jurisdiction by law over natural resources affected by a project that are held in trust for the people of California.

Under the NEPA (40 CFR 1501.6), Federal or state agencies other than the NEPA lead agency that have jurisdiction by law or special expertise with respect to the environmental effects anticipated from the Proposed Project can be included as cooperating agencies. A cooperating agency participates in the NEPA process and may provide input (i.e., expertise) during preparation of the NEPA document.

Additionally, other Federal and state entities may contribute to and rely on information prepared as part of the environmental compliance process. A summary of the agencies and respective review/approval responsibilities is provided in Table 1.7-1 *Summary of Agencies and Specific Review, Approval, or Other Responsibilities*.

Table 1.7-1. Summary of Agencies and Specific Review, Approval, or Other Responsibilities

Agency	Permit, Decision, Approval, or Other Action
National Marine Fisheries Service	• Endangered Species Act (ESA) Biological Opinion (Section 7 of the ESA) • Endangered Species Act Incidental Take Permit • Essential Fish Habitat Under Magnuson-Stevens Fisheries Conservation and Management Act
U.S. Army Corps of Engineers	• National Environmental Policy Act • Clean Water Act Section 404 Permit • Clean Water Act Section 408 Permissions • Protection of Wetlands (11990) • Section 10 Rivers and Harbors Act
U.S. Bureau of Indian Affairs	• Coordination with recognized Tribes • Indian Trust Assets
U.S. Coast Guard	• General Bridge Act of 1946 (33 U.S.C. 525) requires approval of location and plans of bridges
U.S. Environmental Protection Agency	• Section 401 Clean Water Act Compliance (Water Quality Certification) • Section 402 Clean Water Act Compliance (National Pollutant Discharge Elimination System) • Section 404 Clean Water Act Compliance (Permit for Discharge of Dredged or Fill Material)
U.S. Fish and Wildlife Service	• Endangered Species Act Biological Opinion (Section 7 of the ESA) • Endangered Species Act Incidental Take Permit • Fish and Wildlife Coordination Act Report • Migratory Bird Treaty Act
California Department of Boating and Waterways	• Coordination on construction and placement of gates, signage, and use of gates

Table 1.7-1. Summary of Agencies and Specific Review, Approval, or Other Responsibilities

Agency	Permit, Decision, Approval, or Other Action
California Department of Fish and Wildlife	• California Endangered Species Act • Fish and Game Code Section 2050 et seq. • California Endangered Species Act Section 2081 Incidental Take Permit • CDFW Nests and Eggs, Section 3503 • Fish and Wildlife Coordination Act (FWCA), 16 USC 661–667e • Fully Protected Birds, Section 3511(b) • Fully Protected Mammals, Section 4700 • Migratory Birds, Section 3513 • Raptors, Section 3503.5
California Environmental Protection Agency	• Hazardous Materials • Site Assessment
California Office of Historic Preservation	• Section 106 of the National Historic Preservation Act
California Public Utilities Commission	• Railroad Right of Way Encroachment
State Lands Commission	• Lease involving granted tide and submerged lands
State Office of Historic Preservation	• National Historic Preservation Act Section 106 review
State Water Resources Control Board	• Clean Water Act Section 402 National Pollutant Discharge Elimination System Permit Compliance • Clean Water Act Section 402 NPDES Construction Storm Water General Permit (Water Quality Order 99-08-DWQ: General Permit for Storm Water Discharges Associated with Construction Activity [33 USC 1342]) • Clean Water Act Section 401 Water Quality Certification • Identified impaired waters and Total Maximum Daily Loads established under Clean Water Act Section 303(d) • General Certification Order for Dredging for Restoration Projects • Groundwater Quality Monitoring Act • Porter-Cologne Act • SWRCB Decision 1641 (Water Quality) • Water Quality Control Plan for San Francisco Bay/Sacramento–San Joaquin Delta Estuary • Waste Discharge Requirements for Dredging Projects or Fill-Related Activities (Porter-Cologne)
Bay Area Air Quality Management District, California Air Resources Control Board	• Greenhouse Gas Emissions • Permit to Operate an Internal Combustion Engine • Stationary Source Permit • Use of Portable Equipment During Construction
San Francisco Bay Conservation and Development Commission	• Coastal Zone Management Act (CZMA), 16 USC 1451 et seq.
San Francisco Regional Water Quality Control Board	• Basin Plan • Section 401 Water Quality Certification • Stormwater Permit • Waste Discharge Requirements for Dredging Projects or Fill-Related Activities
Santa Clara County Office of Emergency Services	• Notification that construction is occurring at or near levees during the winter

1.7.5 Coordination with Local Governments

The USACE and the non-Federal sponsors met twice with staff from the San José–Santa Clara and Sunnyvale wastewater facilities in 2009 to discuss their plans for evaluating plant upgrades and plant reconfiguration. Following the Shoreline Project reset in 2011 and subsequent refinement of the study area, the project team met with staff from the Wastewater Facility an additional two times in 2012; the Sunnyvale Water Pollution Control Plant is no longer included in the geographic extent of the Recommended Plan (Proposed Project) features. Mentions of the Wastewater Facility hereafter in this document refer to the San José–Santa Clara Regional Wastewater Facility.

In addition, in conjunction with the SBSP Restoration Project, Shoreline Study staff met with representatives of several cities in the study area during the spring of 2006.

1.7.6 Coordination with the Federal Emergency Management Agency

Federal Emergency Management Agency (FEMA) Region IX and the San Francisco District of the USACE have had a close working relationship for over twenty years. Many years later at the national level this close working relationship between the FEMA and the USACE was formalized in a joint memorandum, dated June 3, 2011, and signed by the FEMA's Deputy Federal Insurance and Mitigation Administrator and the USACE's Director of Contingency Operations and Homeland Security. Strengthened by the national resolution for the FEMA and the USACE to perform joint actions related to flood risk management, FEMA Region IX and the San Francisco District have increased their collaborative efforts and will continue to do so for many years to come.

FEMA Region IX initiated the San Francisco Bay Coastal Study (SFBCS) in 2004 as part of its Map Modernization Program. SFBCS was divided into three study areas (North Bay, Central Bay, and South Bay), with the studies phased to start in North Bay and end with the South Bay study. Initial coordination with FEMA Region IX began in 2007, when a series of meetings were held to exchange information on the Shoreline Study's flood mapping effort and the SFBCS North Bay mapping. As a result of these meetings, FEMA Region IX decided to delay map modernization efforts for South San Francisco Bay until the Shoreline Study maps were available. In addition to the above coordination with FEMA staff, three FEMA consultants (private contractors) helped during early meetings to develop the flood analysis methodology. These meetings occurred in 2006, and the purpose behind this coordination was to develop a methodology that would lead to products that could be used by the FEMA in its mapping efforts.

As a result of the re-scoping effort for this study that occurred in 2011, the 2005 Shoreline Study area was significantly reduced to the current Shoreline Phase 1 Study Area (see Figure 1.5-2 *Alviso Ponds Complex and 2005 Shoreline Study Area*) and District Quality Control (DQC) was never completed on the flood maps produced for the 2005 Shoreline Study area. In addition, a switch was made in the hydrodynamic model used for this study from 2011 onward and a comparison run between the old model and new model was never conducted. New floodplain maps based on the post-2011 work have not yet been produced for this study. FEMA

Region IX elected to contract its own modeling for the SFBCS South Bay mapping. FEMA Region IX mapping results for the South Bay are currently being produced, with new Flood Insurance Rate Maps (FIRM) expected in 2016 or 2017. FEMA Region IX and the San Francisco District will continue to participate in each other's meetings to explain the similarities and differences between the two studies and ways to leverage technical products in the future.

1.8 USACE Planning Process Summary

The USACE planning process is based on the economic and environmental Principles and Guidelines (P&G) adopted by the Water Resources Council in 1983 and set forth in USACE ER 1105-2-100 dated April 22, 2000. This regulation requires the formulation of reasonable alternative plans that are responsive to Federal, state, and local concerns to ensure that sound decisions are made.

The P&G further define a six-step study process that should be used for all USACE planning studies to include the following steps as listed below:

1. Identify problems and opportunities,
2. Inventory and forecast conditions,
3. Formulate alternatives,
4. Evaluate alternatives,
5. Compare alternatives, and
6. Select a plan.

The USACE Planning Manual (Institute for Water Resources Report 96-R-21) describes planning as a dynamic and iterative process in which steps are repeated and may occur out of order. During every point in the process, previous steps may be revised and subsequent steps may be anticipated. This planning approach allows the process to progress based on the best information available at any given time. More detail regarding the USACE planning process is provided in Section 3.1 *USACE Planning Process*.

1.9 Scope of the Shoreline Phase I Analysis

1.9.1 Study Area

This Integrated Document focuses on flood risk management and ecosystem restoration for the Alviso subarea within Santa Clara County (Figure 1.9-1 *Shoreline Phase I Study Area – Alviso Subarea within Santa Clara County*). The study area is located between Alviso Slough and Coyote Creek and includes the community of Alviso and the Wastewater Facility. The study area includes areas where restoration and flood risk management action may be implemented, or that may be impacted by such actions, in and between former salt Ponds A9–A15 and A18. Ponds A16 and A17 are not included in the Shoreline Phase I Study footprint because the ponds were previously restored and are currently being monitored through the SBSP Restoration Project Monitoring and Adaptive Management Plan. Results of the monitoring will also inform the restoration effort proposed under the Shoreline Phase I Study.

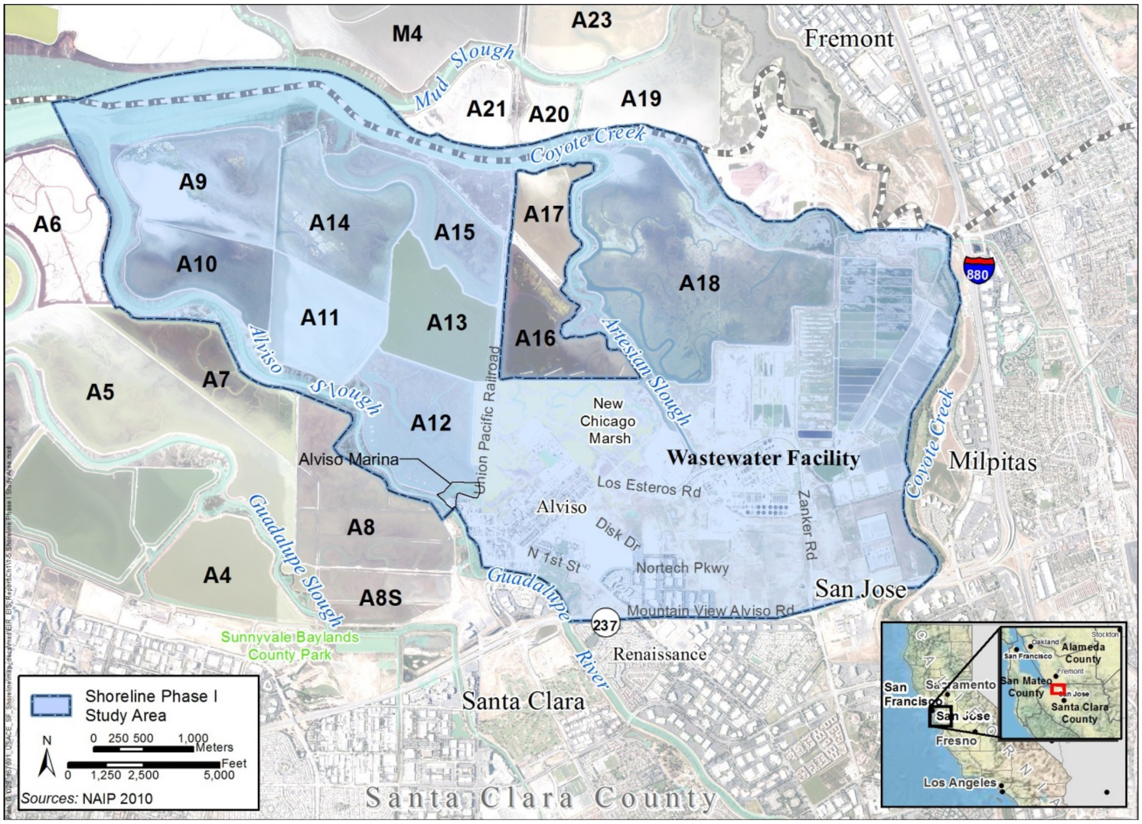


Figure 1.9-1. Shoreline Phase I Study Area – Alviso Subarea within Santa Clara County

Besides the suite of former salt production ponds, the Shoreline Phase I Study Area includes a mix of tidal, diked marsh, and upland habitats as well as residential, industrial, and commercial structures, including both the community of Alviso and the Wastewater Facility.

Alviso, which is part of the city of San José and is located adjacent to the former salt ponds, is the largest residential community within the study area (Figure 1.9-2 *Community of Alviso and San José – Santa Clara Regional Wastewater Facility*). Alviso, annexed by the City of San José in 1968, is located at the very northern edge of San José in Santa Clara County (Neighborhoods of San José Website 2013). The Alviso community includes all properties within the city of San José north of SR 237 between Coyote Creek and Guadalupe River. The community has approximately 2,100 residents and 600 housing units and a median income of $58,304 (American FactFinder Website 2012).

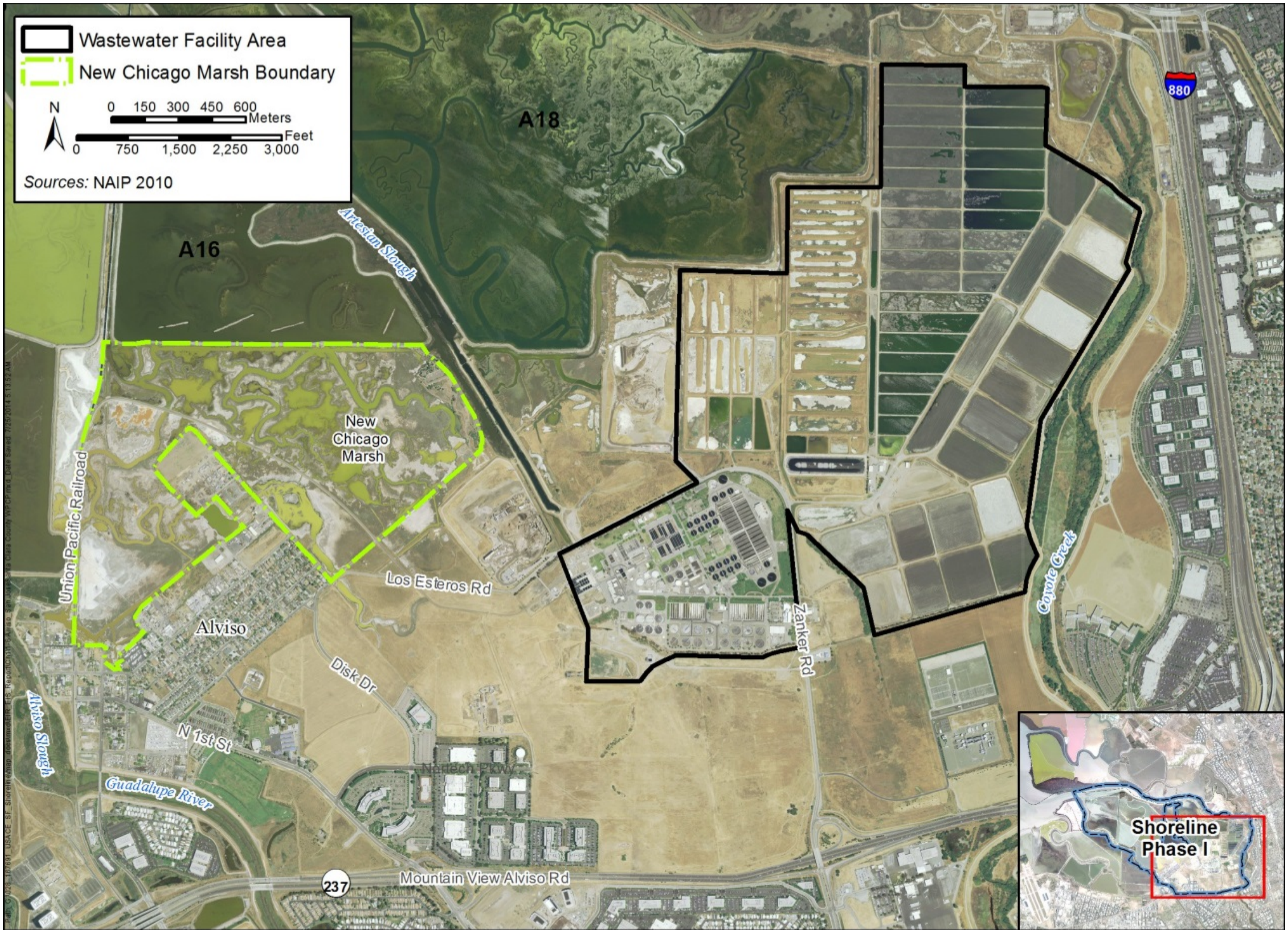


Figure 1.9-2. Community of Alviso and San José–Santa Clara Regional Wastewater Facility

In 1956, the Wastewater Facility was built just east of the residential area of Alviso. Upgraded in 1964 and 1979, the plant today treats and cleans the wastewater of more than 1,500,000 people who live and work in the over 300-square-mile area encompassing the cities of San José, Santa Clara, Milpitas, Campbell, Cupertino, Los Gatos, Saratoga, and Monte Sereno (City of San José Website 2012). Most of the final treated water from the Wastewater Facility is discharged as fresh water through Artesian Slough and into the South Bay. About 10 percent is recycled through South Bay Water Recycling pipelines for landscaping, agricultural irrigation, and industrial needs around the South Bay (City of San José Website 2012).

The current Wastewater Facility site is 2,684 acres, which includes a 175-acre wastewater processing area, a 750-acre sludge-drying area, and an 850-acre former salt production pond (Pond A18; Figure 1.9-2 *Community of Alviso and San José – Santa Clara Regional Wastewater Facility*). In 2008, the Wastewater Facility began a plant master plan to evaluate the need to replace, augment, or upgrade existing facilities. The city councils of San José and Santa Clara initiated the development of a Plant Master Plan, which resulted in a broad project concept that was introduced at a community workshop in May 2009 and continues to be further refined. Public input on the recommended final plan was solicited in 2011, and, after review by the city councils, a programmatic EIR was initiated. Public draft review occurred in late 2012 to early 2013 (City of San José Website 2013) and public feedback from this review was considered in the Shoreline Phase I Study's planning process.

1.9.1.1 Area of Impact

Within the broader Shoreline Phase I Study Area are two more-refined footprints that will be used to determine the potential impacts on select resources in areas of construction and habitat alteration. These two footprints (Figure 1.9-3 *Shoreline Phase I Area of Impact and Biological Buffer Area*) are more limited in range and are described in the two subsections below. Other footprints to determine the potential impacts specific to resources with greater areas for potential impacts (e.g., air quality analyses will consider entire San Francisco Bay Area airshed for potential impacts) are identified in their respective resource sections (Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures*), as necessary.

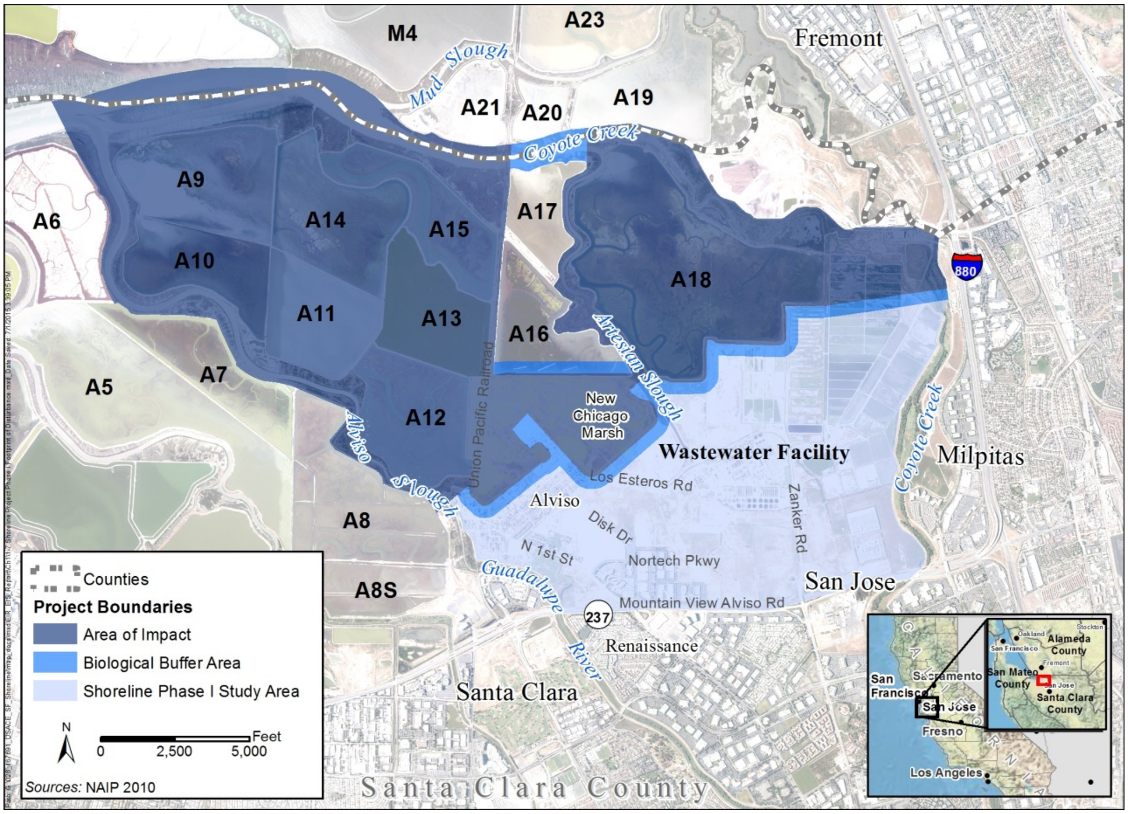


Figure 1.9-3. Shoreline Phase I Area of Impact and Biological Buffer Area

1.9.1.2 Area of Impact

The "area of impact" footprint includes all of the landscape that has the potential to be disturbed directly by construction equipment and/or activities, or during operation and maintenance (O&M) following construction. The boundaries have been defined to include:

- Along the north, west, and east edges, the area is extended to include existing waterways (Alviso Slough and Coyote Creek) that could be impacted by pond restoration (north and west) or levee construction (east boundary above the proposed levee). All project actions would occur within Ponds A9–A15 and A18, all west of Coyote Creek, but there is a risk of temporary water quality and fish habitat impacts within the waterways (these are addressed in the appropriate resource sections). In addition, the entire Alviso Marina (at the southernmost point of Pond A12 along Alviso Slough) has been included because the proposed levee would tie in at the existing levee just east of the marina for any of the alternatives. No other actions are proposed for the marina property.
- Along the southern edge, the area has been defined by applying a 100-foot buffer to the southernmost levee option. This area includes land that would be available for use during construction for activities such as materials and equipment staging and temporary roads for transporting equipment, materials, and personnel along the levee

construction route. All ground-disturbing construction activities would occur within this boundary.

1.9.1.3 Biological Buffer Area

An additional biological buffer area extends beyond the physical impact area and allows assessment of potential secondary impacts such as noise, dust, and light pollution that can extend farther than the actual ground-disturbing construction activities. The buffer broadens the boundary to another 400 feet below the southernmost levee option (total buffer of 500 feet along southern edge of construction footprint in combination with the 100-foot buffer for staging or temporary roads) and also includes a reach of Coyote Creek connecting the Pond A15 and A18 construction areas (for possible in-stream sedimentation impacts) and another section reaching north along the south side of Pond A16 to account for secondary impacts from project work that could occur along that existing levee. Although generally sufficient to account for these types of secondary impacts, depending on the types of human activity or wildlife species of concern found in a specific area, additional geographic and temporal constraints (e.g., during nesting or breeding periods) may be required. As appropriate, any additional constraints are identified in the Avoidance and Minimization Measures sections in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures* for the related resources. For general assessment of biological impacts, this 500-foot combined buffer is applied to each alternative’s footprint to identify habitat impacts specific to that levee alignment option.

1.9.2 Project Study Timeline and Assessment Review Milestones

The Base Year, the year when it is assumed that project features would be functional and providing benefits, is 2021. Benefits and costs presented in this report were developed based upon a Base Year of 2017. This year was established early on in the study process when this year was deemed realistic/feasible and was used in the coastal and economic modeling. In reality, given funding and construction timelines, the year in which flood risk management benefits would be realized is more likely closer to 2021. A sensitivity analysis was conducted to determine whether NED Plan identification would be impacted by changing the Base Year. The 50-year period of damages/benefits/costs used to derive estimates of equivalent annual benefits, costs and net benefits were shifted to start from 2021 instead of 2017. The NEPA analysis uses 2018 as the baseline year. While the NEPA baseline normally represents the affected environment at the time a Notice of Intent (NOI) is issued, NEPA lead agencies have the discretion, where appropriate, to fully or partially update the baseline condition beyond the time of the issuance of the NOI. For purposes of analysis under the NEPA and the planning process, year 2018 is the baseline year, anticipating that construction of an authorized project would begin in 2018, with subsequent benefits accrual beginning in about 2021.

Under the CEQA, the environmental impact analysis *compares the Proposed Action and alternatives being considered, including the No Project Alternative, to the baseline*, normally defined as the existing physical condition when the Notice of Preparation (NOP) is published. The NOP for the project was published in 2014 and therefore, except as specified otherwise within the document, any reference to the "CEQA Baseline" refers to the baseline condition as of 2014.

For this Integrated Document, each resource section provides information to the reader regarding how the baseline was established. For purposes of NEPA analysis, the EIS/EIR describes the existing physical environmental condition used in the analysis (the year and conditions are specific to that resource) and then describes how either (1) there is no anticipated change from existing physical to 2018 baseline condition or (2) the assumptions that have been made in establishing the baseline year of 2017 (e.g., changes in traffic levels due to population increases occurring between the year of the transportation report and the baseline year [2017]).

For purposes of CEQA, the description of existing physical environmental condition (Physical Setting) represents the 2014 CEQA baseline used in the impact analysis, unless otherwise specified. In resource areas where the physical setting discussion references information and data for a range of years, or from years other than 2014, the Integrated Document explains why such data is representative of environmental conditions as they exist in 2014.

Figure 1.9-4 *Shoreline Project Phase I Integrated Document Impact Assessment Milestones* shows this Integrated Document's impact assessment schedule milestones as well as both the hydrologic and landscape evolution modeling points that were used in the project analysis. As the figure suggests, the years used for impact assessment in this document are tied directly to key dates of the modeling. The hydrologic modeling provides information on the forecasted tidal exchange in the South Bay, with allowances for climate change, and is explained further in Section 4.4 *Hydrology and Flood Risk Management*. These points include the existing condition at the assumed start of the project (currently planned for 2018), a point following completion of the levee and first pond breach phase (2021), a point following completion of the second phase of pond breaching (2026), and a final point following completion of the final (third) phase of pond breaching (2031).

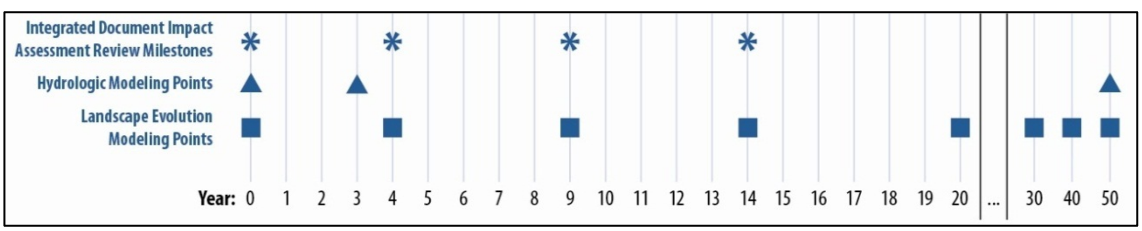


Figure 1.9-4. Shoreline Project Phase I Integrated Document Impact Assessment Milestones

The Landscape Evolution Modeling provides projections for the anticipated habitat evolution in the former salt ponds resulting from a phased restoration schedule. More details on the Landscape Evolution Modeling are provided in Appendix B1 *Shoreline Study Preliminary Alternatives and Landscape Evolution Memo*, and a detailed schedule for construction and restoration of the ponds can be found in Section 3.8.3 *Construction Schedule*. Landscape evolution milestones include the existing condition at the start of the project (2018)[2], milestones at the completion of each phase of pond restoration (2021, 2026, and 2031), a milestone 20 years following project initiation (2037), and then a milestone at each decadal time step (2047, 2057, and 2067) through the end of the 50-year project study period.

Not all resources are expected to have changes at each of these time steps. For instance, the major construction efforts are the proposed levee and transitional habitat constructions (described in Section 3.8 *Action Alternative Component Details*), whereas in-pond construction activities (described in Section 3.8.2 *Ecosystem Restoration Details*) are anticipated to be similar in magnitude to ongoing maintenance work at the Refuge. Therefore, once the levee and transitional habitats are constructed, some resources, such as transportation and noise, which are directly related to these construction activities, are no longer expected to be affected.

1.10 History of Investigations in the Study Area

The Shoreline Phase I Study Area has been included in multiple studies and investigations led by various entities in an effort to identify ways to reduce flood risk, provide ecological restoration, and enhance recreation goals of the community and region. This program has been built on the findings of those studies. Summaries of the primary efforts inclusive of the study area are included below.

1.10.1 Final Recovery Plan for Tidal Marsh Ecosystems

The USFWS issued a final recovery plan for tidal marsh ecosystems in central and northern California in August 2013 (USFWS 2013). This plan presents the USFWS's position on the characteristics, quantity, and spatial distribution of tidal marsh restoration needed for recovery of this ecosystem and the listed (special-status) species that rely on it. The six listed species included in the plan are the Ridgway's rail, the salt marsh harvest mouse, and four plant species: California sea-blite (*Suaeda californica*), soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*), Suisun thistle (*Cirsium hydrophilum* var. *hydrophilum*), and salt marsh bird's-beak (*Corylanthus maritimus* ssp. *maritimus*). An additional 11 California species or subspecies of concern are also addressed in the recovery plan and are expected to benefit from its implementation.

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[2] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

Listed below are some of the general policies and practices listed in the final plan that are intended to assist the recovery of tidal marsh habitat and its associated species. Many additional policies and practices are also recommended in the plan.

- Protect remaining tidal marsh and tidal flats
- Phase tidal marsh restorations to minimize local population impacts and maintain local source populations
- Restore large contiguous areas of tidal marsh habitat
- Restore functional connectivity between species populations with low mobility
- Encourage other specific habitat attributes that will facilitate recovery
- Provide buffers between habitat areas and developed areas
- Remove levees and other habitat and movement corridors for terrestrial predators, where feasible
- Accommodate a range of SLC scenarios, ideally with long, gentle gradients
- Plan and provide funding for long-term monitoring and adaptive management
- Control predators
- Regulate recreation access and public use
- Design flood risk management projects to be compatible with marsh and species recovery, with certain recommended features and characteristics
- Control invasive exotics including smooth cordgrass (*Spartina alterniflora*)

The plan includes numerical goals for habitat restoration in several estuaries including a number of distinct segments of the San Francisco estuary and its shoreline. Segment “p” (Guadalupe Slough/Warm Springs) of the Central or South San Francisco Bay Recovery Unit encompasses the entire Shoreline Phase I Study Area and has specific goals for tidal marsh restoration. Goals from the final plan for areas located within the study area were used to inform the ecological restoration planning process and provided guidance regarding what species should be targeted in developing a landscape evolution plan.

1.10.2 South Bay Salt Pond Restoration Project

The SBSP Restoration Project is a collaborative effort among Federal, State, and local agencies working with scientists and the public to develop a programmatic plan for habitat restoration, flood management, and wildlife-oriented public access within the approximately 15,100 acres of former Cargill salt ponds in South San Francisco Bay acquired in 2003 by the USFWS. The Final EIS/EIR dated December 2007 included program-level evaluation of the SBSP Restoration Project long-term alternatives as well as project-level analysis of the first phase of restoration (Phase I) under the long-term alternatives (EDAW 2007).

1.10.2.1 Phase I

Phase I of the SBSP Restoration Project included actions that were designed as adaptive management experiments and were anticipated to help inform future restoration phases. Restoration planned for Pond A8 included introducing a limited tidal exchange to create muted tidal habitat. Included in the actions were construction of an armored notch through the perimeter levee that separates Pond A8 and upper Alviso Slough, excavation of a pilot channel outboard of the armored notch, infrastructure modification and protection, and levee improvements. These changes allow managed, muted tidal connections from bordering sloughs into Ponds A8, A8S, A5, and A7.

Restoration of Alviso Pond A6, in the Refuge, to tidal habitat was accomplished by breaching and lowering the outboard levee, excavating pilot channels through the fringe marsh outboard of the breaches, and constructing ditch blocks in the perimeter borrow ditch. This restoration has generated large areas of emergent mudflat habitat (at low tide). Tidal channel and vegetated salt marsh habitats are also eventually expected to develop in Pond A6 because of reforming tidal channels and sediment accumulation, leading to vegetation establishment on the emerging mudflats.

In 2011–2012, Alviso Ponds A16 and A17 in the Refuge were also altered to create new islands, berms, water-control structures, and test operational scenarios. Pond A16 remains a managed pond. Pond A17 was restored to tidal habitat by breaching and lowering the outboard levee along Coyote Creek along the north edge. The restoration for Pond A16 is also intended to test bird use for different island configurations, vegetation management, predator management, and water quality management as specified in the SBSP Restoration Project Adaptive Management Plan (EDAW et al. 2007). Since both Ponds A16 and A17 will have been restored as part of SBSP Restoration Project Phase I implementation, they are not being considered for additional action under the Shoreline Phase I Project (Figure 1.5-4 *Alviso Pond Complex and Shoreline Phase I Study Area*).

The Phase I SBSP Restoration Project addressed flood risk management features along the interior levee system only, is not intended to provide flood risk management beyond individual pond's management, and does not provide for a specific level of flood risk protection. For the SBSP Restoration Project Phase I actions (assumed to carry forward to other phases), flood control has been closely linked to tidal habitat restoration activities. The SBSP Restoration Project stated that many flood risk management actions, such as levee construction, may wait for completion of this and future phases of the Shoreline Study, since the SBSP Restoration Project will carry the flood risk management analyses to project-level detail and could result in a substantial Federal cost share for those elements contained within WRDA-authorized projects.

SBSP Restoration Project Phase I recreation and public access actions included interpretive display and viewing installations in several locations throughout the SBSP Restoration Project study area and seasonal and year-round recreational pedestrian and bicycle trails. None of these features will be impacted by the Shoreline Phase I proposed actions.

SBSP Restoration Project Phase I was intended to be a first step toward the interim goal of a 50:50 ratio of tidal marsh to managed ponds while addressing several key project uncertainties through adaptive management. The ultimate objective is to achieve a mix of habitats (between 50:50 and 90:10) that most benefits tidal marsh and pond-dependent species.

1.10.2.2 Phase II Environmental Review

In September 2013, the State Coastal Conservancy as the lead agency under the CEQA and the USFWS as the lead agency under the NEPA issued a Notice of Intent/Notice of Preparation (NOI/NOP) to announce the preparation of a joint EIS/EIR for Phase II of the SBSP Restoration Project (State Coastal Conservancy 2013; USFWS 2013). The draft EIS/EIR is planned for public review in 2015. Phase II of the SBSP Restoration Project proposes to continue habitat restoration activities initiated during Phase I while also providing recreation and public access opportunities and maintaining or improving current levels of flood protection in the surrounding communities (State Coastal Conservancy 2013).

Phase II actions that are being studied would take place in one area of the Ravenswood complex (which is west of the Shoreline Phase I Study Area; see Figure 1.5-1 *South San Francisco Bay Shoreline Interim Feasibility Study Areas*) and three areas of the Alviso complex. The lead agencies are considering different alternatives for each site, including no-action scenarios, which are called Alternative A for each area. Table 1.10-1 *SBSP Restoration Project Phase II Actions Being Considered* summarizes the action alternatives that are being considered for the Alviso area and Figure 1.10-1 *South Bay Salt Pond Restoration Project Actions by Phase* provides a map figure; for more information on the SBSP Restoration Project Phase II planning process and to see maps of alternatives being considered, go to www.southbayrestoration.org/planning/phase2.

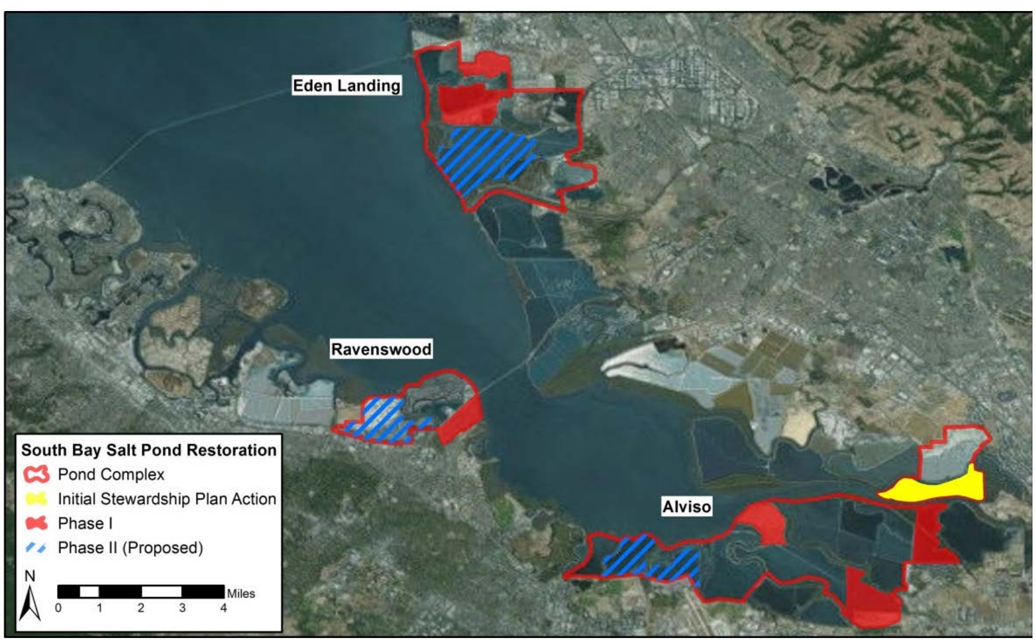

Figure 1.10-1. South Bay Salt Pond Restoration Project Actions by Phase

Table 1.10-1. SBSP Restoration Project Phase II Actions Being Considered

Area and Alternative	Potential Project Elements						
	Habitat Type	Breaches[a]	Upland Transition	Habitat Islands	Levees	Water Control Structures	Recreational Features
Mountain View Area (Ponds C1, A1, and A2W)							
Alternative B	Tidal marsh (A1 and A2W); no change to C1	All new; A1 (1), A2W (4)	South side of A1 and A2W	A1 and A2W	Raise between C1 and A1; improve others as needed to maintain PG&E access	No change	Add viewing platform, interpretive platform, and two footbridges
Alternative C	Same as Alternative B	All new; C1(2), A1 (2), A2W (4)	Same as Alternative B	Same as Alternative B	Improve between C1 and Palo Alto flood basin to west; lower between C1 and A1; maintain PG&E access	Modify C1 water intake system, replace existing C1 control structure with breach	Construct new trails along western side of C1 and eastern side of A2W; add two viewing platforms, two interpretive platforms, and two footbridges
Alviso A8 (Ponds A8 and A8S)							
Alternative B	No change	None	Southwestern and southeastern corners of 8S	None	No change	No change	No change
Alviso Island Ponds (Ponds A19, A20, and A21)							
Alternative B	No change (previously restored to tidal marsh)	Retain existing, add A19 (2)	None	None	Remove eastern side of A20 and western side of A19; lower sections of A19 along north and south sides	None	Add or enhance water-based recreation on Coyote Creek and Mud Slough
Alternative C	Same as Alternative B	Retain existing; expand two existing and add pilot channels; add A19 (2), A20 (1), and A21 (1)	Same as Alternative B	Same as Alternative B	Expands Alternative B to include lowering sections of A20 along north and south sides	Same as Alternative B	Same as Alternative B

Source: URS, no date

[a] Number of new breaches proposed is shown in parentheses.

Additionally, Phase II activity in the Mountain View area ponds is likely to include collaborating with the City of Mountain View's restoration project for Charleston Slough.

None of the potential alternatives that are currently being studied for Phase II of the SBSP Restoration Project would occur within the Shoreline Phase I Study Area. However, activities at Ponds A19, A20, and A21 (the Island Ponds) and at Ponds A8 and A8S would be adjacent to the north and south sides of the Shoreline Phase I Study Area, respectively. Some activities at the Island Ponds, such as recreational enhancements at Coyote Creek, would fall within the biological buffer area applied to the Shoreline Phase I Study Area. However, none of the SBSP Restoration Project Phase II activities would be affected by the Shoreline Phase I Project proposed actions (Recommended Plan).

1.10.3 Coyote and Berryessa Creeks Project

This project constructed channel improvements to contain flood flows up to the 1-percent ACE event, thereby reducing future flood risk to public and private property from fluvial (riverine) flooding. The Lower Coyote Creek element of the Coyote and Berryessa Creeks Project extends approximately 7 miles along Coyote Creek from the confluence of Coyote Creek and the Coyote Slough at the southern tip of San Francisco Bay to the Montague Expressway in the cities of San José and Milpitas.

Reach 1 of the Lower Coyote Creek project portion included construction of an engineered levee on bay mud across a small part of the eastern side of Pond A18. The severed portion of the pond adjacent to Coyote Creek was then breached and opened to tidal action.

1.10.4 Guadalupe River Project

Construction of the downtown reach of the Guadalupe River Project from the Alviso County Marina Park to Interstate 280 was completed in the summer of 2005. This project was constructed to (1) provide 1-percent ACE flood risk management for downtown San José's technology and commercial industries and adjacent residential neighborhoods; (2) protect and improve water quality of the river; (3) preserve and enhance the river's habitat, fish, and wildlife; and (4) provide recreational and open space opportunities.

The Upper Guadalupe River Project will provide 1-percent ACE flood risk management, enhance fishery and wildlife habitat, and facilitate construction of future trails by the City of San José from Interstate 280 to Blossom Hill Road.

1.10.5 Redwood City Harbor Project

Located adjacent to Bair Island, this USACE navigation project is currently in the O&M phase and undergoes periodic maintenance dredging to -30 feet MLLW. The project is also undergoing a USACE feasibility study to deepen the project to -32 feet MLLW. Dredged sediments generated during O&M are currently delivered to a site near Alcatraz Island, but the project could possibly supply dredged material to Bair Island restoration or to the Shoreline Phase I actions.

1.10.6 Alviso Slough Restoration Project

The Alviso Slough Project includes dredging of sediment on the east side of Alviso Slough from upstream of the County Marina boat ramps to the South Bay Yacht Club and implementing a long-term project to re-establish the saltwater connection to the Lower Guadalupe River. The work area covers approximately 4.5 acres. Project objectives include restoring Alviso Slough's channel width and habitat to the pre-1983 condition; improving the community's ability to pursue navigation, recreation, and aesthetics, which will allow expansion of recreational and tourism opportunities; maintaining 1-percent ACE flood risk management in Alviso Slough; reducing mosquito nuisances; and promoting project integration with the SBSP Restoration Project so saltwater connections to the Lower Guadalupe River can be re-established (SCVWD 2009).

In January 2014, the USACE and the U.S. Environmental Protection Agency determined that the Alviso Slough Project does not meet the criteria for the LEDPA under the CWA Section 404(b)(1) alternative analysis guidance. As a result of the LEDPA determination, the USACE stopped its permitting process for the project. The USACE has stated that, if the SCVWD wants to pursue other projects in Alviso Slough, a new permit application is required with supporting documentation for the new project.

1.10.7 Sunnyvale East and West Channels Flood Protection Project

The Sunnyvale East and West Channels were constructed by the SCVWD between 1959 and 1976. The channels were designed with a capacity to convey runoff from the 10-year storm. Since construction of the channels, the project area experienced flooding during major storms in 1963, 1968, 1983, 1986, and 1998. The proposed Sunnyvale East and West Project involves constructing a series of infrastructure upgrades to provide additional flood protection and improve water quality. The project will provide 100-year riverine flood protection to about 1,618 properties and 47 acres within the City of Sunnyvale. The Sunnyvale East Channel extends about 6.5 miles upstream from San Francisco Bay and drains a watershed of about 7.25 square miles. The Sunnyvale West Channel extends about 3 miles from the bay and drains a watershed of about 7.6 square miles. Construction of the project is taking place over the summers of 2015 and 2016.

1.10.8 Permanente Creek Flood Protection Project

The Permanente Creek watershed has historically experienced recurring floods, with the greatest flood impacts occurring in the 1950s when the creek floodplains consisted mostly of farms, followed by urbanized use. The SCVWD is conducting the project with objectives to (1) provide 1-percent flood prevention for areas downstream from El Camino Real, (2) prevent flooding in the Middlefield Road and Central Expressway area, (3) develop a plan addressing asset protection of the existing concreted channels, and (4) create long-term maintenance guidelines. The project is currently in the final design stage and is scheduled to be completed in 2016 (SCVWD 2015).

1.11 Documents Incorporated by Reference

An EIS/EIR can incorporate by reference all or portions of another document that is a matter of public record or is generally available to the public [CEQA Guidelines §15150 (a) and CEQ regulations for implementing the NEPA (40 CFR 1502.21)]. Agencies should incorporate material into an EIS by reference when the effect will be to cut down on bulk without impeding agency and public review of the action. The incorporated material should be cited in the EIS and its content briefly described. No material may be incorporated by reference unless it is reasonably available for inspection by potentially interested persons within the time allowed for comment (CEQ regulations for implementing the NEPA [40 CFR 1502.21]).

The following documents have been incorporated by reference in this Integrated Document:

- **South Bay Salt Pond Restoration Project Final Environmental Impact Statement/ Environmental Impact Report.** EDAW, December 2007. This environmental document is both a Programmatic EIS/EIR covering the 50-year long-term plan as well as a project-level EIS/EIR addressing the specific components and implementation of Phase I of the project. The SBSP Restoration Project area is located in South San Francisco Bay in northern California in the counties of Alameda, Santa Clara, and San Mateo. The project area comprises 15,100 acres of salt ponds and adjacent habitats in South San Francisco Bay which the USFWS and the CDFW acquired from Cargill, Inc., in 2003.This report is available to the public at www.southbayrestoration.org/EIR.
- **South Bay Salt Pond Restoration Project Final Environmental Impact Statement/ Environmental Impact Report – Appendix D *Final Adaptive Management Plan*.** SBSP Restoration Project Science Team (Lead Author: Lynne Trulio), November 2007. The Adaptive Management Plan was developed as an integral part of the project and intended to guide future planning and implementation of each project phase. The importance of adaptive management is presented, along with the team's approach used to generate the included list of uncertainties identified in the project area, as well as the proposed monitoring, applied studies and modeling that could be triggered when specific ecological thresholds are crossed. This report is available to the public at www.southbayrestoration.org/EIR/downloads.
- **South Bay Salt Pond Restoration Project Historic Context Report**. EDAW, August 2005. This memorandum describes the historic context for the areas covered in the Final EIS/EIR. Specifically, a history of the conversion of bay marshes and tidelands to solar salt production is provided. This report is available to the public at www.southbayrestoration.org/EIR/downloads.
- **South Bay Salt Ponds Initial Stewardship Plan Final EIS/EIR**. Life Science March 2004. This document is the Final EIS/EIR for the initial stewardship plan that was developed to maintain and enhance biological and physical conditions within the South Bay salt ponds until a long term restoration plan could be developed and implemented (i.e., the South Bay Salt Ponds Restoration Project). This report is available to the public at www.southbayrestoration.org/EIR/downloads.

- **San Francisco Bay Shoreline Study Office Report, Volume 1: Southern Alameda and Santa Clara Counties.** USACE, San Francisco District. October 1988. This study determined the feasibility of and Federal interest in providing protection against tidal and tidal-related fluvial flooding for developed areas within the tidal floodplain of San Francisco Bay, southern Alameda County, and Santa Clara County in 1988.This report is available for review at www.southbayrestoration.org/…files/SLStudySanMateoNAlameda.pdf.
- **San Francisco Bay Shoreline Study Office Report, Volume 2: San Mateo and Northern Alameda Counties.** USACE, San Francisco District. September 1989. This study determined the feasibility of and Federal interest in providing protection against tidal and tidal-related fluvial flooding for developed areas within the tidal floodplain of San Francisco Bay, San Mateo County, and northern Alameda County in 1989. This report is available to the public at www.southbayrestoration.org/…files/SLStudySanMateoNAlameda.pdf.
- **San Francisco Bay Shoreline Study Final Letter Report.** USACE, San Francisco District. July 1992. This report detailed the results and recommendations of the previous San Francisco Bay Shoreline General Investigation Study and did not recommend a plan to move forward at that time due to a lack of economic justification. This report can be found at www.southbayshoreline.org.
- **Urban Levee Flood Management Requirements (final).** Moffet & Nichols. July 2005. This report provided cost estimates for former salt pond levee work within the Alviso and Ravenswood pond complexes. Brown & Caldwell and PWA used this information to produce a cost estimate for flood-control levees in the study area. This report is available to the public at www.southbayrestoration.org.
- **Baylands Ecosystem Habitat Goals Report.** San Francisco Bay Area Wetlands Ecosystem Goals Project. 1999. This report presented recommendations for the kinds, amounts, and distribution of wetlands and related habitats that would be needed to sustain diverse and healthy communities of fish and wildlife resources in the San Francisco Bay Area. This report is available to the public at www.sfei.org/documents/baylands-goals.
- **San Francisco Bay Subtidal Habitat Goals Report.** California State Coastal Conservancy 2010. The Subtidal Goals Project takes a bay-wide approach to setting science-based goals for maintaining a healthy, productive, and resilient ecosystem. The vision statement of the project is to achieve a net improvement of the subtidal ecosystem in San Francisco Bay through science-based protection and habitat restoration. This report is available to the public at www.sfbaysubtidal.org.

2.0 Need for and Purpose of Action

This chapter presents the results of the first step of the planning process: the specification of water and related land resources problems and opportunities in the study area. It also describes the need for and purpose of the Action under NEPA requirements. An EIS must briefly specify the underlying purpose and need to which the lead agency is responding in proposing the action and the alternatives (40 CFR 1502.130). The chapter concludes with the establishment of planning objectives, planning constraints, and other evaluation criteria, which are the basis for the formulation, evaluation, comparison, and selection of alternative plans.

2.1 Need for the Project

As discussed in Chapter 1 *Study Information*, former management of the study area ponds by Cargill provided incidental flood risk management (FRM) to the South Bay area. The transfer of pond ownership to the U.S. Fish and Wildlife Service (USFWS) and the City of San José created an opportunity to restore tidal marsh habitat by breaching these non-engineered pond dikes. However, breaching the non-engineered pond dikes would increase flood risk to inland areas that are currently separated from San Francisco Bay by these ponds.

Both FRM and ecosystem restoration are important to both the local community and the larger South Bay area. By formulating a multipurpose flood risk management and ecosystem restoration project, the project partners can both reduce flood risk in the area and facilitate tidal marsh restoration. A discussion of the need for the action is presented below.

2.1.1 Flood Risk Management

The study area is at risk of tidal flooding (characterized by or affected by tides, usually coastal) due to large areas of low-lying terrain that are bordered by non-engineered pond dikes originally designed and constructed for commercial salt pond purposes rather than for FRM. The 1-percent annual chance of exceedance (ACE) fluvial flood risk (produced by or found in a river) has been addressed by both the Lower Coyote Creek and Guadalupe River projects as discussed in Section 1.10.3 *Coyote and Berryessa Creeks Project* and Section 1.10.4 *Guadalupe River Project*, respectively.

Prior to Euro-American settlement, nearly all of the shoreline of San Francisco Bay south of the San Mateo Bridge (the South Bay) consisted of tidal marshes, behind which were low-lying plains susceptible to fluvial flooding. Starting in the late 19th century and continuing for several decades, the vast majority of these marshes were ringed by dikes and converted into solar evaporation ponds (salt ponds) for commercial salt production. The various salt production facilities were eventually consolidated under Cargill Salt, a subsidiary of Cargill, Inc. Meanwhile, the adjacent uplands were converted to farmland and later to urban uses. In 2003, the State and Federal government acquired many of the salt ponds from Cargill, and the majority of the salt ponds within the acquisition area were transferred to the USFWS Refuge for restoration and management. Pond A18, which is also in the acquisition area and in the Shoreline Phase I Study Area, is currently owned by the City of San José. The USFWS and the

City of San José have strived to maintain the pond dikes in accordance with Cargill's historic maintenance practices.

Widespread overdraft of groundwater for agricultural and urban uses during the early and middle decades of the 20th century led to severe ground subsidence under most of the Santa Clara Valley and portions of the southern portion of the South Bay, including many of the study area's former salt ponds. Salt pond dikes and other levees were raised by their owners in response, and outboard tidal marshes accumulated sediment quickly enough to maintain their elevation. However, without tidal flows, the floors of the salt ponds and the adjacent alluvial plains had no way to compensate for the previous loss in elevation, which totaled as much as 12 feet near downtown San José and somewhat less within most of the study area. While groundwater overdraft has ceased and the water table has recovered considerably, the previous loss of elevation is permanent.

As a result of this subsidence, many areas landward of the former salt ponds became potentially vulnerable to tidal flooding. The non-engineered dikes protecting these areas were created as early as the 1920s and generally maintained to protect the ponds from tidal flooding when they were being used for salt production. These dikes were not engineered nor intended to reduce flood risk for urban areas. These lands are now substantially urbanized and have high-value development and include much of the well-known Silicon Valley as well as transportation corridors, wastewater plants, and other critical infrastructure. In addition, a substantial sea level change (SLC) is expected during the planning horizon for this study, exacerbating problems from tidal flooding. Public FRM projects to date primarily sponsored by Santa Clara Valley Water District (SCVWD) have generally focused on reducing fluvial flood risk to the 1-percent ACE level.

2.1.2 Ecosystem Restoration

A second issue in the study area is that the historic creation of extensive salt production ponds in the South Bay resulted in the loss of most tidal salt marsh habitat in the area. These local tidal marsh losses are in addition to substantial losses of tidal marsh elsewhere in the San Francisco estuary. Estuary-wide, about 90 percent of all tidal wetlands have been lost, although some of these were converted to non-tidal wetlands (SWAMP 2008).

The tidal marsh in the South Bay has suffered severe losses and degradation from several causes. Habitat losses have generally ceased, but historically they have occurred primarily due to diking of marshes for salt production and filling of marshes and mudflats for landfills and development. Degradation historically was caused by water pollution (now mostly abated), habitat fragmentation, and loss of high-tide refugia, and more recently by invasive plants. Habitat loss and degradation in the tidal marsh have resulted in severe losses of habitat quantity and quality for salt marsh plants and wildlife leading to the listing of several species under the both the Federal and the California State Endangered Species Acts and severe losses of the ecosystem functions and services associated with tidal marshes and estuaries.

Biological and chemical tidal marsh functions that enhance the health of the entire San Francisco Bay were largely lost, impairing bay productivity and water quality. The remaining tidal marsh habitat became severely fragmented and nearly all refugial high-tide habitats (transitional habitat where wildlife can retreat during high-tide events), which are of critical importance to several resident species, have been lost. Native species dependent on tidal marshes lost most of their habitat in the South Bay, and remaining tidal habitat was degraded. As a result, a number of local tidal marsh species have become Rare, and several have been listed as Threatened or Endangered under Federal and State laws.

Over time, though, the ponds have become important habitat for many species of migratory shorebirds and waterfowl. Efforts to restore some tidal marsh in the area by breaching select former salt pond dikes will require a balance with enhanced management of the remaining ponds to allow them to support more shorebirds and waterfowl per acre.

Ecosystem restoration and FRM issues are inseparable in the study area because opening the former salt production ponds to tidal action changes the hydraulic behavior of the ponds under both normal and high-water conditions. Currently, the perimeter (outboard) levees that separate the pond complex from San Francisco Bay are stronger, higher, and more robust than the interior levees that separate the ponds from each other. Breaching the outboard non-engineered pond dikes to reconnect the ponds with the bay would alter both ecosystem conditions and increase the potential flood risk to the areas located inland from the ponds.

Tidal salt marshes are in dynamic equilibrium with water levels in the bay and can keep pace with rising sea levels through accretion of sediment if restoration activities begin soon, based on current and projected sediment availability. In addition, a vegetated marsh plain can slow down tidal surge velocity and reduce wave heights as they traverse the marsh surface. Therefore, having an established marsh in front of flood protection infrastructure would increase the resiliency of the shoreline relative to the projected effects of SLC.

2.2 Federal Objectives

The Federal objectives are twofold. First, the objective for water and related land resources planning is to contribute to National Economic Development (NED) while remaining consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Contributions to NED are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net economic benefits that accrue in the planning area and the rest of the Nation.

The U.S. Army Corps of Engineers (USACE) has added a second national objective for ecosystem restoration in response to legislation and administration policy. This objective is to contribute to the Nation's ecosystems (or National Ecosystem Restoration [NER]) by restoring degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. Contributions to NER are increases in ecosystem value and productivity and are measured in nonmonetary units such as acres or linear feet of habitat or increased species number or diversity. The "NED/NER Plan" or "Combined Plan" is a multipurpose plan that contributes to both NED and NER outputs.

2.3 Non-Federal Sponsors' Objectives and Public Concerns

The non-Federal sponsors' objectives for the study are to provide 1-percent ACE tidal FRM and ecosystem restoration in the study area that takes into consideration future SLC and planning constraints such as maintenance of existing wildlife populations. Increased recreation access is a subordinate goal that will be constrained by the need to protect sensitive wildlife populations and public safety.

A number of public concerns were identified during the course of both the reconnaissance and feasibility stages of this study. Additionally, Congress expressed initial concerns in the USACE Study Authorization. Additional input was developed by the study team and received through coordination with the non-Federal sponsors, coordination with other agencies (e.g., City of San José and National Marine Fisheries Service), public review of interim products, and public meetings. A discussion of public involvement is included in Chapter 6 *Public Involvement, Review, and Consultation*. Input received during this process identified several concerns that form the basis of, and are reflected in, the problems and opportunities, planning objectives, planning constraints, and other evaluation criteria in the paragraphs that follow.

2.4 Problems and Opportunities

2.4.1 Problems

The first step in the USACE's Six-Step Planning Process involves identification of problems and opportunities in the study area. Problem identification for the Shoreline Phase I Study was compiled through a combination of public input, study team review of existing reports, and consultation with individuals and groups familiar with the study area. The identified problems and opportunities have guided the study's inventory and forecast of conditions and the development of the study planning objectives.

Problems and opportunities that have been identified are included below. Unless otherwise noted, responsibility for addressing the following problems is considered to be within the mission and authorization of both the USACE and local interests.

2.4.2 Problem 1 – Risk to Public Health and Human Safety

There is a risk to public health and safety associated with flooding caused by tidal and fluvial sources near the South Bay shoreline in Santa Clara County. This risk is exacerbated by the non-engineered condition of the salt pond dikes. This risk will likely increase over time because of future changes in sea level.

Floods create problems for public health and human safety. Floodwaters present both acute and chronic threats to the population in the affected area. Acute threats include injury and death from trauma and drowning. Chronic threats include injury, and possibly death as a result of injury and exposure to the elements and to contaminated floodwaters. Public health and human safety are also affected if utility and emergency services are interrupted.

Flooding can create problems for public health and human safety as well as cause economic and environmental damages that can affect property owners; business owners; and Federal, state, and local governments. Although fluvial flood risk has been addressed by other existing and planned local and Federal projects, there will always be the opportunity to further reduce tidal flood risk. Global climate change and SLC modeling suggests increases in risk for communities located along the South Bay shoreline from the heightened potential for tidal flooding because of inadequate FRM structures.

The existing patchwork of non-engineered dikes was constructed, operated, and maintained by Cargill Inc. for commercial salt pond production, which also incidentally afforded a level of flood protection and prevented tidal flooding in the study area. Cargill Inc. no longer owns the land or operates in these ponds (Appendix C *Economics*). The current salt pond owners, USFWS and City of San José, have continued the same maintenance activities and have prevented tidal flooding in the period of ownership. Nevertheless, the dikes were not designed for FRM, and the continuation of the same maintenance paradigm is likely unsustainable in the far term. Incremental decreases in maintenance effectiveness will result in corresponding increases in tidal flood risk to urban infrastructure and the community of Alviso.

The population at risk within the study area includes approximately 6,000 residents and people working in the area. This figure does not include people traveling through the area on one of the major highways. A structure inventory conducted as part of the economic analysis for this study identified 1,140 structures (1,034 residential, 54 commercial, 42 industrial, and 9 public) in the 0.2-percent ACE floodplain under the USACE High SLC scenario that defines the study area's boundaries for the flood risk assessment.

There is a close correlation between the tidal and fluvial flood risk and the El Niño Southern Oscillation cycle, notably during a strong El Niño period. A strong El Niño period will affect San Francisco Bay by causing an elevated mean sea level, on the order of 10 to 30 centimeters, along with an increase in "storminess" and rainfalls. While recent non-engineered dike performance has prevented tidal flooding, the onset of a strong El Niño combined with anticipated SLC creates the potential for extreme water levels of as much as 1 foot greater than recently experienced. This increase is equivalent to the SLC associated with roughly 150 years under local historic rates of SLC (i.e., USACE Intermediate SLC scenario). This potential upward shift will likely impact the dike performance negatively, and increases the potential for their non-performance.

2.4.2.1 Opportunity 1

There is an opportunity to reduce future tidal flood risk by reducing the likelihood of failures of non-engineered dikes by building flood risk management levees.

The USACE conducted extensive tidal hydrodynamic modeling in order to understand the existing and future risk from coastal storm events (Appendix D1 *Coastal Engineering and Riverine Hydraulics Summary*). The modeling effort was complicated by the existence of the former salt pond that traverses the study area. The model considered static water level, wave and tidal forces, dynamic and static failure of the existing non-engineered dikes, and overtopping volumes into the various ponds in the study area. All of these factors affect the estimate of water-surface elevation at the innermost area of the bay adjacent to the populated area (Appendix C *Economics*).

The USACE planning process is required to consider a range of potential SLC scenarios (Engineering Regulation 1100-2-8162 *Incorporating Sea Level Change in Civil Works Programs*). Therefore, in formulating and evaluating alternatives, future SLC scenarios ranged from the “USACE Low SLC” scenario to the “USACE High SLC” scenario. The USACE Low SLC is consistent with the local historical rate and is the lower limit of predicted SLC in a 50-year period of analysis. The “USACE High SLC” scenario is consistent with the “Curve III scenario” that was presented by the National Research Council of the National Academies (NRC) in the 1987 report *Responding to the Changes in Sea Level: Engineering Implications*, as modified by the global mean sea level value given in Intergovernmental Panel on Climate Change (IPCC 2007) (referred to as “Modified NRC Curve III” in study documentation) and the State of California’s planning requirements on the upper limit. The estimated results for the period of analysis (2017-2067)[1] under each scenario included a rise in sea level of approximately 0.51 foot under the USACE Low SLC scenario, 1.01 feet under the USACE Intermediate SLC scenario, and 2.59 feet under the USACE High SLC scenario (Appendix D2 *Tidal Flood Risk Analysis Summary Report*). The screening of the scenarios is discussed further to determine the appropriate levee height to build to anticipate positive SLC (e.g., sea level rise).

2.4.3 Problem 2 – Economic Flood Damages

There is a risk of economic and environmental flood damages from potential flooding near the South Bay shoreline in Santa Clara County. Over time, this risk will likely increase because of a rise in sea level.

Historic fluvial floods have caused economic and environmental damages that have affected property owners; business owners; and Federal, State, and local governments. Such floods have been addressed by separate Federal and non-Federal FRM projects. Residents and business owners in the community of Alviso and the City of San José who are at risk of tidal flood damages have expressed the need for improved FRM in the study area. Additionally, owners and managers of resources such as the San José–Santa Clara Regional Wastewater Facility (Wastewater Facility), the Don Edwards San Francisco Bay National Wildlife Refuge, and regional landfills are invested in flood risk management advocacy because of the risks posed to their properties. Lastly, the governments associated with the above municipalities—the SCVWD, the Federal Emergency Management Agency (FEMA), and the USACE—have advocated improvements to FRM infrastructure to prevent injury and costs associated with flood damages.

[1] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

Engineering and economic modeling to date has indicated that there is currently a significant threat of major tidal flooding throughout the Alviso community, and this threat is projected to increase significantly over time because of SLC. Currently, the only infrastructure protecting the community of Alviso from widespread economic damages, as well as threats to life and safety, is a non-engineered system of dikes and ponds that our engineering analysis indicates have a high likelihood of failure over the period of analysis. Alviso is at an elevation at or below an elevation of 5 feet NAVD 88, which is lower than mean high tides in the area. Because of its low elevation, a coastal flood could result in water depths as great as 8 feet throughout much of the floodplain. Floods that would result in several feet of flooding in Alviso are estimated to cause more than $100 million in direct damage to structures and contents.

To date, the existing non-engineered salt pond dikes have prevented tidal flooding in the study area. According to the current coastal flood risk analysis, however, there is an expected high annual risk of flooding, and this risk will increase over the period of analysis under any of the three USACE SLC scenarios. According to the combined coastal and geotechnical modeling, in 2017 the annual chance of flooding is approximately one in three. Under the USACE Intermediate SLC scenario the annual risk of flooding by the year 2067 is estimated to be greater than fifty percent (annual risk of flooding by 2067 is approximately 40 percent under the low and 95 percent under the high). This increase is due to the increase in relative sea level at the study location over the period of analysis.

The increasing likelihood of future coastal flooding in the area also threatens the Wastewater Facility, which is a critical regional facility. The plant serves approximately 1.4 million people and a large portion of businesses in Silicon Valley. A flood causing inundation of the under-ground equipment is estimated to cause more than $200 million in direct damage. The plant is not in the current coastal floodplains developed by USACE, but it is in the future floodplains that incorporate SLC projections. This nearly $3 billion[2] facility is essential to the region, and in the absence of a Federal FRM project, it is assumed that the City of San José would take measures to protect the facility from flooding (i.e. construct a ring levee).

2.4.3.1 Opportunity 2

There is an opportunity to reduce economic flood damages in the Study Area.

The opportunity to reduce or prevent tidal flood damages to the community of Alviso and urban infrastructure was discussed in Opportunity 1. The flood plain structural inventory value is estimated to be $465 million.

[2] Estimated replacement value; source: San José–Santa Clara Regional Wastewater Facility

2.4.4 Problem 3 – Tidal Marsh Habitat Degradation and Environmental Degradation

Over the past century, baylands[3] habitat quality, acreage, and connectivity have declined in the San Francisco Bay Area. This condition has resulted in the loss of ecological functions and environmental services, negative impacts on the bay itself, and negative impacts on native species, including special-status species such as steelhead trout, salt marsh harvest mouse, western snowy plover, California least tern, and Ridgway's rail, which are of technical and institutional significance throughout the area.

Concern over the decline in tidal marsh habitat has grown steadily in recent decades. Restoration of this valuable resource has long been a goal of legislators, resource agencies, and nongovernmental organizations (NGOs) working to protect San Francisco Bay. Supporters of tidal marsh restoration efforts include the California Department of Fish and Wildlife, USFWS, California State Coastal Conservancy (State Coastal Conservancy), the San Francisco Estuary Institute, San Francisco Bay Joint Venture, Save the Bay, San Francisco Bay Institute, National Audubon Society, Audubon California, Citizens Committee to Complete the Refuge, San Francisco Bay Trail, SF Bay Conservation and Development Commission, California Native Plant Society, and many other agencies, organizations, and individuals. In addition, individuals and organizations involved in recreational activities such as hiking, bicycling, boating, bird watching, and hunting are actively interested in protecting the baylands ecosystem.

Tidal marshes in the South Bay have decreased extensively over the years, but they still support high densities of, and a fairly high diversity of wildlife species, including several native to San Francisco Bay. The State- and Federally-endangered salt marsh harvest mouse (SMHM; *Reithrodontomys raviventris*) and the salt marsh wandering shrew (*Sorex vagrans halicoetes*) are present, particularly in areas where pickleweed is present. The California vole (*Microtus californicus*) is present here as well and is often the most common small mammal in tidal marshes. Ridgway's rail (*Rallus longirostris obsoletus*) nest in gumplant on the higher-elevation channel edges, in high pickleweed clumps, and to a lesser extent in thicker stands of cordgrass in both salt and brackish tidal marshes. In general, remaining South Bay tidal marsh habitat for these species is highly fragmented. Remaining populations of SMHM are relatively small and isolated and may lack the size and full range of resources necessary for long-term persistence. Because of the relatively low mobility of these marsh obligates, expansive, unfragmented marshes with high connectivity to other marshes and ample high-tide refugium (e.g., transitional habitat zones) provide the optimal landscape configuration for these species by allowing large population sizes in a given area and facilitating dispersal among marshes. Higher-elevation areas, such as natural levees along higher-order channels and transitional habitat zones on the upper sides of tidal marshes, are important during spring tides when rails, SMHM, and nesting songbirds must seek cover from high water (and from avian and mammalian predators that hunt the marshes during these tides). However, little high-quality tidal salt marsh habitat with these attributes is present in the South Bay. Local populations of these species are also threatened by flooding during high tides, especially in narrow strip

[3] Baylands are the areas between the highest and lowest tides (also known as tidal marsh) and lands that would be tidal in the absence of human-made structures that block the tides.

marshes. Few existing marshes are actually wide and high enough on their landward margins, to support large, viable populations of small mammals unless the marshes contain highly channelized slough systems in the marsh interior with ample gumplant or other corridors with adequate cover.

The San Francisco Bay estuary is an extremely productive, diverse ecosystem, yet it has been degraded considerably since the 1800s. The estuary has lost more than 90 percent of its original tidal wetlands to diking, draining, and filling, and it has been more heavily invaded by nonnative species than any other aquatic ecosystem in North America (Goals Project 1999). Despite this degradation, native wildlife diversity is high, with more than 250 species of birds, 120 species of fish, 81 species of mammals, 30 species of reptiles, and 14 species of amphibians regularly present in the estuary (Harvey et al. 1992). Additionally, a number of endemic, endangered, threatened, and rare wildlife species or subspecies reside in the San Francisco Bay Area.

2.4.4.1 Opportunity 3

There is an opportunity to increase habitat acreage for special-status species and native South Bay species and to enhance existing salt pond habitat to benefit special status wildlife and migratory birds.

The opportunity to restore tidal marsh habitat would increase the total acreage of habitat that is currently available in the Bay Area, which is important to the public. Converting the former salt ponds to tidal marsh would also provide more salt and brackish marsh habitat for the salt marsh harvest mouse, Ridgway rail, and other threatened and endangered species.

There is an opportunity to improve habitat quality and natural ecosystem processes throughout the broader network of the San Francisco Bay's former salt pond network, inclusive of, but not limited to, the Shoreline Phase I Study Area. Salt ponds and former salt ponds managed for bird use have valuable ecological functions. However, the Baylands Habitat Goads report (1999) and the South Bay Salt Pond Restoration Project EIS (2006) support the conversion of 50 percent to 90 percent of former salt production ponds in the south portion of the bay to tidal habitats including marsh. In addition, a vegetated marsh plain can slow down tidal surge velocity and reduce wave heights as they traverse the marsh surface. Therefore, having an established marsh in front of flood protection infrastructure would also increase the resiliency of the shoreline relative to the projected impacts of SLC.

A project proposed by the current Shoreline Phase I Study could complement and further regional ecosystem restoration associated with existing and planned ecosystem restoration projects, most notably the South Bay Salt Pond Restoration Project (SBSP Restoration Project. The Shoreline Phase I Study has already benefitted during the feasibility phase through direct involvement in and the use of work products from the SBSP Restoration Project public outreach program, planning tasks, and monitoring and adaptive management program. This coordination and collaboration could be continued during the implementation phase of this project.

2.4.5 Problem 4 – Increased Need for Recreational Access

The tremendous urban growth that has occurred in and near the study area in recent decades has created a high demand for and substantial public interest in expanded recreational access to the South Bay. In response to this demand, cities, counties, and several State agencies are facilitating recreational uses of the baylands. Agencies such as the State Coastal Conservancy and San Francisco Bay Conservation and Development Commission that encourage or require public access to the shoreline are fulfilling a part of their public-trust responsibility to ensure long-term bay protection.

2.4.5.1 Opportunity 4

There is an opportunity to provide public access, education, and recreational opportunities in the Study Area.

Most of the non-urbanized lands and diked ponds within the study area are now part of the Don Edwards San Francisco Bay National Wildlife Refuge. National wildlife refuge lands and waters may be used for wildlife-related recreation to the extent that it is compatible with the primary purpose of the refuge system, which is protecting and enhancing wildlife habitat values. Because of the sensitivity of wildlife to active recreational use, these uses are expected to be expanded only on a limited basis. Opportunities to provide public access, education, and recreation include development of multi-use trails for walking, jogging, cycling, hiking, and nature observation; facilitating education and photography by constructing viewing platforms along multi-use trails overlooking the evolving marshes.

2.4.6 Problem 5 – Proliferation of Nonnative Plant and Animal Species

Nonnative plant and animal species have proliferated within the Study Area, impairing ecosystem function and harming special-status species.

Although nonnative species have been observed in the San Francisco Bay area since the 1800s, scientific and agency concern about the impacts of these exotic species on native species and ecosystem function heightened greatly in the mid-1980s following the proliferation of several invasive species including the Asian clam (*Potamocorbula amurensis*), smooth cordgrass (*Spartina alterniflora*), and perennial pepperweed (*Lepidium latifolium*), each of which has presented a significant threat to native species and ecosystem function.

Concern over the effects of the specific invasive nonnative plant and animal species in the study area has grown steadily in recent decades. Studies monitoring special-status species' populations have identified the damaging impacts that some nonnative plant and animal species have on native species and ecosystem function. A number of legislators, resource agencies, and NGOs working to protect San Francisco Bay are working to control the problems associated with nonnative plant and animal species proliferation in the study area.

In 1997, San Francisco Estuary Institute established the Biological Invasions Program to:

- Assess the extent and impacts of exotic invasions
- Identify and characterize the mechanisms that transport and release exotic species
- Investigate and report on the scientific and policy aspects of reducing the transport and release of exotic species
- Understand how species characteristics and environmental factors affect the success of invasions

Following these findings, the State Coastal Conservancy initiated the largest nonnative species project within the study area, the San Francisco Estuary Invasive Spartina Project, in 2000. The State Coastal Conservancy has also developed partnerships with local jurisdictions to control invasive *Spartina* species.

Additionally, the California Native Plant Society, which focuses primarily on native plant species, also concerns itself with nonnative plant species that disturb native species and overall ecological function. The California Invasive Plant Council (formerly the California Exotic Pest Plant Council) is another nonprofit organization dedicated to reducing the environmental threats of nonnative plant species.

Concerns have also risen regarding recent discoveries of abundant nonnative phytoplankton in the South Bay (Cloern et al. 2005; Miller et al. 2004). One potential source of nonnative and harmful phytoplankton is the former salt ponds. The U.S. Geological Survey has collected samples within some ponds in the Alviso pond complex and discovered high abundances of phytoplankton species that have produced harmful blooms and fish kills elsewhere. Many of these phytoplanktons have not been present historically within the bay, although they have been observed in the far South Bay.

2.4.6.1 Opportunity 5

There is an opportunity to address predators and invasive species in the Study Area.

Tidal marsh habitat restoration will be planned, constructed, monitored with adaptive management protocols, and operated to reestablish native species and reduce or minimize invasive species.

2.5 Project Planning Objectives

The USACE project planning objectives are statements of the study purpose. Planning objectives are more specific than the USACE national objectives (Section 2.2 *Federal Objectives*) and respond to problems and opportunities in the Shoreline Phase I Study Area and adjacent lands. Each objective is developed to address one or more of the identified problems and opportunities; however, not all of the problems and opportunities will become planning objectives. These planning objectives guide the formulation of alternatives and represent desire positive changes in the without-project condition that may be recommended for implementation by the USACE, the USFWS, other Federal agencies, or non-Federal entities.

The planning objectives for the Shoreline Phase I Study would be attained within the period of analysis for the study, a 50-year time frame of 2021 to 2071. All of the objectives focus on activities within the study area.

The Shoreline Phase I Study planning objectives are as follows:

- Reduce the risk to public health, human safety, and the environment caused by tidal flooding along the South Bay shoreline for the community of Alviso, City of San José, Santa Clara County, California and surrounding areas.
- Reduce potential economic damages to the community of Alviso and surrounding areas from tidal flooding in areas near the South Bay shoreline in Santa Clara County.
- Restore ecological function and habitat quantity, quality, and connectivity in the study area for native plant and animal species, including special-status species such as steelhead trout, Ridgway's rail, and salt marsh harvest mouse.
- Community support (local to statewide) has advanced development of a fourth planning objective to provide opportunities for public access, education, and recreation in the study area (San Francisco Bay Trail Plan).

2.6 Planning Constraints

Unlike planning objectives that represent desired positive changes, planning constraints represent restrictions that should not be violated as a result of project implementation. Planning constraints identified in this Study are as follows:

- Do not increase flood risk in developed areas of the study area where loss of life and monetary damages may occur.
- Do not increase the bioaccumulation of mercury in humans or wildlife within the study area over the 50-year project study period.
- Ensure that proposed new recreational features are compatible with ecosystem restoration objectives and FRM objectives.

2.7 Other Planning Considerations

2.7.1 USACE Environmental Operating Principles

The USACE has reaffirmed its commitment to the environment by formalizing a set of seven Environmental Operating Principles applicable to all of its decision making and programs. These principles foster unity of purpose on environmental issues, reflect a new tone and direction for dialogue on environmental matters, and ensure that employees consider conservation, environmental preservation, and restoration in all USACE activities. By implementing these principles, the USACE will continue its efforts to develop the scientific, economic, and sociological measures to judge the effects of its projects on the environment and to seek better ways of achieving environmentally sustainable solutions.

The seven USACE Environmental Operating Principles are as follows:

1. Foster sustainability as a way of life throughout the organization.
2. Proactively consider the environmental consequences of all USACE activities and act accordingly.
3. Create mutually supporting economic and environmentally sustainable solutions.
4. Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the USACE, which may affect human and natural environments.
5. Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
6. Leverage scientific, economic, and social knowledge to understand the environmental context and effects of USACE actions in a collaborative manner.
7. Employ an open, transparent process that respects the views of individuals and groups interested in USACE activities.

2.7.2 Additional Planning Considerations

The following issues will inform, but not necessarily direct or constrain, the planning process:

- The Santa Clara Valley Water District guidance includes a goal to provide at least a 1-percent ACE level of flood risk protection to urban lands in Santa Clara County, which is consistent with FEMA requirements for eligibility in the National Flood Insurance Program. This is a local goal, as the USACE does not require a minimum level of FRM for its projects.
- Global climate change and SLC will affect flood potential and physical stresses on flood risk control structures.
- Global climate change and SLC will affect restoration processes, with potential for disrupting resident flora and fauna and/or improving conditions for invasive species.
- Adjacent low-lying urban areas are up to 13 feet below sea level due to subsidence.
- Work must be coordinated with the FEMA.
- Sediment availability, primarily from tidal influx, will influence restoration design.
- Historical pond subsidence will affect tidal habitat evolution.
- Long-term changes to landscape will affect resident flora and fauna.
- Historical geomorphic features such as channels and sloughs may inform restoration design.
- Adaptive management can be used to guide the establishment of tidal marsh.
- Design features that are self-sustaining, using and harmonizing with natural processes, are desirable for environmental and economic reasons.
- There has been a reduction in the South Bay’s salinity and change to historical hydrology due to wastewater discharges from the Wastewater Facility.
- There is a tradeoff between performing rodent control on levees and protecting salt marsh harvest mouse.
- Current USACE levee guidance requires suppression of natural intertidal and transitional vegetation on levees and the artificial maintenance of perennial grass on the entire levee surface. This requirement may be impractical in intertidal brackish and saltwater areas.

3.0 Alternative Plan Formulation, Evaluation, Comparison, and Selection

This chapter first describes the general planning process used by the USACE and non-Federal sponsors to formulate and select alternatives that address both the NEPA and the CEQA requirements and the U.S. Army Corps of Engineers (USACE) planning objectives. The chapter then turns to the specifics of the Shoreline Phase I process: the initial development of management measures, and ultimately, alternative plans (USACE Planning Step 3); the comparison and evaluation of the alternative plans (USACE Planning Steps 4 and 5); and the identification of the Recommended Plan (USACE Planning Step 6), also known as the Proposed Project under CEQA and the Proposed Action under NEPA.

The inventory and forecast of future No Action (without-project condition; USACE Planning Step 2) of significant resources is covered in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures*. Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* integrates information regarding the existing and future condition that is relevant to the plan formulation and evaluation process.

3.1 USACE Planning Process

The USACE planning process is based on the economic and environmental Principles and Guidelines (P&G) adopted by the Water Resources Council in 1983 and set forth in USACE Engineer Regulation (ER) 1105-2-100 dated April 22, 2000. This regulation requires the formulation of reasonable alternative plans that are responsive to Federal, state, and local concerns to ensure that sound decisions are made. The plan formulation process requires a systematic and repeatable approach. Per ER 1105-2-100:

> The Federal objective of water and related land resources project planning is to contribute to national economic development (NED) consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.
>
> The USACE objective in ecosystem restoration planning is to contribute to national ecosystem restoration (NER). Contributions to national ecosystem restoration (NER outputs) are increases in the net quantity and/or quality of desired ecosystem resources. Multipurpose plans that include ecosystem restoration shall contribute to both NED outputs and NER outputs. In this latter case, a plan that trades off NED and NER benefits to maximize the sum of net contributions to NED and NER is usually recommended.
>
> The planning process shall address the Nation's water resources needs in a systems context and explore a full range of alternatives in developing solutions. Innovative solutions and the application of the full range of the USACE programs and authorities are integral to the planning process.

The P&G further define a six-step study process that should be used for all USACE planning studies to include the following steps as summarized below (the complete regulation is provided in ER 1105-2-100, pages 2-1 to 2-8).

3.1.1 Step 1 – Identify Problems and Opportunities

The first phase of the planning process defines study area problems and opportunities as well as study goals, objectives, and constraints. Goals, objectives, and constraints are framed in terms of the Federal objective and the specific study planning objectives. Because this study encompasses both flood risk management and ecosystem restoration, problems and opportunities are developed to address combined Federal NED and NER objectives. The NEPA scoping process, required by NEPA regulations (40 CFR 1500–1508), also provides information that can help to identify issues of interest to the public related to flood risk and environmental concerns that can be addressed in subsequent steps of the planning process. This step is addressed in Chapter 2 *Need for and Purpose of Action*.

3.1.2 Step 2 – Inventory and Forecast Conditions

The second planning step consists of inventorying and forecasting critical resources relevant to the problems and opportunities being considered in the study area. This inventory step accounts for the level or amount of a particular resource that currently exists within the study area (i.e., identification of the existing condition). This step also involves forecasting the future without-project condition through the 50-year period of analysis, assuming no actions are taken. This step is addressed partially in this chapter, and more thoroughly in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures.*

3.1.3 Step 3 – Formulate Alternatives

The third step is to generate alternative solutions. Alternatives are formulated using the information gathered and developed in steps 1 and 2, with consideration of four criteria from the USACE EO *Principles and Guidelines for Water and Land Related Resources Implementation Studies*):

1. Completeness – the extent to which a proposed alternative provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects,
2. Effectiveness – the extent to which a proposed alternative alleviates the specified problems and achieves the specified opportunities,
3. Efficiency – the extent to which a proposed alternative is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment, and
4. Acceptability – the workability and viability of the proposed alternative with respect to acceptance by state and local entities and the public and compatibility with existing laws, regulations, and public policies.

This step is addressed in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*.

3.1.4 Step 4 – Evaluate Alternatives

In the fourth step, preliminary alternatives are evaluated for their potential to address the specific study problems, needs, and objectives. After assessing the most likely with-project condition for each action alternative, a comparison is made between the future without-project condition and those conditions predicted to occur with each action alternative in place for each of the relevant resources (e.g., cultural resources or wildlife). This difference is referred to as the positive benefits of the action alternative. The final task of this step is to identify the alternatives that will be further considered in the planning process based on a comparison of the adverse and beneficial effects (i.e., costs and benefits) and the evaluation criteria. This step is also addressed in both Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* and Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures*.

3.1.5 Step 5 – Compare Alternatives

In this step, also addressed in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* and Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures*, the final alternatives (including the No Action Alternative) are compared against each other, with emphasis on the outputs and effects that will have the most influence in the decision-making process. The comparison takes into account both the beneficial and adverse effects of each alternative, including monetary and nonmonetary benefits and costs. This step can be viewed as a reiteration of the evaluation step (Step 4), with the exception that in this step each plan (including the No Action plan) is compared against each other plan and not against the future without-project condition. The output of the comparison step is a ranking of plans. Identification and documentation of tradeoffs are required to support the final recommendation.

3.1.6 Step 6 – Select a Plan

In this step, a single alternative plan is recommended from among all of those plans that have been considered. The recommended plan must be shown to be preferable to taking no action (if no action is not recommended) or implementing any of the other alternatives considered during the planning process. Projects that produce both NED and NER benefits will result in a single “best” recommended plan that attempts to maximize the net NED and NER benefits (known as the “NED/NER Plan”) and to offer the best balance between the two Federal objectives. Projects may deviate from recommending the NED/NER Plan if the non-Federal sponsor(s) (i.e., the SCVWD or the State Coastal Conservancy) request another policy-compliant plan and the Assistant Secretary of the Army for Civil Works (ASA [CW]) approves the recommendation. This recommendation was approved on August 24, 2015. However, Federal participation in the Recommended Plan is set by the NED/NER Plan. If the Locally Preferred Plan (LPP) is a more expensive plan than the NED/NER Plan, Federal participation in the LPP would be limited to the Federal cost share for the NED/NER Plan. If the LPP is less expensive than the NED/NER Plan, then cost sharing for the LPP would be calculated using the same rules as for the NED/NER Plan.

The USACE Planning Manual (Institute for Water Resources Report 96-R-21) describes planning as a dynamic and iterative process in which steps are repeated and may occur out of order. For instance, identifying existing and future conditions (step 2) contributes to understanding system-wide problems and opportunities (step 1). During every point in the process, previous steps may be revised and subsequent steps may be anticipated. This planning approach allows the process to progress based on the best information available at any given time. This step is introduced in the final sections of Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* and then defined in detail in Chapter 9 *Findings and Recommended Plan*.

3.2 Plan Formulation

Plan formulation takes into consideration the study area's problems and opportunities, study goals, objectives and constraints (described in Chapter 2 *Need for and Purpose of Action*), and the four P&G criteria (completeness, effectiveness, efficiency, and acceptability) that guide USACE planning and evaluation for Federal water resources projects. The process considers the problems and opportunities with respect to both the existing condition and the future without-project condition (No Action Alternative).

Before describing specific outcomes of the Shoreline Phase I Study's plan formulation process, it is necessary to understand the planning terminology as well as the general plan formulation strategy (Figure 3.2-1 *Plan Formulation Strategy*).

A "management measure" (or "measure") is a feature or an activity (or collection of features and activities) that addresses one or more planning objectives.

Measures are the building blocks for alternatives that address all of the planning objectives. For complex, multi-objective planning studies such as this one, the process of building alternative plans to address objectives that span multiple purposes can benefit from interim formulation, evaluation, and screening steps that occur before formulating a final array of alternatives. Accordingly, "options" were formulated as an intermediate step between measures and alternatives. An "option" is a collection of measures that addresses all of the objectives for either flood risk management (FRM) or ecosystem restoration. Flood Risk Management was considered primary and was formulated first. Ecosystem restoration was formulated second with the assumption that an FRM option would be in-place. The sections that follow describe the formulation, evaluation, and screening of single-purpose FRM and ecosystem restoration options.

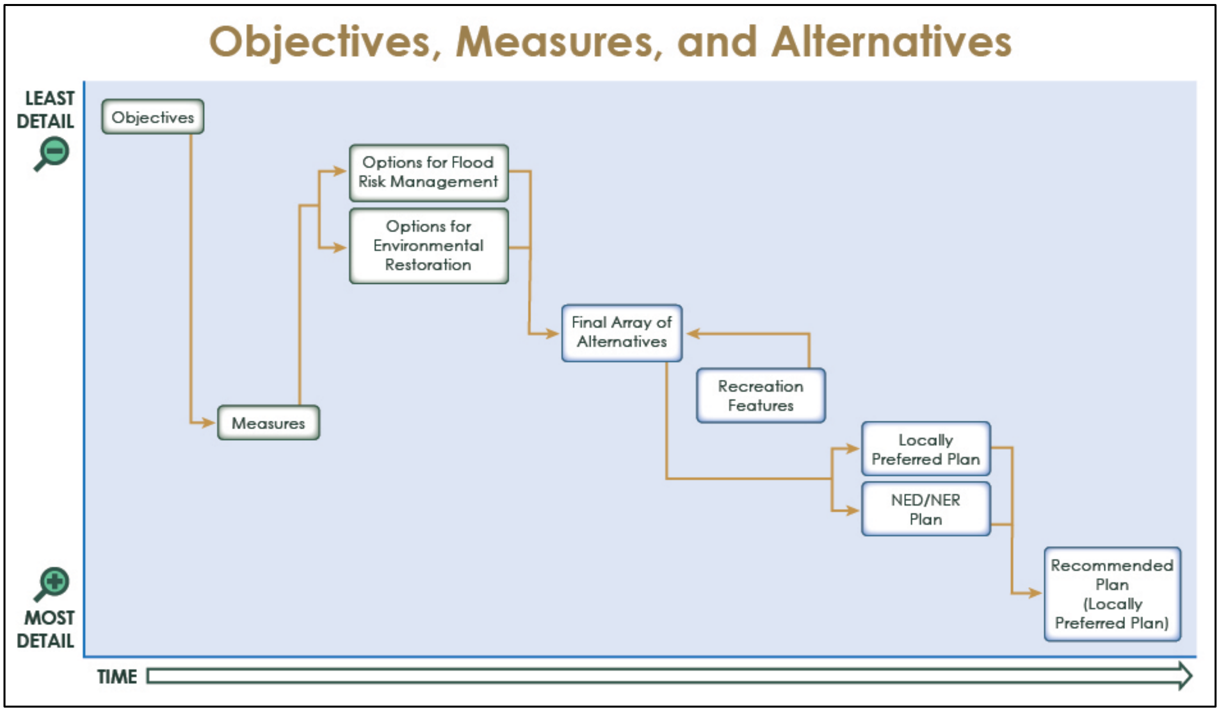

Figure 3.2-1. Plan Formulation Strategy

After the full set of options were screened to remove those that were too costly or complex, the remaining options were combined into alternative plans that address the planning objectives, and recreation features were incorporated into these alternatives as part of the planning objectives. These alternatives are “combined alternatives,” “multi-purpose alternatives,” or “multi-objective alternatives” because they address multiple high-priority USACE mission areas: FRM and ecosystem restoration. These alternatives made up the final array of alternatives in which detailed analysis completed to evaluate costs, benefits, and impacts (discussed in this chapter and in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures*).

The benefit, cost, and impact analyses on the final array culminated in the identification of the National Economic Development/National Ecosystem Restoration Plan (NED/NER Plan), which reasonably maximizes net FRM and ecosystem restoration benefits compared to the other alternatives and defines the level of maximum Federal cost sharing. An NED/NER plan must be identified in a study; however, it does not need to be recommended. The non-Federal sponsors can and did request that the USACE recommend a Locally Preferred Plan (LPP), which is a policy-compliant plan other than the NED/NER Plan. The term “Recommended Plan” is also used to describe this plan.

3.2.1 Shoreline Phase I Alternatives Development Process

The plan formulation process (Figure 3.2-2 *Shoreline Phase I Plan Form Process*) began in 2004, when USACE and its study partners completed a reconnaissance study to confirm Federal interest in the broader study area's water resources problems and opportunities. As part of this process, measures and preliminary alternatives were identified and evaluated using existing data and concluded that there would likely be an economically justified project that could be implemented by the Federal government and non-Federal partners. Accordingly, USACE recommended that the study effort continue into the current feasibility phase, which would conduct the planning process in more detail and would conclude with either a recommendation of no Federal action or a recommendation for an alternative plan for Congressional authorization and Federal implementation. During this time, the broader study area included the entire shoreline of Santa Clara County and all of the adjacent ponds.

From 2005 to 2009, preliminary plan formulation was conducted while it focused on the inventory and forecast of existing and future without-project condition (future No Action) for significant resources (details provided in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures*). The future without-project condition is important because it defines the baseline against which the array of alternatives is evaluated both within the USACE planning process and for the NEPA analysis.

The initial plan formulation process consisted of identifying a broad array of potential measures to address the planning objectives and conducting initial screening of those measures. The screening was based on technical, economic, and environmental considerations, as well as the four P&G criteria – completeness, effectiveness, efficiency, and acceptability. Some measures were eliminated because they fell outside the refined project footprint as the project was rescoped in 2011 (for more information, see Section 1.5 *Project Background and Physical Study Area Setting*). The actions that other entities should implement outside of a future Federal project constructed by the USACE were also identified.

From 2009 to 2010, preliminary concepts for FRM and ecosystem restoration were identified at a conceptual level. These concepts consisted of potential levee alignments and habitat endpoints (i.e., tidal marsh or managed ponds) for the mosaic of ponds in the broader study area.

In 2011, the study partners substantially reduced the study area (as discussed in Chapter 1 *Study Information*) and coordinated with the USACE vertical team (Division and Headquarters) on several simplifying assumptions to facilitate the planning process. This coordination process determined that the study effort could adopt the recommendations from the SBSP Restoration Project and local planning efforts on the target landscape (i.e., which ponds would be restored to tidal marsh or retained as managed ponds). The ponds within the revised study area (Ponds A9–A15 and A18) had been recommended for potential tidal marsh restoration by the SBSP Restoration Project (A9–A15) and by the City of San José's (A18) planning efforts; the Shoreline Phase I Study is consistent with that recommendation.

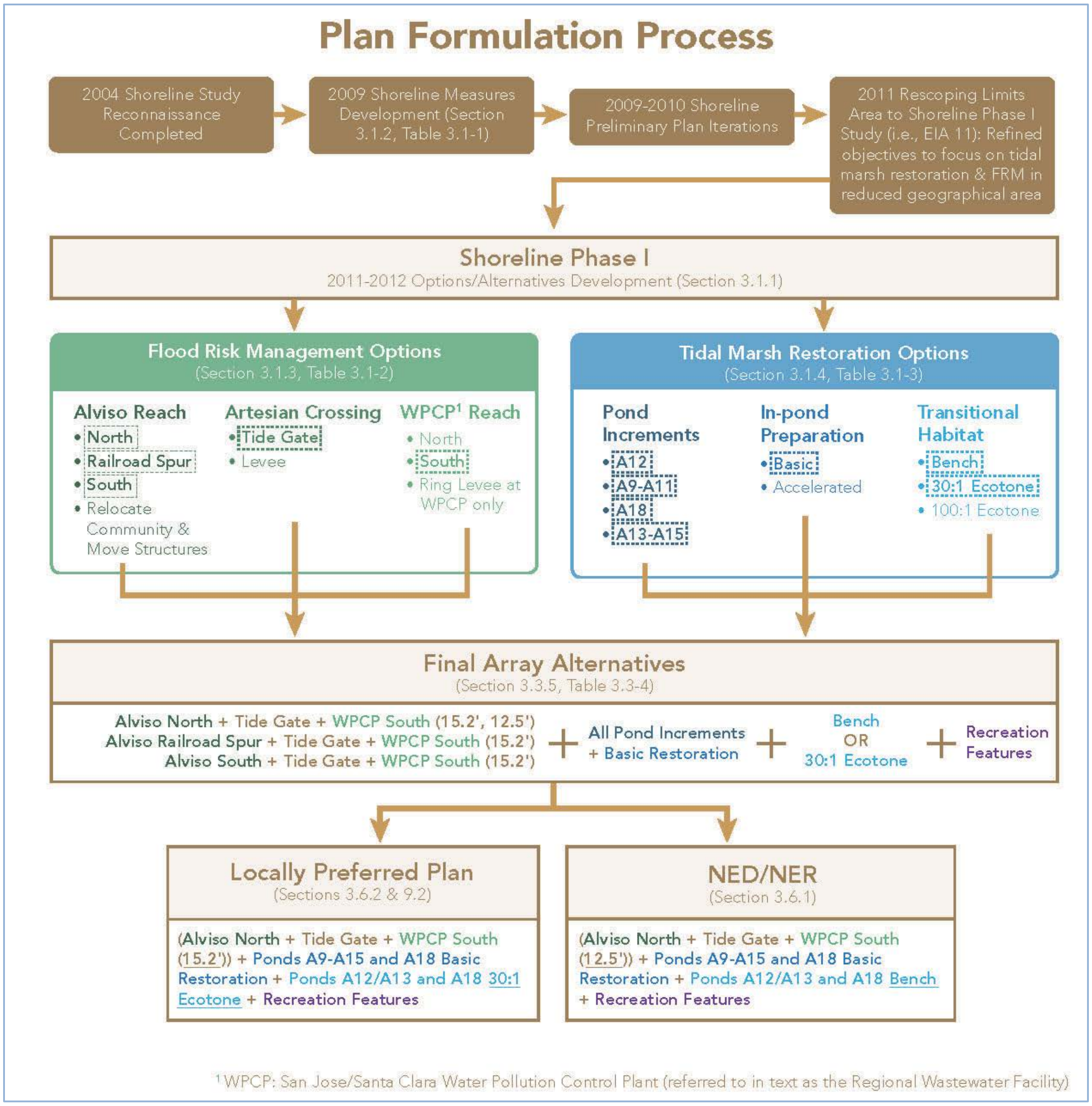

Figure 3.2-2. Shoreline Phase I Plan Form Process

Since the 2011 rescoping process, the identification and screening of measures was refined (Sections 3.6.4 *Criteria for Evaluation and Screening of Ecosystem Restoration Options* and 3.7.4 *Criteria for Evaluation and Screening of Ecosystem Restoration Options*), formulated and screened FRM and ecosystem restoration options (Sections 3.6.5 *Application of Screening Criteria to Flood Risk Management Measures and Options* and 3.7.5 *Results of Screening Ecosystem Restoration Options*), combined the options with each other and with recreation features to create a final array of multipurpose alternatives (Section 3.7 *Final Array of Alternatives*), identified a NED/NER Plan (Section 3.10.1 *Designation of the NED/NER* Plan), and identified a LPP as the Recommended Plan (Section 3.10.2 *Recommended Plan* (Proposed Project)*]*).

The study process analyzed actions for Federal interest irrespective of land ownership. Therefore, the analysis of USFWS lands is integrated into the overall planning discussion. Section 1025 of the Water Resources Reform and Development Act (WRRDA) 2014 enables the USACE to implement actions on USFWS-managed land as long as there is a memorandum of understanding between the USFWS and non-Federal sponsor and the actions are approved by the Secretary of the Army for Civil Works. Chapter 9 *Findings and Recommended Plan* and Chapter 10 *Conclusions and Recommendations* articulate the details of the Recommended Plan, respective implementation responsibilities, and funding requirements for the USACE and for the non-Federal sponsors.

3.3 Future Without-Project Condition

The future without-project condition used in the USACE planning process is equivalent to the NEPA No Action Alternative for this study (also referred to as the future No Action). It is the benchmark for assessing the benefits and impacts of the array of options (and, eventually, alternatives) under the USACE planning and NEPA process. The USACE future without-project condition assumes that no project would be implemented by the USACE to achieve the Shoreline Phase I Study planning objectives.

The "period of analysis" begins with the year that project outputs are first expected, which is 2021 for this study, and spans 50 years (to 2071).

Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures* contains a detailed discussion of the future condition under the future without-project condition (No Action Alternative). The future without-project condition includes ongoing projects, programs, and policies included under the baseline conditions (for more discussion of establishing baseline for each resource, refer to Section 1.9.2 *Project Study Timeline and Assessment Review Milestones*), as well as any reasonably foreseeable future actions by governing agencies (Federal, State, or local) that would affect or be affected by the Recommended Plan (Proposed Project) or the options and alternatives. This includes continued implementation of operations, maintenance, enforcement, and protection programs by Federal, State, and local agencies and nonprofit groups.

3.3.1 Assumptions in the No Action/Future Without-Project Condition

Under the future No Action (future without-project condition), the increasing future flood risk represents a real risk to human health and safety in the study area. Also, in the aftermath of a flood, the temporary or long-term displacement of people and businesses would adversely alter the community and the lives of those affected. If the flooding were severe enough to damage an unprotected San José–Santa Clara Regional Wastewater Facility (Wastewater Facility), the potential release of raw sewage into the bay and the loss of service would have catastrophic impacts on the region. In the long-term, the increasing frequency of floods would likely force people to relocate out of the floodplain, and the community of Alviso would either be significantly adversely affected or cease to exist altogether. The relocation of structures out of the area would be expected to include an elementary school, several churches, and potentially the San José Fire Department Station #25.

The specific assumptions, discussed as follows, were used in development of the No Action Alternative and the USACE future without-project condition:

- Sea level change (SLC) – The USACE planning process is required to consider a range of potential SLC scenarios (EC 1165-2-212 *Sea Level Change Considerations for Civil Works Programs* and ER 1100-2-8162 *Incorporating Sea Level Change in Civil Works Programs*). Therefore, in formulating and evaluating alternatives, an array ranging from the "USACE Low SLC" scenario (consistent with the local historical rate) on the lower limit, to the "USACE High SLC" scenario (consistent with the "Curve III scenario" presented by the NRC in the 1987 report *Responding to the Changes in Sea Level: Engineering Implications* [referred to as "NRC Curve III" in study documentation] and the State of California's planning requirements) on the upper limit were considered. Under these scenarios, sea level was estimated to rise approximately 0.51 feet during the 50-year period of analysis (2017–2067)[1] under the USACE Low SLC scenario, 1.01 feet under the USACE Intermediate SLC scenario, and 2.59 feet under the USACE High SLC scenario (Appendix D2 *Tidal Flood Risk Analysis Summary Report*). The without-project equivalent annual damage from flooding over the entire 50-year period of analysis is estimated to be approximately $18.9 million, $23.6 million, and $42.1 million under the USACE Low, Intermediate, and High SLC scenarios (Appendix C *Economics*).
- The future flood risk, which is summarized in this section, is explained in detail in Section 4.4 *Hydrology and Flood Risk Management* and in Appendix C *Economics*. Under the future without-project condition (future No Action Alternative), tidal flooding has the potential to affect people and structures in the community of Alviso, the Wastewater Facility, and major highways serving the "Silicon Valley" vicinity of the San Francisco Bay Area (e.g., State Route [SR] 237).

  Flood risk will increase as sea level rises, which is the expected nature of change in the area over the life of the project. According to tidal flood risk assessment conducted for this study (Appendix D2 *Tidal Flood Risk Analysis Summary Report*), flood depths in parts of the community of Alviso could be as high as 7 feet under the USACE Low SLC scenario (consistent with historic SLC rates), as high as 9 feet under the USACE Intermediate SLC scenario, and as high as 10 feet under the USACE High SLC scenario (consistent with the State's planning guidance).

[1] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

There are approximately 2,100 people living in the floodplain, mostly low-income minority families. There are estimated to be another 3,400 individuals that work in the area and are considered part of the overall "population at risk". This number does not include people traveling through the study area. A structure inventory conducted as part of the economic analysis for this study identified 1,139 structures (1,034 residential, 54 commercial, 42 industrial, and 9 public) in the 0.2-percent ACE floodplain under the USACE High SLC scenario that defines the study area's boundaries for the flood risk assessment.

- Anticipated local response to future floods:
  - Community of Alviso - After damaging floods, structures and residents would be relocated out of the floodplain rather than endure repeated damages. This assumption reduced the potential economic damages calculated under the USACE future without-project condition and economic benefits of Flood Risk Management (FRM) options.
  - Wastewater Facility
    - In the event of a flood, the Wastewater Facility would first take measures to insulate critical mechanical and electrical components to prevent inundation. These measures include placing sandbags and soil at entrances to pump stations or motor control centers to act as a physical barrier between flood waters and vital operational equipment. Temporary sump pumps would drain any water that seeps in. If flooding of the equipment seems inevitable, mechanical and electrical components would be turned off immediately, resulting in limited to no treatment capabilities during the flood threat. Shutting down these components would help to reduce damage to equipment and shorten overall operational downtime in the event that flood waters inundated parts of the plant. When flood waters recede, any components exposed to flood water must be removed and taken off site to be cleaned, restored to full functionality, and fully tested. During this process, the Wastewater Facility is expected to shut down for a 2-to-3-month period unless temporary components are installed while the permanent fixtures are restored to working order. If mechanical and electrical components are not shut off before inundation, the components would likely require replacement, which takes 6 to 12 months for procurement and installation. During larger floods, the Wastewater Facility would likely shut down. The ramifications of a plant shut down include the inability to treat raw sewage and a lack of availability of recycled water to local customers who depend on it for the cooling of machinery during industrial processes. These customers include local power providers. In general, large floods that result in plant shutdown will lead to potential sewage overflows in the communities served by the plant, degradation of the bay, and a shutdown of recycled water customers. Sewage releases into the bay would result in significant environmental damage and large fines.

  - Since much of the plant's electrical systems are located underground, significant damage is expected to occur at even shallow flood depths at the plant. The following is a list of assets that would be significantly exposed to damage from a flood that reached the plant: pump stations, plant computer system, treatment areas, headworks, digesters, cogeneration facilities, operation and maintenance building, and tunnels. According to officials from the Wastewater Facility, the damage to these assets from a flood that at least inundates the underground facilities is estimated to total more than $250 million. This does not include the impacts and costs to health and human safety and the environment from a release of raw sewage into the bay, the cost of fines imposed by the local and State agencies, nor does it include the impact of a loss of service to homes and businesses in the region.
  - Given the financial, safety, and environmental impacts of a damaging flood at the plant, it is assumed that in the absence of a larger Federal project the City of San José would invest in flood risk reduction measures at the plant, which would most likely consist of a ring levee and associated features. Specifically, it was assumed that the City of San José would build a ring levee of approximately $24.76 million in cost to protect its key infrastructure from flood damage. This cost of the assumed ring levee is a benefit as a cost avoided.

- Pond non-engineered dike performance, as well as maintenance and repair by the USFWS and other landowners under the No Action Alternative, which are generally guided by the SBSP Restoration Project Initial Stewardship Plan, are:
  - The USFWS and other landowners will maintain the existing dikes to their existing condition.
  - Analysis of levee failure potential assumes that only a single breach would form along a segment of the outboard dike (enclosing a single pond) during a specific flood-generating storm. The dimensions of a breach are conservatively assumed to reach equilibrium immediately. The precise location of the potential levee breach on each segment is assumed not to affect the long-wave model response. That is, the volume of floodwaters that pass through the breach is controlled by the head difference across the levee, which does not vary dramatically along a single levee segment.
  - The geotechnical performance of an outboard dike was assumed to control the performance of the entire dike-pond system (Appendix D2 *Tidal Flood Risk Analysis Summary Report*). This assumption means that failure at the outboard dike will result in overtopping and subsequent failure at the inboard dikes. Overtopping of the inboard dike is likely to occur at as low as elevation 6.5 feet NAVD 88. Therefore, overtopping, or a breach before overtopping, at the outboard dike will likely result in appreciable (>1 foot) overtopping at an inboard dike during a high-

water event and subsequent normal high tides. Under these assumptions a breach of the inboard dike is assumed to occur shortly after breach of the outboard levee.

- The inboard dike was assumed to fail via overtopping. The inboard pond dike crest width is variable within Ponds A9–A15. Crest widths vary from as little as 8 feet to as much as 18 feet, and are typically between 10 and 15 feet wide. The flood risk analysis performed for this study concluded that an overtopping height of 1 foot for the duration of three to four hours is likely to induce a breach at the inboard dikes. Static failures prior to overtopping were not considered credible during the current effort (Appendix D2 *Tidal Flood Risk Analysis Summary Report*). Current water levels have been successfully operated in the ponds for significant periods near mean tide elevation (i.e., 3.5 feet) without levee failure. If the outboard pond dike experienced a breach, normal high tide water levels (i.e., mean higher high water [MHHW] of approximately 7 feet) would overtop the lowest reaches (elevation 6 to 6.5 feet) of the inboard dike. Therefore, sustained water levels that are appreciably above elevation 3 feet and do not overtop the inboard dikes are highly unlikely to induce breach.

- Ponds within the interim study area defined in the SBSP Restoration Project Initial Stewardship Plan would continue to be managed under the SBSP Restoration Project's Initial Stewardship Plan. Ponds would be maintained as managed ponds, not subject to tidal or fluvial sediment exchange. As a result, ponds would continue to subside and get deeper over time and would provide habitat limited to these conditions. The SBSP Restoration Project is planning to restore ponds near, but not within, the Shoreline Phase I Study Area.
- Per Don Edwards San Francisco Bay National Wildlife Refuge (Refuge) staff (Appendix B3 *Flood Risk Management Coordination with the USFWS*), there is no plan to raise the Refuge ponds in response to SLC, and, therefore, the assumption is that more frequent flooding within ponds could occur in the future, with the likelihood of breaches along the outboard and inboard dikes and the potential for flooding beyond the ponds' current footprint increasing as well.
- The Initial Stewardship Plan did not attempt to predict future seismic activity in the interim study area, or quantify the effects of earthquakes on the future without-project condition of the existing dikes.
- Existing pond trails would continue to be open and available for recreation access, subject to wildlife restrictions and safety associated with the stability of existing dikes.

3.3.2 Sea Level Change

Tidal flood risk projections developed for with- and without-project conditions are based on procedures prescribed by ER 1100-2-8162 *Incorporating Sea Level Change in Civil Works Programs* (USACE 2013). The geographically closest suitable National Oceanic and Atmospheric Administration (NOAA) tide gauge to the study area is the San Francisco, California, NOAA tide gauge, Station ID: 9414290 (Figure 3.3-1 *Vicinity Map Showing*

Location of Tide Gauges Used in the Shoreline Phase I Study). The San Francisco tide gauge has a long record length (110 years) and has been referenced to NAVD 88. Sea level change projections for the project area in South San Francisco Bay will use the current relative sea level rise (RSLR) rate for the San Francisco tide gauge—2.06 millimeters/year (mm/yr)—based on 1983–2001 National Tidal Datum Epoch (NTDE). The NOAA tide gauge at Coyote Creek, California, Station ID: 9414575, is located within 5 miles of the project area and has been intermittently operated to collect observed data. The gauge does have an established tidal datum based on the current NTDE and has predicted tide data available.

The planning, design, and construction of a large water resources infrastructure project can take decades. Though initially justified over a 50-year economic period of analysis, USACE projects can remain in service much longer. The climate for which the project was designed can change over the full lifetime of a project to the extent that stability, maintenance, and operation may be impacted, possibly with serious consequences, but also potentially with beneficial consequences. Given these factors, the project planning horizon (not to be confused with the economic period of analysis) should be 100 years, consistent with ER 1110-2-8159 *Life Cycle Design and Performance* (USACE 1997).

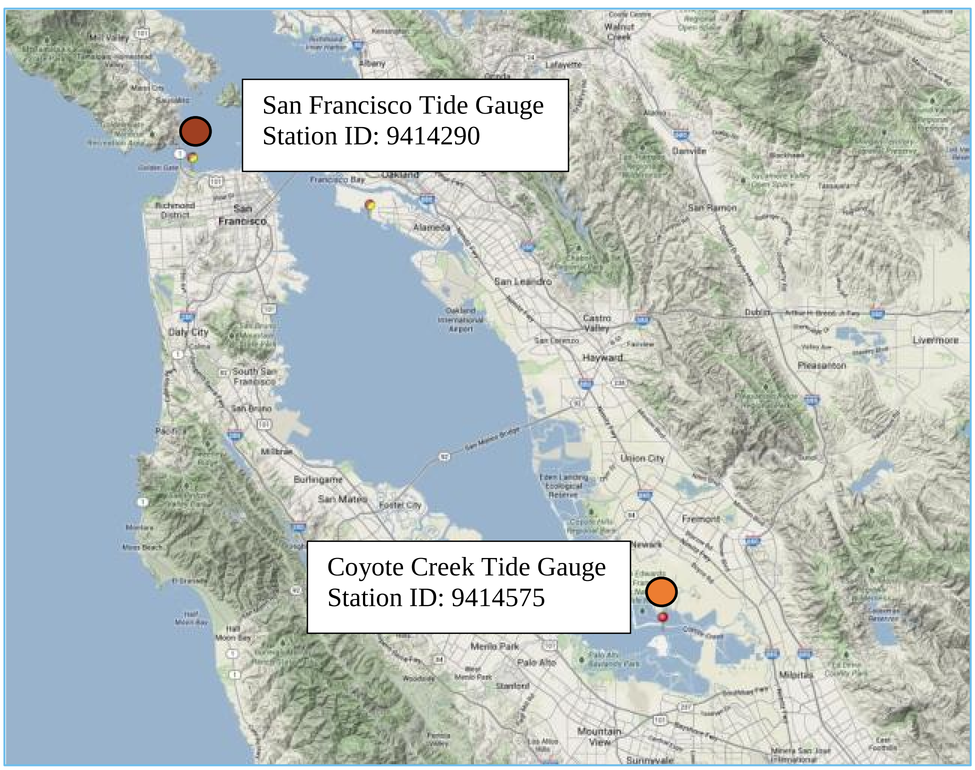

Figure 3.3-1. Vicinity Map Showing Location of Tide Gauges Used in the Shoreline Phase I Study

Water level changes have been developed for the end of the Shoreline Phase I Study 50-year economic and 100-year planning analyses periods using the current RSLC for the San Francisco NOAA tide gauge (2.06 mm/yr; Table 3.3-1 *50-Year Relative Sea Level Rise Low,* *Intermediate, and High Estimates for the Shoreline Phase I Study Economic and Planning Analyses Periods*). Projections have been made to the year 2100.

Table 3.3-1. 50-Year Relative Sea Level Rise Low, Intermediate, and High Estimates for the Shoreline Phase I Study Economic and Planning Analyses Periods

South San Francisco Bay Scenario – Economic Analyses Period	2017–2067 Change (in feet)		
	Low	Intermediate	High
Coyote Creek Tide Gauge /Alviso	0.51	1.01	2.59
South San Francisco Bay Scenario – Planning Analyses Period	2017–2100 Change (in feet)		
	Low	Intermediate	High
Coyote Creek Tide Gauge /Alviso	0.73	1.77	5.05

3.4 Management Measures

Management measures were identified to address each of the planning objectives listed in the previous section and discussed in detail in Chapter 2 *Need for and Purpose of Action*. The measures identified and evaluated fall into four categories:

- **Nonstructural flood risk management.** These measures reduce flood risk by addressing the consequences of flooding but not the likelihood that flooding will occur. They reduce life safety threats and economic flood damages by changing how people respond to flood risk and the way that floods affect structures. Nonstructural measures generally do not involve substantial construction of new features, although ring levees and floodwalls that protect individual structures fall into this category, as do raising and relocating structures. Nonstructural measures can be implemented along with structural measures (defined below) to reduce residual risk (the risk that remains after implementing any FRM measure). Nonstructural measures can also be implemented by local entities in conjunction with or independent of a Federal project. Executive Order 11988; Floodplain Management requires the consideration of nonstructural measures in USACE FRM projects.
- **Structural flood risk management.** These measures reduce the likelihood that a flood will occur by changing where and when water appears. They include substantial construction of engineered structures such as levees, floodwalls, reservoirs, and channels.
- **Ecosystem restoration.** These measures address the quantity, quality, and connectivity of functioning habitat. They involve the conversion of former solar salt ponds into higher-quality habitats such as managed ponds, tidal marsh, and transitional zones between habitats. Integral to the ecosystem restoration strategy is the concept of monitoring and adaptive management to guide the restoration process, which is not

explicitly listed as a measure but is described in Section 3.6.10 *Monitoring and Adaptive Management*.

- **Recreation.** These features improve the quality of human interaction with the restored environment by providing increased or higher-quality public access consistent with the future project's ecosystem restoration objectives. In this study, recreation features focus on the quality of the visitor experience.

Table 3.4-1 *Management Measures* contains the full list of initial measures and the results of initial screening. Initial screening was based on technical, economic, and environmental considerations, as well as the four P&G criteria of completeness, effectiveness, efficiency, and acceptability.

Table 3.4-1. Management Measures

Management Measures	Objectives: 1 Reduce tidal flood risk (Health/Safety/Environment)	2 Reduce tidal flood risk (Economic)	3 Increase marsh habitat for resident/native species	3 Restore ecological function/ quality/connectivity	4 Provide public access, education, and recreation	Results of Preliminary Screening
No Action						✓ Retained
Nonstructural Flood Risk Management						
Require FEMA Flood Insurance for new structures in floodplain		x				Eliminated; already implemented to extent possible by Federal mandates
Restrict building in floodplain	x	x				Eliminated; already implemented to extent possible by Federal mandates
Tax for construction of new structures in floodplain	x	x				Eliminated; outside scope of project; unlikely to occur since it would require local bond measure proposal and vote
Relocate people and structures outside of floodplain	x	x				✓ Retained; included in nonstructural alternative
Use of dry and wet flood-proofing to upgrade existing infrastructure	x	x				Eliminated; recommended for local consideration to reduce residual risk
Elevate structures and transportation infrastructure	x	x				Eliminated; recommended for local consideration to reduce residual risk
Relocate or reinforce critical utility infrastructure (e.g., sewage lines)	x	x				✓ Retained; included in proposed action alternatives for local implementation
Provide emergency education and outreach in potentially affected communities	x	x				✓ Retained; included in proposed action alternatives for local implementation
Establish evacuation and flood-response plans	x	x				✓ Retained; included in proposed action alternatives for local implementation
Establish local flood warning systems	x	x				✓ Retained; included in proposed action alternatives for local implementation
Manage disease vectors (e.g., mosquitoes)	x	x				✓ Retained; included in proposed action alternatives for local implementation
Construct floodwall or ring levee(s) around sewage treatment plant and protect landfills	x	x				✓ Retained; included in nonstructural alternative

Table 3.4-1. Management Measures

Management Measures	Objectives: 1 Reduce tidal flood risk (Health/Safety/Environment)	2 Reduce tidal flood risk (Economic)	3 Increase marsh habitat for resident/native species	3 Restore ecological function/ quality/connectivity	4 Provide public access, education, and recreation	Results of Preliminary Screening
Structural Flood Risk Management						
Rehabilitate existing pond dike infrastructure	x	x			x	Eliminated; no reduction in risk of future levee overtopping; does not allow for tidal restoration. Improving the existing pond dikes in place (rather than building new levees) is constrained by the following issues: (1) The farther bayward the alignment, the deeper the bay mud and more substantial (costly) the foundation treatments and settlement considerations, and (2) The existing dikes are not engineered levees and do not meet State and Federal criteria for flood protection features. Regardless of alignment, any fix in-place option would require degrading the existing dike (and likely foundation to some degree) and rebuilding the levee prism with suitable fill.
Increase erosion protection for existing pond dikes	x	x		x	x	✓ Retained; included in current USFWS maintenance activities; included in proposed action alternatives
Protect sites containing potentially hazardous materials	x	x		x		✓ Retained; included in proposed action alternatives
Construct tidal barrier in San Francisco Bay	x	x				Eliminated; wave and tidal surges can be more effectively addressed through wave attenuation and erosion protection; does not allow for tidal restoration
Erect operable floodwall closure with tide gate at Artesian Slough	x	x				✓ Retained; included in proposed action alternatives
Erect operable flood gate across UPRR tracks	x	x				✓ Retained; included in proposed action alternatives
Construct new levee	x	x	x	x	x	✓ Retained; included in proposed action alternatives
Construct floodwalls	x	x				Eliminated; practicable only for projects with extreme real estate constraints because of higher relative cost than levee construction; does not allow for tidal restoration
Install wave attenuators	x	x				Eliminated; short-term fix only; does not reduce risk for modeled future tidal flooding scenarios
Construct barrier islands	x	x	x			Eliminated; short-term fix only; does not reduce risk for modeled future tidal flooding scenarios
Raise ground level	x	x				Eliminated; recommended for local consideration for new construction
Increase tidal marsh footprint to attenuate tidal flooding	x	x	x	x		✓ Retained; tidal marsh restoration is being incorporated into alternatives; also anticipated to provide some risk reduction from tidal flooding
Increase downstream conveyance through tidal marsh restoration	x	x	x	x		✓ Retained; tidal marsh restoration is being incorporated into alternatives; may also provide some risk reduction from tidal flooding

Table 3.4-1. Management Measures

Management Measures	Objectives: 1 Reduce tidal flood risk (Health/Safety/Environment)	2 Reduce tidal flood risk (Economic)	3 Increase marsh habitat for resident/native species	3 Restore ecological function/ quality/connectivity	4 Provide public access, education, and recreation	Results of Preliminary Screening
Use existing ponds for floodwater storage and conveyance	x	x				Eliminated; no reduction in risk of future levee overtopping; does not allow for tidal restoration
Divert flood waters from populated areas and existing infrastructure; install more pump stations	x	x				Eliminated; limited flood risk reduction from future levee overtopping; does not allow for tidal restoration
Reduce or prevent flooding caused by water seeping through existing levees	x	x				✓ Retained; included in proposed action alternatives (levees would be replaced)
Ecosystem Restoration						
Purchase land or easements	x	x	x	x		✓ Retained; included in proposed action alternatives
Use on-site material and natural sedimentation processes to fill in low areas of ponds			x	x		✓ Retained; included in proposed action alternatives
Import fill or dredge material for habitat restoration actions			x	x		✓ Retained for proposed bench or ecotone construction at Pond A18; assumed that sufficient on-site material will be available for in-pond work with all proposed action alternatives, and for Pond A12 bench or ecotone construction
Manage sediment accretion areas to maintain or create marshes and trap additional material	x	x	x	x		✓ Retained; included in proposed action alternatives
Eliminate or relocate biosolids lagoons at the Wastewater Facility and convert to additional marsh area	x	x		x		Eliminated; ongoing planning process being completed by City of San José for Wastewater Facility property will identify future use of area
Restrict public access				x		✓ Retained; included in proposed action alternatives
Control and remove nonnative predator species				x		✓ Retained; included in proposed action alternatives
Enhance native species populations				x		✓ Retained; included in proposed action alternatives
Enhance food supply productivity				x		✓ Retained; included in proposed action alternatives
Improve habitat connectivity			x	x		✓ Retained; included in proposed action alternatives
Establish mosaic of tidal marsh habitat	x	x	x	x		✓ Retained; included in proposed action alternatives in varying levels
Establish species-specific tidal marsh habitat and features			x	x		✓ Retained; included in proposed action alternatives

Table 3.4-1. Management Measures

Management Measures	Objectives					Results of Preliminary Screening
	1 Reduce tidal flood risk (Health/Safety/Environment)	2 Reduce tidal flood risk (Economic)	3 Increase marsh habitat for resident/native species	3 Restore ecological function/ quality/connectivity	4 Provide public access, education, and recreation	
Incorporate nesting islands for native birds in proposed designs				x		Eliminated; Refuge is conducting study regarding bird use of nesting islands constructed in earlier SBSP Restoration Project efforts at adjacent ponds and as proposed as part of SBSP Restoration Project Phase II actions and may construct at future date pending results of study
Remove and/or relocate undesirable nonnative species				x		✓ Retained; included in proposed action alternatives
Prevent or deter entry of additional undesirable nonnative species				x		✓ Retained; included in proposed action alternatives
Remove perching areas used by undesirable nonnative species				x		✓ Retained; included in proposed action alternatives
Control food sources used by undesirable nonnative species				x		✓ Retained; included in proposed action alternatives
Increase public awareness and restrict human activity				x	x	✓ Retained; included in proposed action alternatives
Recreation						
Install educational or interpretive signs					x	✓ Retained; included in proposed action alternatives
Install safety or sanitary facilities as necessary to meet local standards					x	✓ Retained; included in proposed action alternatives
Create seating areas					x	✓ Retained; included in proposed action alternatives
Construct multi-use trails for public use					x	✓ Retained; included in proposed action alternatives
Construct wildlife-viewing platforms					x	✓ Retained; included in proposed action alternatives
Construct pedestrian bridge over Artesian Slough					x	✓ Retained, included in proposed action alternatives

FEMA = Federal Emergency Management Agency; USFWS = U.S. Fish and Wildlife Service; SBSP Restoration Project = South Bay Salt Pond Restoration Project; WPCP = Water Pollution Control Plant, now referred to in text as the San José–Santa Clara Regional Wastewater Facility; UPRR = Union Pacific Railroad

3.5 Flood Risk Management Options

3.5.1 Overview of Flood Risk Management Options

The screening process for the FRM options was conducted in two parts. The first identified the most cost-effective levee alignment. The second identified the levee height with the highest net benefits (i.e., NED Plan). Once the most cost-effective levee alignment was identified, the costs and economic benefits of various heights of that alignment were compared to determine the levee height that would generate the highest net benefits and therefore represent the limit of Federal participation in FRM. Once this NED Plan was identified, the non-Federal sponsor determined whether it would support implementation of this plan or prefer a different FRM option (differing in levee alignment or height or both) that would be included in a LPP. In addition to the FRM options representing the NED Plan and the local preference, FRM options of particular interest to resource agencies and stakeholders were also retained.

The FRM options that were retained after the screening process were combined with ecosystem restoration features to formulate the final array of alternatives. This process is discussed in Section 3.7 *Final Array of Alternatives*.

3.5.2 Nonstructural FRM Plan Formulation Strategy

Nonstructural flood risk management measures are proven methods and techniques for reducing flood risk and flood damages incurred within floodplains. Examples include elevating structures, relocating at-risk structure(s), acquiring property and/or land, and launching a flood warning system. Besides being very effective for both short and long term flood risk and flood damage reduction, nonstructural measures can be very cost effective when compared to structural measures. A particular advantage of nonstructural measures when compared to structural measures is the ability of nonstructural measures to be sustainable over the long term with minimal costs for operation, maintenance, repair, rehabilitation, and replacement.

From the nonstructural measures that were identified (Table 3.4-1 *Management Measures*), a nonstructural-only alternative that included both a ring levee around the Wastewater Facility and relocation of structures in Alviso, was developed. Given the high probability of flooding, the size of the floodplain and number of structures within it, and the significant depths of flooding should the outer dikes fail, these were the only nonstructural measures identified that would be effective in reducing flood risks, without the addition of structural measures.

A number of additional nonstructural measures were identified for local implementation under all action alternatives (nonstructural and structural). These are identified in Table 3.4-1 *Management Measures* in the section *Nonstructural Flood Risk Management*.

3.5.3 Structural FRM Plan Formulation Strategy

The structural FRM options involve three segments (reaches) within the study area:

- Alviso Segment – the footprint west of Artesian Slough and closest to the Alviso community, including the crossing of the Union Pacific Railroad tracks;
- Artesian Crossing Segment – the crossing of Artesian Slough itself; and
- Water Pollution Control Plant (WPCP) Segment – the footprint east of Artesian Slough and closest to the Wastewater Facility[2] (previously referred to in planning as the WPCP).

Under the structural FRM formulation strategy, concerns along the Alviso and WPCP segments are addressed by new levees, while the crossing of Artesian Slough is addressed with either a tide gate closure system or a new levee.

3.5.3.1 Alviso Segment

Structural measures in the Alviso segment would address tidal flood risk to the community of Alviso and SR 237, which is an important commuter corridor for Silicon Valley employees. The community of Alviso has a history of fluvial flooding from the Guadalupe River, which is east of the community. As a result, many of the residential structures have been rebuilt or raised substantially so that the finished floor elevation is as much as 6 feet or more above the ground. Fluvial flood risk has been reduced through local and Federal projects. Tidal flood risk in the Alviso area, however, is the highest of any area along San Francisco Bay because of subsidence from historical groundwater withdrawal to support the historical agricultural industry in what is today's Silicon Valley.

Three potential Alviso segment levee alignments are located west of Artesian Slough (Figure 3.5-1 *Potential Alviso* Segment Levee Alignments) and are at least partially located on USFWS lands (i.e., pond dikes and New Chicago Marsh [NCM]) because of the Refuge's proximity to the community of Alviso; all three options require crossing of Union Pacific Railroad tracks that run in a north-south parallel to the eastern border of Pond A12. The levee segment options are located adjacent to and north of NCM (Alviso North), through the marsh (Alviso Railroad Spur, or Alviso RR Spur), or along the southern border of the marsh, closer to the community of Alviso (Alviso South; south of NCM).

The Alviso North alignment, which is located entirely on USFWS lands, begins at the Alviso Marina and roughly follows the western and northern outer levees of NCM along the existing margins of Ponds A12, A13, and A16. It is the farthest from the community of Alviso, and extends FRM to the area within NCM. The levee would incorporate a flood gate where the alignment crosses the UPRR tracks, near the northeast corner on Pond A12 and the southwest corner of Pond A16.

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[2] The corresponding segment of proposed levee was named when the Wastewater Facility was referred to as the "Water Pollution Control Plant", hence the acronym WPCP; since then, the City has requested that the facility be referred to as the San José–Santa Clara Regional Wastewater Facility.

The other alignment options are located partially on USFWS lands (NCM) and partially on privately owned lands. The Alviso South alignment follows the southwest outer (landward) levee of the NCM and is the closest to the community of Alviso with a footprint and construction buffer area of about 48 acres. The Alviso South levee section option begins at the easternmost area of the Alviso Marina property, but, instead of running north along the western boundary of NCM, this levee section alignment would generally run south and east along the internal edge of the marsh. After crossing the railroad tracks near the Alviso Marina (where a flood gate would be installed), the Alviso South levee section option would follow the marsh boundary until just west of Artesian Slough, where the Alviso South levee would turn north, staying landward of the Refuge’s Environmental Education Center, and end at Artesian Slough.

The Alviso Railroad Spur footprint and its construction buffer area would include about 46 acres of land. Its alignment coincides with the Alviso North alignment on the western portion, follows the alignment of the existing railroad spur levee through the NCM, and coincides with the Alviso South alignment at the eastern portion. This alignment is located between the North and South alignments and is therefore intermediate in distance from the community of Alviso. This levee would also incorporate a flood gate where it crosses the UPRR tracks, to the south of the northeast corner on Pond A12 and the southwest corner of Pond A16.

Construction of any of the Alviso levee options would block a freshwater input from Artesian Slough to a freshwater marsh area near the Environmental Education Center. Because of this, all of the alternatives include a small breach of an existing berm along the west side of Artesian Slough to allow gravity flow of freshwater from the slough to the marsh. The breach would be sized to provide the same amount of input that occurs under the baseline condition.

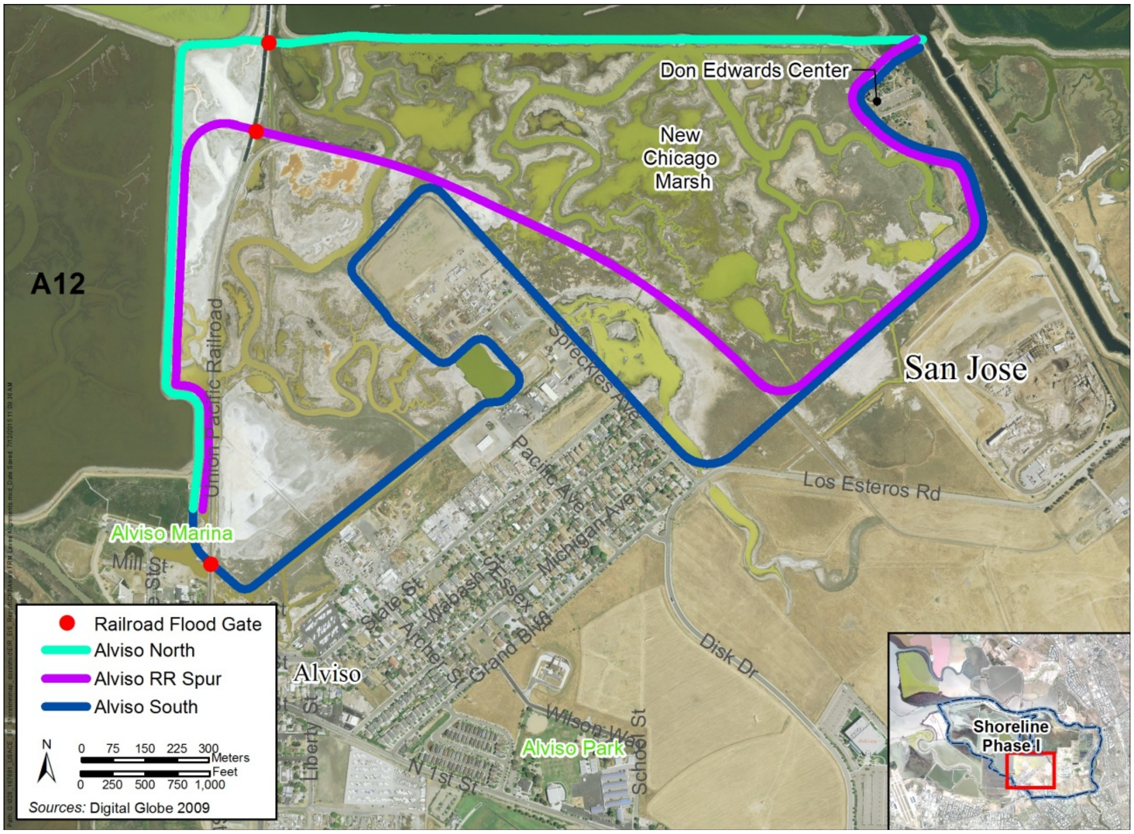

Figure 3.5-1. Potential Alviso Segment Levee Alignments

3.5.3.2 Artesian Slough Crossing

The Artesian Slough crossing must be addressed to prevent water from overtopping existing levees along the slough during future high-tide floods. Adjacent to the slough are a materials-processing facility and landfills (Figure 3.5-2 *Potential Artesian Slough* Crossing Options). The Wastewater Facility is located east and southeast of the slough.

Two measures for crossing Artesian Slough were identified. One option installs a new tide gate closure system across the slough. The tide gate system would be located about 300 feet bayward of the Wastewater Facility's existing outfall weir and would tie into the levee segments on either side of the slough. During construction, a cofferdam would likely need to be constructed temporarily. The tide gate structure would allow flow (discharge) from the Wastewater Facility into Artesian Slough. A gate across Artesian Slough would be based on a top-hinged traditional tide gate similar to the structure in place at the Palo Alto flood basin. This type of tide gate opens when the force on the gate's upstream side (effluent from the Wastewater Facility) exceeds the force on the gate's downstream side (tidal flow). Under varying tide and storm conditions (i.e., normal, the 1-percent and 0.1-percent ACE tide conditions), the tide gate would be open more fully during low tides and less open during high-tide conditions.

During low tide, the tide gate would be open, and the water surface elevation in Artesian Slough would reach an equilibrium level with the tidal event, such that the flow through the gate balances with the Wastewater Facility's effluent. During high tide, the gate would be only partially open because the water surface elevation on the downstream side of the gate would be greater than the water surface elevation on the upstream side of the gate, thereby allowing less effluent flow through the gate (i.e., during high tide, some of the Wastewater Facility's effluent would be stored temporarily in Artesian Slough until the tide began to drop).

At some point in the future, with the onset of sea level change, a pump station would likely be required to ensure that the Wastewater Facility's effluent continues to discharge against the tide gate. With a pump station in operation during extreme tidal events, the tide gate would never be closed, since the pump station would assist the discharge of the effluent against the higher tidal pressure under these extreme events. The tide gate across the secondary channel would be based on a traditional flap gate design whereby the gate remains open under normal, low-tide, and high-tide conditions to allow flows in and out of the channel. During an extreme tidal event, the gate would be closed and would prevent tidal flows from flowing inland because the downstream tidal water surface elevation would be greater than the upstream side.

The other measure would require the construction of approximately 1.1 miles of new levee along Artesian Slough. The new levee reaches would tie into high ground at the existing Zanker Landfill on the west side, and to high ground on the Wastewater Facility's property on the east side (Figure 3.5-2 *Potential Artesian Slough* Crossing Options). The new levees would match the height of other FRM features. Construction would require the full or partial relocation of existing streets along both sides, and require the relocation of all utilities that follow the east side of the slough.

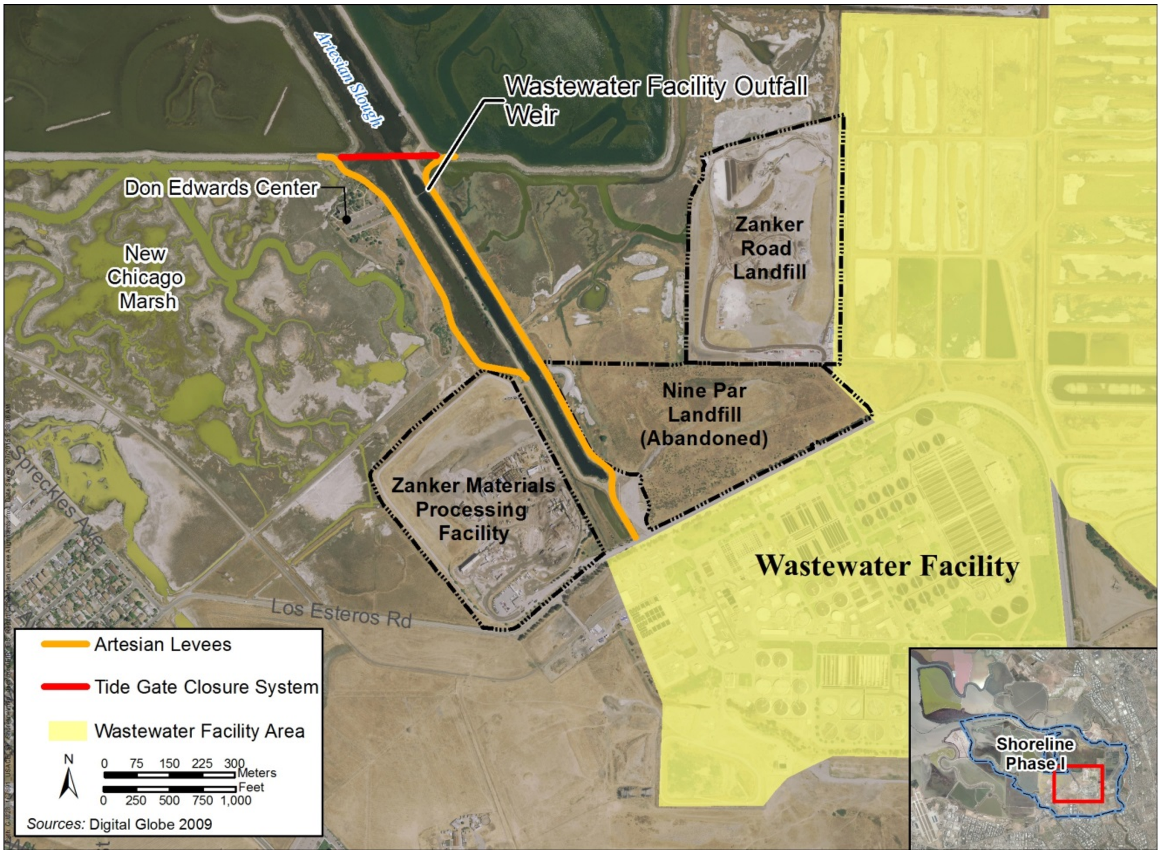

Figure 3.5-2. Potential Artesian Slough Crossing Options

3.5.3.3 Wastewater Facility (WPCP) Segment Levee Alignment

This segment would address future flood risk to the Wastewater Facility and its infrastructure, e.g., drying beds and office buildings. The Wastewater Facility has developed and is beginning to implement a 30-year Plant Master Plan to reconfigure its facilities. As the owner of the Wastewater Facility property, the City of San José has been coordinating implementation of the Plant Master Plan with this study as well as the SBSP Restoration Project to address FRM and ecosystem restoration opportunities. SR 237 and Interstate 880 are located to the south and east of the Wastewater Facility, respectively, although floodwaters within this segment are not expected to reach those roads even under the High SLC Scenario. This segment was named when the Regional Wastewater Facility was referred to as the "Water Pollution Control Plant," hence the acronym WPCP; since then, the City has requested that the facility be referred to as the San José–Santa Clara Regional Wastewater Facility (Wastewater Facility).

Four potential Wastewater Facility levee alignments are located east of Artesian Slough (Figure 3.5-3 *Potential Wastewater Facility Segment Levee Alignments*). Two variations of the WPCP South alignment follow the existing levee that runs west to east in a stair-step pattern along the north border of the existing Wastewater Facility infrastructure; one then cuts across existing Wastewater Facility drying beds (WPCP South – drying beds), while the other turns north to follow the existing levee along the eastern side of Pond A18 (WPCP South – eastside berm).

Alternatively, the WPCP North alignment includes construction of a new levee that partially bisects Pond A18, expanding the area that would be available south of the proposed engineered levee, and then also either cuts across existing Wastewater Facility drying beds (WPCP North – drying beds) or turns north to follow the existing levee along the eastern side of Pond A18 (WPCP North —eastside berm).

The WPCP levee segment would block the culvert that transfers brackish water to the non-tidal mitigation marsh east of Artesian Slough and south of Pond A18. As part of the project, the culvert would be replaced with some other mechanism to supply brackish water to the mitigation marsh area. The new structure would be designed to provide the same function as the existing culvert.

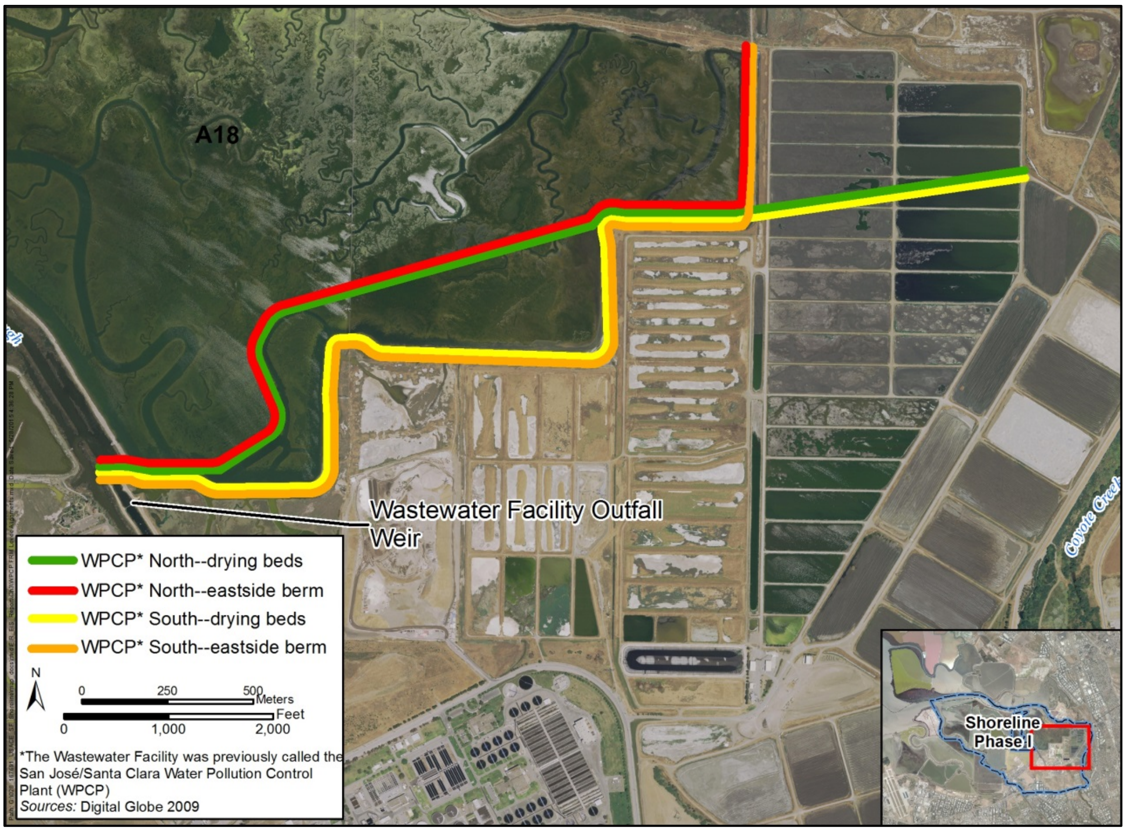

Figure 3.5-3. Potential Wastewater Facility Segment Levee Alignments

3.5.4 Evaluation and Screening Criteria for Flood Risk Management Measures and Options

During this stage in the process, the USACE and non-Federal sponsors used the P&G criteria (completeness, effectiveness, efficiency, and acceptability) to evaluate the FRM measures and options and to determine which options would move forward as building blocks for the final array of combined alternatives.

Completeness is determined by whether a plan includes all necessary actions to realize the planned effects (i.e., benefits) for a particular plan. This criterion may have limited usefulness during the screening process because incomplete plans can usually be made complete by adding measures. When this criterion is applied to the final array of combined alternatives, however, each alternative must meet the completeness criterion.

Effectiveness is the extent to which a plan achieves planning objectives. A plan does not need to address all objectives to be considered effective.

Efficiency generally involves comparing the cost of implementing an option to its quantified outputs (related to objectives). The efficiency of the FRM options was analyzed by comparing the cost of each option to its monetized FRM benefits. The screening-level costs include real estate, construction, and operation and maintenance. The benefits are the economic flood damages that are prevented, including: structure and content damages, cost to temporarily displaced residents, automobile damages, emergency and cleanup costs, cost to relocate residents, cost to reduce the flood risk to the Wastewater Facility, traffic delay and detour costs.

Two key products of this analysis are the net benefits (benefits less costs) and the benefit-to-cost ratio (BCR) for each option. Positive net benefits and a BCR greater than 1.0 indicate economic efficiency. The most efficient option, which is where net benefits are reasonably maximized, is identified as the NED plan. At the option screening phase, the concept of economic efficiency was applied to screen out a particular option if another option provided a similar level of benefits at a lower cost or provided a higher level of benefits at the same or a lower cost.

Acceptability is viewed in terms of reasonableness, rather than local preference, when used as a screening criterion. State and local laws, plans, and policies do not necessarily determine what is acceptable from the Federal perspective but are considered when evaluating plan effects. Local land-use and master plans are expressions of local preferences that do not by themselves preclude consideration of potential NED or NER plans. The *acceptability* criterion at the option screening level involves two considerations. The first is **consistency with the planning constraints and considerations.** Key planning constraints relevant to the screening of options includes avoidance, minimization, and mitigation of environmental effects (environmental feasibility). This is a standard yet important criterion to ensure that an alternative does not have onerous environmental effects relative to other alternatives. Additionally, this criterion asks whether the benefits of the proposed alternative could be achieved by implementing another alternative that would be less environmentally damaging. The second consideration is **institutional/technical/legal acceptability.** This addresses the following questions: Would constructing, operating, or maintaining this alternative violate Federal laws or codes? Is construction technically feasible? Would the alternative require a permit or agency approval that could not reasonably be obtained?

3.5.5 Application of Screening Criteria to Flood Risk Management Measures and Options

Screening criteria were first applied to the levee alignments within each of the three locations. The remaining alignments were evaluated with flood damage assessment modeling and preliminary cost estimates to identify the most effective levee heights.

3.5.5.1 Nonstructural Option (Relocate Community of Alviso and Ring Levee for Wastewater Facility)

The nonstructural FRM option meets the completeness, effectiveness, efficiency, acceptability criteria from the Federal perspective. It was not carried into the final array, however, because it has a much higher cost (Table 3.5-1 *Nonstructural FRM* Option Costs (October 2013 Price Levels) but similar NED benefits than the structural FRM options, and would not yield a benefit-cost ratio greater than 1.0[3]. Based on the lack of net benefits, it would not possible be identified as the NED Plan or be recommended as part of an LPP. However, several non-structural measures noted in Table 3.4-1 *Management Measures* were carried forward as a component of all remaining FRM options, for local implementation.

Table 3.5-1. Nonstructural FRM Option Costs (October 2013 Price Levels)

Cost Type	Cost (1,000s)
Flood-Free Property Acquisition Cost	$390,740
Fed & Non-Fed Real Estate Administration	$8,200
Ring Levee Construction (Incl. RE)	$24,760
Fed & Non-Fed Real Estate Administration	$1,500
Total	$425,200

3.5.5.2 Levee Alignment

Because all three of the levee alignment options tie into the same high ground on both sides of the study area, and because all of the alignments are bayward of the developed area, the flood benefits (damages reduced) are simply a function of levee height. The selection of levee alignment has cost and environmental implications but not FRM implications. Therefore, the most cost-efficient option at a given level of FRM will be the one with the lowest cost, since the benefits will be the same across alternatives.

The most cost-effective levee alignment at any given height was determined to be the Alviso North, WPCP South – eastside berm alignment with a tide gate closure system crossing Artesian Slough, because it has the lowest cost for the same benefits as the other alignments (Table 3.5-2 *Cost Comparison of Levee Alignments*).

[3] A preliminary economic analysis that was performed on the non-structural option during a feasibility-level value engineering study estimated an annual cost of roughly $22 million and expected annual benefits of $8 million, which would yield a benefit-cost ratio well below unity ($8 million / $22 million = 0.36).

Table 3.5-2. Cost Comparison of Levee Alignments*

October 2013 price levels

Cost	Alviso North, WPCP South	Alviso Railroad, WPCP South	Alviso South, WPCP South
Construction Cost	$79,831,000	$90,315,000	$91,907,000
Average Annual Cost	$3,403,000	$3,850,000	$3,918,000
Operation & Maintenance Cost	$539,000	$539,000	$539,000
Total Average Annual Cost	$3,942,000	$4,389,000	$4,457,000

* Costs displayed are for a levee height of 15.2 feet NAVD 88.

Additional levee alignments were carried forward for further analysis, as described in Section 3.5.5.3 *Alviso Segment Levee Alignments* through Section 3.5.5.5 *Wastewater Facility Segment Levee Alignments*.

3.5.5.3 Alviso Segment Levee Alignments

The three Alviso segment levee alignments (Alviso North, Alviso Railroad Spur, and Alviso South) met the completeness and effectiveness screening. The Alviso North levee alignment, which is located entirely on USFWS lands, is the most cost effective of the three alignments at any given ACE. It has the lowest cost for the same benefits as the other alignments. All three alignments were acceptable but some stakeholders preferred the Alviso Railroad Spur or Alviso South while others considered the Alviso North alignment as the most suitable. All three alignments were carried forward for further evaluation as components of the final array of alternatives.

3.5.5.4 Artesian Slough Crossing Options

The tide gate closure measure met all screening criteria and was retained.

The levee measure (construct new levees along either side of Artesian Slough) met all of the screening criteria but was eliminated because it is less economically efficient than the tide gate closure system measure, did not provide any additional advantages relative to the other criteria, and would have additional impacts. Potential levees down both sides of Artesian Slough would require fill into Artesian Slough, NCM, and/or the wetlands just east of this alignment. A preliminary analysis found that approximately 3.6 acres of fill would be required to accommodate the levees. The tide gate across Artesian Slough would result in approximately 1.1 acres of fill to Artesian Slough. In addition to the amount of fill that would result from constructing the Artesian Slough levees, the structures would greatly interfere with Wastewater Facility utilities in the levee footprint and would increase the amount of levee material required by the project. A tide gate closure structure across the slough would provide an equal level of FRM at a lower cost than the new levees along either side of Artesian Slough.

With or without a tide gate closure system, the Wastewater Facility would have to deal with SLC in their discharge operations. In an effort to best meet the general operation requirements for the Wastewater Facility and allow for discharge during storms, the tide gate closure system would be designed in coordination with Wastewater Facility engineers. It is assumed that the tide gate would have staged elevation relief points to minimize impacts to the treatment plant operation. Additionally, the proposed location of the tide gate for all alignment options would be at least 300 feet bayward of the existing Wastewater Facility outfall weir for treated water at Artesian Slough (see Figure 3.5-2 *Potential Artesian Slough Crossing*).

3.5.5.5 Wastewater Facility Segment Levee Alignments

The WPCP South- and North -drying beds alignments were not carried forward because the Wastewater Facility is still considering whether to retain the existing sludge lagoons, which currently occupy the area needed to implement these alignments. Because the availability of these lands for levee construction relies on actions of the Wastewater Facility, the drying bed alignments do not meet the completeness criterion. As the Wastewater Facility Plant Master Planning effort proceeds into design, there may be further opportunity to revisit the alignment section. Additional environmental evaluation would be required if it is decided that this footprint is a better environmental option and meets the Wastewater Facility's schedule for discontinuing the operation of drying biosolids in that area.

The WPCP South – eastside berm alignment, hereafter referred to as "WPCP South," met all of the screening criteria and was retained.

The WPCP North – eastside berm alignment, hereafter referred to as "WPCP North," is complete, effective, and efficient but was eliminated based on the acceptability criterion. The WPCP North alignment would have substantially greater negative environmental impacts than the WPCP South alignment, making it unacceptable to Federal resource agencies. In particular, it would require the introduction of substantial fill materials to jurisdictional waters, making it unlikely for an alternative on this alignment to be the least environmentally damaging project alternative (LEDPA). See Section 3.10 *Plan Selection* for additional discussion of the LEDPA.

3.5.5.6 Levee Height and Identification of the FRM NED and LPP

Once the most cost-effective levee alignment (Alviso North, WPCP South, with tide gate structure) was identified, varying scales (i.e., heights ranging from 11 feet NAVD 88 to 15 feet NAVD 88) were analyzed using the USACE-certified version of HEC-FDA (version.1.2.5) to find the height that would generate the highest net benefits when comparing costs and benefits under three USACE SLC scenarios. Details on structural value, content, and SLC scenarios are provided in Appendix C *Economics*.

In terms of number of structures, the study area is dominated by residential structures, estimated at 1,034. There are 54 commercial, 42 industrial, and 9 public, with a total of 1,140 structures within the 0.2-percent ACE Floodplain. There are several manufactured and mobile home parks, and several business parks with large commercial and industrial properties. The floodplain contains a school, several churches, a fire station (the structure is elevated out of the floodplain), critical infrastructure such as Highway 237 and the Wastewater Facility, and a wide range of commercial and industrial buildings—including many high technology and information technology companies. Cisco Systems, Inc. is the most well-known company located in the floodplain; their worldwide headquarters is located across Highway 237 in the study area. Table 3.5-3 *Structure and Content Value in 0.2-percent Floodplain* shows the estimated structure and content value for each of the major structure categories in the 0.2-percent ACE floodplain (rounded for presentation purposes). In total, more than $850 million of structures and contents are exposed to some level of flood risk by the end of the period of analysis. This value should not be confused with event-based or expected flood damage.

Table 3.5-3. Structure and Content Value in 0.2-percent Floodplain

October 2014 Price Levels

Structure Type	Total Structure Value (1,000s)	Total Content Value (1,000s)
Commercial	$340,403	$303,984
Industrial	$72,177	$48,188
Public	$5,180	$1,882
Residential	$58,008	$28,508
Total	$475,768	$382,563

The area has a history of flood damage from overflows from the Guadalupe River [4]. As a result, many of the residences have been rebuilt or raised significantly so that the finished floor elevation is as much as six feet or more above the ground.

The with-project results for the three USACE SLC scenarios all show positive net benefits, ranging from approximately $15 million to $38 million in annual net benefits. All structural projects considered have strong economic justification under the three SLC scenarios considered. The benefit-cost ratios range from about 4 to 12 (at a discount rate of 3.375 percent). The optimum levee heights based on annual net benefits for the three SLC scenarios are 12.5’ for the USACE Low and Intermediate SLC scenarios, and 13.5’ for the USACE High SLC scenario. Table 3.5-4 *Results of FRM Option NED Analysis – USACE* Low SLC Scenario, Table 3.5-5 *Results of FRM* Option NED Analysis – USACE Intermediate SLC Scenario, and Table 3.5-6 *Results of FRM* Option NED Analysis, USACE High SLC Scenario summarize the results of the benefit-cost analysis completed for comparing the FRM options and identifying the NED. As these tables show, there is very little difference in the net benefits of several of the levee options evaluated under each of the SLC scenarios. As an illustration of this point, under the USACE High SLC scenario, compared to the NED, there is less than a 1-percent difference in net benefits for the next-smaller and next-larger levee heights. A similar result occurs under the USACE Low and Intermediate SLC scenarios.

[4] The levees along the Guadalupe River in the study area were raised in the 2004, reducing the risk from flooding to fluvial events larger than the 1% ACE event.

The costs shown in Table 3.3-1Table 3.5-1 to Table 3.6-6 are presented at October 2013 price levels. These are planning level costs developed in fiscal year 2014 used to evaluate and compare alternatives to identify the NED/NER and LPP FRM and ecosystem restoration plans. Table 3.7-2 through Table 3.10-2 are presented at October 2014 price levels. These costs reflect updated and refined costs, incorporating a full cost and schedule risk analysis. They were used to evaluate and compare the Combined NED/NER and LPP/Recommended Plans at current price levels (in effect at the time of the Final Report submittal). The Total Project First Costs as presented in Chapter 9 (Findings and Recommended Plan), reflect the costs from the Total Project Cost Summary (TPCS) certified by the Cost Estimating Mandatory Center of Expertise and are presented at October 2015 price levels. These costs will serve as the basis for project authorization, which is anticipated in fiscal year 2016.

Table 3.5-4. Results of FRM Option NED Analysis – USACE Low SLC Scenario

October 2013 price levels, 3.5% discount rate

Without-Project Equivalent Annual Flood Damage (1,000s)										
Structure and Content Damage	$11,478									
Relocation Cost	$6,691									
Total	$18,170									
Alternative/Levee Height	No Action	11 ft	11.5 ft	12 ft	12.5 ft	13 ft	13.5 ft	14 ft	15 ft	Non-Structural
With-Project Equivalent Annual Damages & Damages Reduced (1,000s)										
With-Project Average Annual Flood Damage	$18,170	$2,418	$1,123	$84	$17	$0	$0	$0	$0	$0
Annual Damages Reduced	$0	$15,752	$17,047	$18,086	$18,153	$18,170	$18,170	$18,170	$18,170	$18,170
Project Costs (1,000s)										
Project Cost	$0	$58,186	$59,761	$61,336	$62,486	$63,636	$65,536	$67,436	$71,536	$425,000
Interest During Construction	$0	$3,021	$3,102	$3,184	$3,244	$3,304	$3,402	$3,501	$3,714	$0
Total Investment Costs	$0	61,207	$62,863	$64,520	$65,730	$66,940	$68,938	$70,937	$75,250	$425,000
Capital Recovery Factor (CRF)	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426
Average Annual Costs	$0	$2,607	$2,678	$2,749	$2,800	$2,852	$2,937	$3,022	$3,206	$18,105
Annual O&M Costs	$0	$387	$387	$387	$387	$387	$387	$387	$387	$0
Total Average Annual Costs	$0	$2,994	$3,065	$3,136	$3,187	$3,239	$3,324	$3,409	$3,593	$18,105
Results										
Annual Net Benefits	$0	$12,758	$13,982	$14,951	$14,966	$14,931	$14,846	$14,761	$14,577	$65
Benefit-to-Cost Ratio	N/A	5.26	5.56	5.77	5.70	5.61	5.47	5.33	5.06	1.00

O&M=Operations and Maintenance

Table 3.5-5. Results of FRM Option NED Analysis – USACE Intermediate SLC Scenario

October 2013 price levels, 3.5% discount rate

Without-Project Equivalent Annual Flood Damage (1,000s)										
Structure and Content Damage	$11,478									
Relocation Cost	$6,691									
Total	$18,170									
Alternative/Levee Height	No Action	11 ft	11.5 ft	12 ft	12.5 ft	13 ft	13.5 ft	14 ft	15 ft	Non-Structural
With-Project Equivalent Annual Damages & Damages Reduced (1,000s)										
With-Project Average Annual Flood Damage	$18,170	$2,418	$1,123	$84	$17	$0	$0	$0	$0	$0
Annual Damages Reduced	$0	$15,752	$17,047	$18,086	$18,153	$18,170	$18,170	$18,170	$18,170	$18,170
Project Costs (1,000s)										
Project Cost	$0	$58,186	$59,761	$61,336	$62,486	$63,636	$65,536	$67,436	$71,536	$425,000
Interest During Construction	$0	$3,021	$3,102	$3,184	$3,244	$3,304	$3,402	$3,501	$3,714	$0
Total Investment Costs	$0	61,207	$62,863	$64,520	$65,730	$66,940	$68,938	$70,937	$75,250	$425,000
Capital Recovery Factor (CRF)	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426
Average Annual Costs	$0	$2,607	$2,678	$2,749	$2,800	$2,852	$2,937	$3,022	$3,206	$18,105
Annual O&M Costs	$0	$387	$387	$387	$387	$387	$387	$387	$387	$0
Total Average Annual Costs	$0	$2,994	$3,065	$3,136	$3,187	$3,239	$3,324	$3,409	$3,593	$18,105
Results										
Annual Net Benefits	$0	$12,758	$13,982	$14,951	$14,966	$14,931	$14,846	$14,761	$14,577	$65
Benefit-to-Cost Ratio	N/A	5.26	5.56	5.77	5.70	5.61	5.47	5.33	5.06	1.00

O&M=Operations and Maintenance

Table 3.5-6. Results of FRM Option NED Analysis, USACE High SLC Scenario

October 2013 price levels, 3.5% discount rate

Without-Project Equivalent Annual Flood Damage (1,000s)										
Structure and Content Damage	$31,902									
Relocation Cost	$8,293									
Total	$40,195									
	No Action	11 ft	11.5 ft	12 ft	12.5 ft	13 ft	13.5 ft	14 ft	15 ft	Non-Structural
With-Project Equivalent Annual Damages & Damages Reduced (1,000s) by Levee Height										
With-Project Average Annual Flood Damage	$40,195	$29,154	$14,490	$5,071	$1,575	$419	$92	$16	$0	$0
Annual Damages Reduced	$0	$11,040	$25,704	$35,123	$38,619	$39,776	$40,103	$40,178	$40,195	$40,195
Project Costs (1,000s) by Levee Height										
Project Cost	$0	$58,186	$59,761	$61,336	$62,486	$63,636	$65,536	$67,436	$71,536	$425,000
Interest During Construction	$0	$3,021	$3,102	$3,184	$3,244	$3,304	$3,402	$3,501	$3,714	$0
Total Investment Costs	$0	61,207	$62,863	$64,520	$65,730	$66,940	$68,938	$70,937	$75,250	$425,000
Capital Recovery Factor (CRF)	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426	0.0426
Average Annual Costs	$0	$2,607	$2,678	$2,749	$2,800	$2,852	$2,937	$3,022	$3,206	$18,105
Annual O&M Costs	$0	$387	$387	$387	$387	$387	$387	$387	$387	$0
Total Average Annual Costs	$0	$2,994	$3,065	$3,136	$3,187	$3,239	$3,324	$3,409	$3,593	$18,105
Results										
Annual Net Benefits	$0	$8,046	$22,639	$31,988	$35,432	$36,537	$36,779	$36,770	$36,592	$22,090
Benefit-to-Cost Ratio	N/A	3.69	8.39	11.20	12.12	12.28	12.07	11.79	11.16	2.22

O&M=Operations and Maintenance

As shown above, the 12.5-foot NAVD 88 levee maximizes net benefits under the Low and Intermediate SLC scenarios, and the 13.5-foot NAVD 88 levee maximizes net benefits under the High SLC scenario. Therefore, these are two of the plans identified as NED Plan candidates. However, ER 1105-2-100, *Planning Guidance Notebook*, Appendix G, states the following regarding NED Plan identification:

> Where two cost-effective plans produce no significantly different levels of net benefits, the less costly plan is to be the NED plan, even though the level of outputs may be less.

Based upon this criterion, the 12-foot NAVD 88 levee scale could be identified as the NED Plan, since there are not significant increases in net benefits with larger scale levees under the three SLC scenarios. The following sections provide further comparisons of the 12.0-foot

NAVD 88, 12.5-foot NAVD 88, and 13.5-foot NAVD 88 levee options used to determine the overall NED Plan.

Comparison of Overtopping Probabilities and Residual Risk

Table 3.5-7 *HEC-FDA Project Performance Statistics in 2067* displays the project performance statistics for the without-project future condition and the 12-foot NAVD 88, the 12.5-foot NAVD 88, and the 13.5-foot NAVD 88 FRM levee options in the year 2067. Compared to the without-project future condition (No Action Alternative), all three of the potential NED levee options significantly reduce the risk of tidal flooding over the 50-year period of analysis. The mean annual exceedance probability is the likelihood of flooding in any given year, although, in this case because of rising sea level, this value reflects a snapshot in time at the year 2067. The long-term risk (30 years) represents the likelihood over a 30-year period that a tidal flood event will occur. Thirty years was chosen to display because that is the duration of a typical home mortgage loan and is therefore a time interval that would be familiar to members of the public during flood risk communication efforts. Assurance for the 1-percent ACE indicates that the levee will not be exceeded (overtopped) by storm events of lesser or equivalent size. In this case, the 10-percent, 2-percent, 1-percent, and 0.2-percent ACE events are displayed. Note that these statistics are a function of the engineering, rather than economic, inputs to the HEC-FDA model.

Table 3.5-7. HEC-FDA Project Performance Statistics in 2067

SLC Scenario	FRM Option	Average Annual Exceedence Probability in 2067	Long Term Risk (30 yrs) 2067	Assurance/Conditional Non Exceedance Probability by Event 2067			
				10%	2%	1%	0.20%
Low	No Action	39.40%	100.0%	36.9%	24.7%	16.2%	3.9%
	12' Levee	0.18%	5.4%	99.9%	99.9%	99.8%	64.1%
	12.5' Levee	0.08%	2.6%	99.9%	99.9%	99.9%	94.9%
	13.5' Levee	0.02%	0.7%	99.9%	99.9%	99.9%	99.9%
Intermediate	No Action	53.00%	100.0%	29.6%	7.3%	5.4%	2.5%
	12' Levee	0.37%	10.5%	99.9%	99.2%	93.0%	45.0%
	12.5' Levee	0.08%	2.0%	99.9%	99.9%	99.9%	92.6%
	13.5' Levee	0.02%	0.6%	99.9%	99.9%	99.9%	99.9%
High	No Action	94.97%	100.0%	0.3%	<.01%	<.01%	<.01%
	12' Levee	26.95%	100.0%	2.7%	<.01%	<.01%	<.01%
	12.5' Levee	8.51%	93.1%	66.7%	3.2%	0.7%	<.01%
	13.5' Levee	0.48%	13.4%	99.9%	98.3%	88.2%	33.5%

For the sake of illustration, the results table shows that, depending on the SLC scenario, a 13.5-foot NAVD 88 levee at the year 2067 has between a 0.02-percent and 0.48-percent chance of being overtopped each year (Average Annual Exceedance Probability in 2067). At the 2067 sea level, over a 30-year period, there is between a 0.7-percent and 13.4-percent chance of a damaging tidal flood event occurring (Long Term Risk [30 years] 2067). Finally, there is an 88-percent to 99-percent chance of that levee containing the 1-percent ACE event in the year 2067 (Assurance/Conditional Non Exceedance Probability by Event 2067 [1 percent column]).

Table 3.5-7 *HEC-FDA Project Performance Statistics in 2067* shows that all of the levee options provide a high degree of project performance under the Low and Intermediate SLC scenarios, even at the end of the 50-year period of analysis. However, there are noticeable differences in performance under the High SLC scenario at the end of the period of analysis. For example, the annual probability of tidal flooding due to the project design being exceeded is approximately 3.2 times higher for the 12.0-foot NAVD 88 levee than for the 12.5-foot NAVD 88 levee. The 12.5-foot NAVD 88 levee also has at least a 67-percent probability of containing the more-probable flood events (up to the 10-percent ACE event), while the 12.0-foot NAVD 88 levee has a very low probability of containing these events. Likewise, the 13.5-foot NAVD 88 levee provides a significant incremental increase in project performance relative to the 12.5-foot NAVD 88 levee at the end of the period of analysis. For example, the 13.5-foot NAVD 88 levee has over an 88-percent probability of containing the 1-percent ACE event, while the smaller scale levees have a minimal corresponding probability. These performance statistics indicate that, under the High SLC scenario, there is a significant likelihood that, by the end of the period of analysis, the 12.0-foot NAVD 88 and 12.5-foot NAVD 88 levees would need to be raised or otherwise modified to address the increasing threat of tidal flooding to the community, while such improvement s would likely be unnecessary for the 13.5-foot NAVD 88 levee.

Residual tidal flood risk is the flood risk that remains from tidal flooding after the project has been implemented. This analysis specifically focuses on the residual risk associated with coastal flooding, and references to residual risk throughout this chapter are based on this source of potential flooding. This analysis does not assess any residual risk that may be attributable to flooding from the Guadalupe River. The 12.0-foot NAVD 88, the 12.5-foot NAVD 88, and 13.5-foot NAVD 88 levee heights would in general have very low residual tidal flood risk at the time of construction and for many years afterward. The residual tidal flood risk will increase as sea-level rises under any of the three USACE SLC scenarios, and significant differences between the residual tidal flood risk of these two levee heights emerge later in the period of analysis.

Equivalent annual damage remaining is one measure of residual flood risk. The equivalent annual damage at 2017[5] is zero for any of the three levee heights. This does not mean that residual flood risk is zero, but the likelihood of flood damage is so low as to be negligible. Residual equivalent annual damages over the period of analysis are very minimal under the Low and Intermediate SLC scenarios. However, there is a more pronounced difference in residual equivalent annual damages under the High SLC scenario. The differences in residual damage are even more significant when focusing on results at the end of the study period. Under the Low and Intermediate SLC scenarios, the equivalent annual damage at the end of the period of analysis is still very low. However, under the USACE High scenario, the 12.0-foot

[5] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

NAVD 88 and 12.5-foot NAVD 88 levees have significantly more residual tidal flood risk than higher levees. For example, according to the HEC-FDA modeling, in 2047 the equivalent annual damage for the 12.5-foot NAVD 88 levee is nearly $1 million and increases to more than $20 million by 2067 (Table 3.5-8 *Summary of NED Analysis Results (in $1,000)]).* In contrast, the equivalent annual damage for the 13.5-foot NAVD 88 levee does not reach $1 million until 2067. Levees 15-feet NAVD 88 or higher would have an extremely low likelihood of being overtopped over the period of analysis under even the USACE High SLC scenario. The degree of residual risk beyond the period of analysis obviously depends on the rate of future SLC.

The equivalent annual damage calculations referenced above are based on overtopping events and assume no other flooding mechanism such as a levee breach. Although no levee can be said to eliminate all risk of failure below the top of levee elevation, the likelihood of structural failure for any of the three levees, if well maintained, is estimated to be very low. The consequences of a levee breach during a storm event would be significant, but the USACE considers this likelihood to be extremely low. As always, residual tidal flood risk can be further reduced with effective floodplain management and flood warning and evacuation plans.

NED Levee Height

Table 3.5-8 *Summary of NED Analysis Results (in $1,000)* summarizes the primary results for the three candidate levee heights under consideration for selection as the NED plan. From a net benefits and benefit-cost ratio perspective, the three levee scales are very similar under each SLC scenario. Since EC 1100-2-8162 does not assign probabilities to the three SLC scenarios, it is not possible to identify the overall best plan by weighting the results for each levee option under the three SLC scenarios.

Table 3.5-8. Summary of NED Analysis Results (in $1,000)

October 2013 price levels, 3.5% discount rate

SLC Scenario	FRM Option	Total Equivalent Annual Benefits	Net Benefits	BCR @ 3.5%	Residual Equivalent Annual Damage	Residual Annual Damage in 2067	Average Annual Exceedence Probability in 2067
Low	12' Levee	$18,086	$14,951	5.77	$84	$457	0.18%
	12.5' Levee	$18,153	$14,966	5.70	$17	$244	0.08%
	13.5' Levee	$18,167	$14,846	5.47	$3	$60	0.02%
Intermediate	12' Levee	$22,414	$19,278	7.15	$131	$826	0.37%
	12.5' Levee	$22,524	$19,337	7.07	$21	$300	0.08%
	13.5' Levee	$22,542	$19,221	6.78	$0	$2	0.02%
High	12' Levee	$35,123	$31,988	11.20	$5,071	$63,236	26.95%
	12.5' Levee	$38,619	$35,432	12.12	$1,575	$22,322	8.51%
	13.5' Levee	$40,103	$36,779	12.07	$92	$1,588	0.48%

The primary difference between the three options emerges under the USACE High SLC scenario in terms of residual tidal flood risk and average annual exceedance probability. According to the results of this study's coastal engineering analysis (Appendix D1 *Coastal*

Engineering and Riverine Hydraulics Summary), at 2067 the 1-percent ACE water surface elevation is 13.2 feet NAVD 88, which would exceed the 12.0-foot NAVD 88 and 12.5-foot NAVD 88 levees. According to the HEC-FDA modeling performed for the economic analysis (Appendix C *Economics*), the expected annual residual damage at 2067 would be over $63 million for the 12.0-foot NAVD 88 levee and over $22 million for the 12.5-foot NAVD 88 levee, while the damage with a 13.5-foot NAVD 88 levee would be significantly less.

After consideration of all of the factors evaluated, the 12.5-foot NAVD 88 levee scale was identified as the NED Plan. The primary reasons are because the 12.5-foot NAVD 88 levee:

- Maximizes net benefits under the Low and Intermediate SLC scenarios.
- Provides substantially greater risk reduction than the 12-foot NAVD 88 levee under the High SLC scenario:
  - 11-percent-higher net benefits
  - 69-percent-lower residual equivalent annual damages
  - 65-percent reduction in EAD under future conditions
  - 68-percent-lower annual exceedance probability under future conditions
  - Is adaptable and can be raised in the future if necessary to accommodate sea level rise under the High SLC scenario

Locally Preferred Levee Height

A 15.2-foot NAVD 88 levee would specifically address local sponsor goals by allowing them to still meet Federal Emergency Management Agency (FEMA) requirements for levee accreditation in the year 2067. A 15.2-foot NAVD 88 levee height corresponds to an elevation 2 feet above the mean 1-percent ACE water surface elevation at year 2067 (the end of the period of analysis) with 95 percent conditional non-exceedance probability. The 2 additional feet of levee height represent the FEMA's freeboard requirement.

Conclusion

All potential levee heights analyzed meet the completeness, effectiveness, efficiency, and acceptability criteria as defined by the P&G. In an effort to streamline the final array of alternatives, only two levee heights were retained for inclusion in the final array: one levee height that represents the NED (12.5 feet NAVD 88) and a second levee height that addresses local goals (15.2 feet NAVD 88). The strategy for formulating the final array is to include the minimum number of levee alignment and levee height combinations to represent Federal interest, local preference, and NEPA/CEQA requirements.

3.6 Ecosystem Restoration Plan Formulation

3.6.1 Historical Context

Sediment supply to the South Bay, both from local watersheds and possibly the Sacramento River, changed significantly over the last 200 years. Over the last 60 to 150 years most of the

South Bay's tidal marshes were diked off for salt pond production. This obliterated vegetated tidal marsh functions and associated habitats, specifically marsh plain ponds, perimeter salt pans, transitional marshes, and the large tidal channels within the marsh. Diking of the marshes also affected estuarine processes. The tidal prism was reduced, allowing tidal sloughs to silt in and narrow as fringing marsh between the levees expanded. It appears that this process is still affecting Coyote Creek, where the channel is narrowing and fringing marshes expanding. Diking of the marshes eliminated a sediment sink allowing more sediment to be recirculated within the estuary, probably resulting in increased suspended sediment concentrations (SSCs) and higher rates of siltation in the subtidal channel.

Within the far South Bay (the part of the South Bay to the south of Dumbarton Bridge), land subsidence occurred due to groundwater pumping in the mid-20th century (Poland and Ireland 1988). During this period, sedimentation overall has kept pace with subsidence (Foxgrover and others 2004) and, based on their hypsometry, the mudflats appear to be reaching equilibrium with the local wind-wave climate. Most significantly, the degree of subsidence in the salt ponds on former marsh plains has created a large new potential sediment sink within the system that can affect the sediment dynamics and sediment budget of the South Bay when tidal action is restored.

The sediment budget of the South Bay has also been altered by dredging to maintain flood control channels, navigation, and to provide construction materials. Since the 1970's, a series of restoration projects have created new sediment sinks at the Bay margin.

3.6.2 Conceptual Model of Sediment Dynamics of the South Bay

Although the South Bay receives inputs of sediment from local watersheds and from the Central Bay, the major source of sediment in circulation within the South Bay is the wave-induced erosion of consolidated mud on the surface of the shallows and mudflats (collectively referred to as the "sweep zone") on the east and west side of the deep subtidal channel north of the Dumbarton Bridge (Foxgrover and others 2004). Once eroded, this mud becomes mobile and though it is continuously re-eroded and deposited, it does not replenish the erosional platform because of its low settling velocity. Instead, much of this eroded sediment stays in motion and migrates southwards with the prevailing wind. SSC is highly correlated with wind speed; during periods of high summer northwesterly winds SSCs increase and this sediment moves south with the wind-driven circulation through the Dumbarton Narrows from where it can be dispersed into the far South Bay on flood tides. A portion of this eroded sediment circulates into the subtidal channel, where it is either deposited or moves north out of the South Bay into the Central Bay (Schoellhamer 1996).

The resuspension of eroded sediment and the movement of sediment southwards cause average SSCs to increase to the south. In the far South Bay, the eroded estuarine sediments are mixed with sediments derived from the local watershed. Increasing sediment concentrations means that rapid sedimentation can occur if the mudflats and channels south of the Dumbarton Bridge are not in equilibrium with the wave climate and tidal flows. It also means that as the shallows and mudflats in the far South Bay approach equilibrium with the wave climate and tidal flows the excess sediment will migrate northwards along the deeper subtidal channel.

The sweep zone shallows and mudflats in the far South Bay have been historically net depositional (Foxgrover and others 2004). Because freshly deposited sediment has lower bulk density than old consolidated mud, the surface layers of the mudflats are continually being eroded and deposited in response to variation in wind and tidal conditions, and continually being recirculated into the water column as suspended sediment. A portion of these suspended sediments can be captured in adjacent sediment sinks, such as restored ponds or in the subtidal channel.

The sediment dynamics within the South Bay are further described in the Hydrodynamics and Sediment Dynamics Existing Conditions Report (PWA and others 2005).

3.6.3 Conceptual Model of the Evolution of Restored Tidal Wetlands

When tidal action is restored to a subsided pond site through a deliberate or accidental levee breach, physical processes are set in motion that dictate the rate and manner in which the site will evolve. These sedimentary processes have been described in conceptual models of youthful saltmarsh development (Allen 1990; Orr and others 2003) and are different from the processes, dominated by sea-level rise, which created the extensive transgressive ancient marshes of the South Bay.

In a restoring marsh, flood tides carry in suspended estuarine sediments that deposit in the wave-protected slack waters of the flooded site. Ebb tidal currents are insufficient to resuspend deposited muds, except in the locations of nascent tidal channels. As sediment accumulates, large areas of intertidal mudflats form. As they rise in elevation, the period of tidal-water inundation decreases and rate of sedimentation declines.

Once tidal mudflats reach a high enough elevation relative to the tidal frame, pioneer plant colonization can occur. Initial establishment usually occurs by seed or from plant fragments. Colonization becomes progressively more rapid through lateral vegetative expansion from the pioneer plants and continued deposition of seeds and plant fragments. These restored areas evolve in response to estuarine sedimentation processes, from subtidal, to intertidal mudflat, to initial mudflat colonization by salt-tolerant marsh plants, to ultimately a fully mature vegetated marsh plain. Sites that have relatively high initial elevations will therefore reach colonization elevation more quickly than more deeply subsided sites.

In San Francisco Bay, Pacific cordgrass (*Spartina foliosa*) is typically the first vegetation to colonize an accreting mudflat and dominates the low marsh. In the fresher parts of the Bay bulrushes (*Scirpus robustus*) will be the pioneer vegetation and will colonize lower in the tidal frame. Once mudflat colonization occurs, a vegetated marsh plain forms through lateral expansion of roots and rhizomes from established plants on the mudflat, and from plants along the site perimeter. The presence of vegetation contributes to the slow build-up of the marsh plain through sediment trapping and organic accumulation (Eisma and Dijkema 1997). Once vegetation is established, organic material will accumulate within the marsh both above ground as surface litter and below ground, through the decay of roots, rhizomes, and tubers, in the form of peat. As the vegetated marsh plain rises within the tidal frame, estuarine sediment accretion slows exponentially until a marsh plain forms at an elevation around MHHW (Atwater and others 1979). As tidal inundation decreases, soil salinities increase and pickleweed (*Salicornia virginica*) outcompetes cordgrass to form the characteristic saltmarsh plains of San Francisco Bay.

The rate at which the mudflat and marsh plain builds up is dependent on the amount of sediment, or SSC, carried into the site by the flood tide, the rate of relative sea-level rise, the tidal range, and the amount of wind-wave action that erodes deposited sediments. The higher the average SSC in the flood tide entering the site, the quicker the restored site will evolve. Long-term average annual SSCs at any point in the South Bay vary depending on position relative to the hydrodynamics of the estuary, in particular its proximity to extensive intertidal mudflats where sediment can be resuspended by wave action (Schoellhamer 1996). Average SSCs are ultimately determined by the (1) long-term sediment budget of the estuary, which dictates how much sediment is available to the estuary, and (2) the estuarine hydrodynamics that determine how it moves and where it is concentrated.

Large-scale restoration itself can affect the sediment budget and estuarine hydrodynamics. Restoring tidal action to subsided ponds creates a sediment sink within the estuary that is large enough to affect the sediment budget and decrease SSCs by capturing sediment suspended in the water column of flood tide flows entering the restored sites. This in turn can lower the rate of marsh evolution within the South Bay and accelerate the rate of mudflat erosion outside the restored ponds.

Relative sea-level rise is the product of global eustatic sea-level rise and local long-term subsidence. Due to global warming eustatic sea-level rise is predicted to accelerate. The higher the rate of sea-level rise the longer it takes for the marsh to evolve in a restoring site (Orr and others 2003).

Where restoration sites are fully tidal, periods of inundation are unrestricted and similar to those in mature marshes. Where tides are muted or restricted by narrow channels, periods of inundation are altered and vegetation establishment can be delayed. Over time, scouring action tends to enlarge constricted tidal channels, eventually restoring full tidal exchange (PWA 2004). Until this occurs, the volume of sediment entering the site on the flood tide will be reduced proportionally to the reduction in tidal prism, extending the time of evolution.

Even where the bayfront levees remain intact at a restored site, locally generated wind waves within the restored area can inhibit deposition of suspended sediment from the water column and resuspend deposited mud. In the South Bay, Schoellhamer (1996) found that SSCs were well-correlated with seasonal variations in wind shear stress. Wind-wave action can reduce the net accretion rate or “trap efficiency” in a restored site, slowing the evolution of the marsh plain and can even limit the equilibrium elevation of the site, resulting in a permanent mudflat too low to be colonized by emergent vegetation.

Concurrently with the physical evolution of the marsh plain, the tidal drainage system starts to form. As mudflats accrete, tidal channels first form in the mudflat. As vegetation becomes established, these sinuous mudflat channels become imprinted in the marsh plain, eventually forming a dendritic tidal channel system. Within this system, the tidal prism of the marsh "watershed" upstream mainly dictates the size and shape of the tidal channel geometry at any given point (Williams and Faber 2001). Within a mature marsh, the channel banks and the bed of lower-order tidal channels provide sustainable intertidal bare mud habitat.

3.6.4 Conceptual Model of the Evolution of Offshore Mudflats and Fringing Marshes

The shape and extent of estuarine mudflats is dominated by the prevailing wind-wave climate and sedimentary regime (Dyer 1998). Mudflats comprise the upper, intertidal portion of the wave sweep zone. This zone is defined by the vertical and lateral extent of subtidal shallows and intertidal mudflats that dissipate wave energy on the marsh edge shoreline. The lower limit of the sweep zone is defined by joint probability and scouring effect of large wind waves occurring at low tide and its shape equilibrates with the cumulative erosive effects of wind waves occurring at different tide levels.

The erosional mechanism on consolidated erosional platforms, such as occurs north of Dumbarton Bridge, is complex, relying on bioturbation and deflocculation as well as wave-induced bed shear stresses (Dyer 1998). Once set in motion, freshly eroded mud has a significantly lower bulk density and is more easily eroded than the underlying material, and while it can be temporarily redeposited locally, tends to be preferentially eroded and dispersed within the estuary. This means that continuous erosion occurs over long periods of time, with lateral shoreline erosion rates keeping in step with the rate of mudflat lowering. Eroded sediments can be captured in adjacent sediment sinks like deep channels or marshes, but increasing the size of these sinks and rate of capture has little effect on erosion rates of these consolidated platforms.

However, on wave-exposed depositional mudflats, such as occur in the far South Bay, mudflat accretion and erosion are more dynamic and responsive to seasonal changes in wave climate. This means that the upper layers of sediment have lower bulk densities and lower resistance to erosion and can be recirculated within the estuarine system more readily. Eroded sediments can be captured in nearby sediment sinks, like restored ponds, and are no longer redeposited within the sweep zone, resulting in mudflat lowering. Where SSCs are high, the mudflat slope can assume a flatter or even convex shape (Kirby 2000; Roberts and others 2000). Under these conditions, it is possible for mudflats to be accreting in wave-exposed areas while the shoreline is eroding. Where the shoreline is sheltered from wave action accreting mudflats allow for expansion of fringing marsh.

3.6.5 Conceptual Model of the Evolution of Tidal and Subtidal Channels

In mesotidal estuaries like San Francisco Bay, the depth, width and cross-sectional area of tidal channels within marshes tends to equilibrate to the upstream tidal prism (Allen 2000; D'Alpaos and others 2005; Lawrence and others 2004). This means that restoring tidal action to subsided ponds can significantly increase tidal prism and create potential for scouring downstream tidal channels. Over time, the increased tidal prism will diminish as sediment builds up in the restoring site, although the net result will still be an increase in channel size. The adjustment of the tidal channel can be lagged with the increase in tidal prism by several decades (PWA 2004).

Similarly, in many estuaries the subtidal channel will also tend to equilibrate to upstream tidal prism (Pethick and Lowe 1999). In those estuaries where the tidal prism is significantly reduced by diking, or where sea-level rise dominates over sedimentation processes, the subtidal channel can become oversized, acting as an internal sediment sink.

3.6.6 Ecosystem Restoration Options

The habitat restoration strategy for the Shoreline Phase I Project is to convert former salt ponds into tidal wetlands through a phased restoration process guided by monitoring and adaptive management. The ponds could not be restored to tidal action without first addressing future tidal flood risk, therefore, development and analysis of the ecosystem restoration measures assumed that the Shoreline Phase 1 Project would include measures to address future tidal flood risk.

The actions included in all options seek to establish vegetated tidal wetlands with goals of maximizing long-term habitat benefits, particularly in consideration of potential SLC. With this phased restoration strategy in mind, ecosystem restoration options were formulated that would be screened and combined with FRM options (and recreation features) to form a final array of multipurpose plans.

Planned ecosystem restoration options would reduce disturbance to wildlife caused by recreational use of the study area by removing public access to large portions of the study area housing species sensitive to human disturbance. The post-project trail system on Refuge lands is a consequence of restoring Ponds A9-15 to tidal marsh habitat, which involves breaching and abandoning levees to facilitate natural tidal processes. Where levees will be retained for pond management purposes, a trail system will be maintained to continue providing wildlife-dependent recreation opportunities that are compatible with the refuge's mission to conserve wildlife and its habitat.

The option to create islands to benefit wildlife in the breached ponds was considered. Such islands could provide refugia for marsh species during especially high tides. However, this presented practical difficulties. These islands would need to be high enough to be above nearly all tides, plus would need additional height to account for settling and subsidence of the underlying bay mud over time. This depth of fill would not be stable without application of extensive engineering techniques such as wick drains, or else multiple lifts over many years which would delay breaching. Therefore, creation of new islands on the pond bottoms was determined to be impractical. Existing wildlife islands in non-tidal A16 are far lower and do not present the same difficulties.

An alternate approach to creating refugial islands for wildlife was created instead. As existing levees are lowered during the pond breaching process, small portions will be retained at their current elevation. These islands will be surrounded by mudflats and marsh, making them safe from land-based predators. Because these islands will consist entirely of existing long-standing fill, they will be reasonably stable over time.

3.6.7 Mercury Methylation Options

One possible way to address the potential for additional mercury methylation occurring would be to cap areas of elevated mercury. This measure was not carried forward for two reasons. First, areas of elevated mercury are extensive enough that capping is not feasible. Second, areas of high total mercury do not always correspond with the areas of high methylmercury.

The ecosystem restoration approach instead addresses the processes that are driving mercury methylation within the ponds. These drivers include the weather (temperature, timing and amount of precipitation), water chemistry (salinity, dissolved oxygen content), depth and duration of inundation, etc. that create conditions for methylation spikes. Restoration actions fundamentally change the water chemistry in these ponds and shift the partitioning of methylmercury (MeHg) onto more terrestrially derived organic material and therefore making it less bioavailable (Ackerman et al 2013). This is why improved circulation from the full tidal restoration of a pond is likely to decrease bioavailability of mercury, regardless of the amount of mercury present. As discussed in Spatial Distribution of Mercury in Alviso Ponds (pp. 3.4-22-23) in the South Bay Salt Pond Restoration Project Final Environmental Impact Statement/Report (December 2007) while "there is a clear spatial pattern with the highest mercury sediment concentrations (Ponds A7, A8, A12, and A13) located adjacent to Alviso Slough" (the original source of the mercury), there are also "striking spatial differences in MeHg concentrations in sediments between some ponds" and "high spatial variability within the pond". These data show general patterns of distribution but do not indicate particular hot spots.

3.6.8 In-pond Preparation Prior to Breaching

As a building block for formulating ecosystem restoration options, two strategies were formulated for preparing ponds for restoration prior to breaching and establishing a tidal connection. These two in-pond preparation strategies differ in the specific measures included and the resulting speed with which tidal marsh restoration would occur. At a fundamental level, creating tidal marsh from the current ponds involves breaching outboard pond dikes to allow tidal exchange with the adjacent sloughs and San Francisco Bay. Over time, natural processes would bring in sediment from the bay to raise the elevation of the pond bottoms, creating a continuum of subtidal and tidal habitats. Construction features and actions such as pilot channels and levee lowering accelerate the restoration process by recreating the natural processes, but on a much faster time frame.

The following features are included in the two in-pond preparation strategies:

- Basic in-pond preparation includes outboard dike breaches with pilot channels from streams or sloughs into ponds, internal pond dike breaches, and ditch blocks.
- Accelerated in-pond preparation includes actions from basic option plus addition of outboard pond dike and inboard pond dike lowering on either side of breaches, and starter channels with sidecast berms that imitate the berms that would naturally form along marsh channels in Ponds A9, A12, A14, and A18.

3.6.8.1 Basic In-Pond Preparation

Outboard pond dike breaches are excavations through the perimeter dikes that open the pond to tidal inundation from the adjacent tidal sloughs. Breaches through the outboard levee and excavation of **pilot channels** through the outboard marsh leading to these breach sites would be placed at major historical tidal channel locations. Breach size would be determined based on the hydrologic relationship between the tidal channel and marsh drainage area and on data from tidal channels in mature marshes throughout the bay (ESA PWA 2012). Breaches are sized to long-term equilibrium dimensions to balance between excavation costs, scour potential, and tidal drainage consistent with *Design Guidelines for Tidal Wetland Restoration in San Francisco Bay* (ESA PWA 2004). Dimensions are adjusted to provide a cross-section with side slopes of 4:1 to 5:1 and a bottom width of approximately 10 feet. On the inboard side of the levee, the breach excavation would extend to the levee toe.

The breaches are expected to be "undersized" compared to restored tidal flows because of the larger tidal prism of the existing subsided ponds. Large tidal flows are expected to scour and enlarge the breaches until equilibrium between the tidal prism and channel dimensions is reached. Over time, the tidal prism would decrease as the pond fills in from sedimentation and vegetation establishment.

Internal pond dike breaches are intended to reconnect historical channels and restore the hydrologic connections to the innermost ponds in the project footprint. Breach excavations would be sized in a similar manner to those applied to the outboard dikes and would extend beyond the dike into the remnant historical channel.

Ditch blocks would be constructed from material excavated from the existing dikes. They would inhibit flow through existing borrow ditches, would promote scour and flow through the remnant historical and starter channels, and may provide some initial pickleweed habitat where located at the correct elevations. Ditch blocks would be located so that the borrow ditch on both sides of the block connects to a breach, also reducing the potential for fish stranding.

Without the construction of ditch blocks, tidal flows would occur primarily in the borrow ditches around the perimeter of the restored pond and would decrease the formation of complex dendritic channels in the restored marsh habitat. These channel networks are a critical component of the ecosystem from a hydrodynamic standpoint, and they also serve important ecological functions such as nesting and foraging by Ridgway's rails.

3.6.8.2 Accelerated In-Pond Preparation

Outboard pond dikes may be lowered to increase connectivity to the bay, sloughs, and creeks and to and prevent isolated high ground that would serve as a weed source.

Internal dikes may be lowered in some areas during the breach excavation to vegetated marsh habitat on the dike crests in the short term while the ponds develop from mudflat to vegetated marsh. No new internal levees are proposed. During this stage, dikes in adjacent ponds not yet being breached would be temporarily raised to provide increased FRM inboard of the current pond breaching actions.

Starter or pilot channels would be excavated through the outboard marsh to connect each outboard levee breach to the adjacent tidal slough. The new channels would be located at historical channel locations to the extent possible. Similar to the outboard breaches, pilot channels would be sized to the long-term channel depth and 60 to 80 percent of the long-term channel width. The resulting channels would be somewhat undersized to reduce the amount of excavation and are expected to naturally scour and enlarge. Pilot channels are essential to the restoration to provide a connection from the restored pond to the tidal waters of the bay. Tidal drainage would be monitored for effectiveness as part of the monitoring and adaptive management program, and additional excavation could be implemented if needed.

Figure 3.6-1 *In-pond Preparation Actions Considered – Pond A12 Example* provides a sample of in-pond preparation actions, using Pond A12 as an example and displaying all possible in-pond preparation features. Figures reflecting final combinations of in-pond preparation features, as well as proposed construction phasing by groups of ponds, are provided in Section 3.8 *Action Alternatives Component Details*.

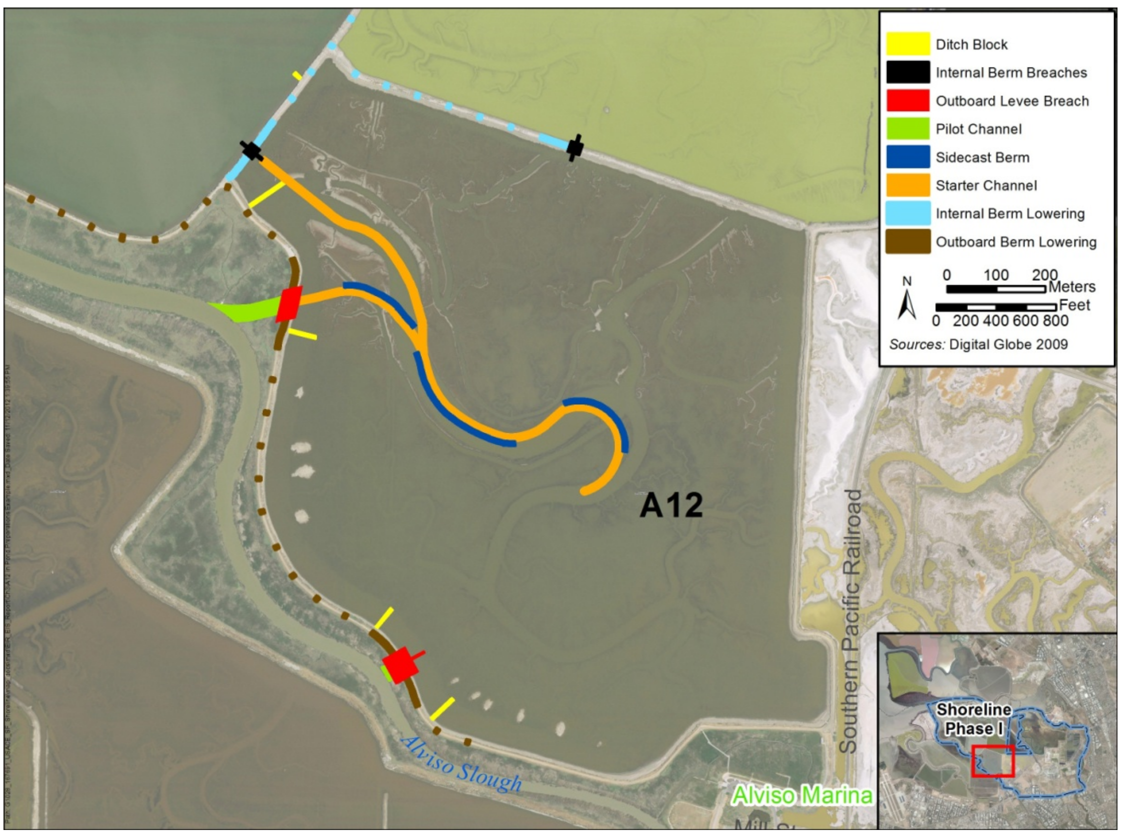

Figure 3.6-1. In-pond Preparation Actions Considered – Pond A12 Example

3.6.9 Transitional Habitat

Transitional habitat is defined as a transition area between two distinct habitats (in this case, tidal wetland and upland habitat). Currently in San Francisco Bay, the wetland-upland transition zones have largely disappeared from the edges of marshes. These important areas serve as high tide refugia for species such as Ridgway's rails[6], black rails, and the salt marsh harvest mouse and provide habitat for a unique suite of plant species. These areas also allow landward migration of marshes as sea levels rise and provide greater protection from extreme tides and waves. Adding transitional habitat would benefit the recovery of wetland species and restore these ecological functions. In addition, a large ecotone would buffer any management actions that would be necessary on the adjacent levee per USACE requirements.

Two levels of transitional habitat adjacent to Ponds A12/A13 and A18 were considered: a high ecotone incorporating 100:1 slopes, which would provide the most expansive habitat and a medium ecotone incorporating 30:1 slopes.

A 50-foot-wide flat bench would be built as a result of building the FRM levee rather than separately constructed specifically as additional transitional habitat and would not have a gradual slope like the 30:1 ecotone. Instead, it would be a bench below the levee top and a steep slope down to the water level. The steep slope would support narrow bands of low marsh, middle marsh, and high marsh (transitional) habitats. Because the slope is much steeper and the vegetative bands narrower, the bench would not provide as much refugium as the 30:1 ecotone. However, given the relative scarcity of transitional habitat between upland and marsh habitats in the area, the narrow bands of habitat that a bench would provide would be somewhat beneficial to wildlife using the adjacent tidal marsh areas. For both bench and ecotone, vegetation would be limited to non-woody and semi-woody plants and would be otherwise unmanaged, except for control of invasive exotics.

Figure 3.6-2 *Pond A12 Proposed Bench Option Cross-Section* provides a cross-section view of the Pond A12 proposed bench with limited refugia; however, while low-, medium-, and high-marsh plants would establish along the outer slope of the bench, the steepness and narrowness of this habitat area would greatly reduce its value. Upland habitat on the flat surface of the bench would provide a limited degree of refugial and buffer value for marsh wildlife during very high tides. In contrast, Figure 3.6-2 *Pond A12 Proposed Bench Option Cross-Section* and Figure 3.6-3 *Pond A12 Proposed Ecotone with 30:1 Side Slopes Cross-Section at Year 2020* show the same Pond A12 view with proposed ecotone at 30:1 side slopes at construction completion (2020) and as anticipated to evolve by 2067. The 2067 simulation assumes that sediment accretion from Alviso Slough would cause the pond floor to be restored with further development of expansive marsh habitat to provide species' refugia; a similar expectation would provide some development of the bench option, although the expectation is that the accretion would create "steps" of habitat refugia rather than a single continuous incline. The

[6] The newly titled (American Ornithologists' Union, July 2014) California Ridgway's rail (previously referred to as the California clapper rail) includes three subspecies: the Bay Area's California Ridgway's rail; the light-footed Ridgway's rail in Los Angeles and San Diego; and the Yuma Ridgway's rail in Arizona, Nevada, and eastern California. All three remain on the Endangered species list. It is part of a larger split; two rail species will now be five: king rails in the eastern U.S. and the Caribbean; clapper rails in the eastern U.S. and Cuba; mangrove rails in South America; Aztec rails in the Mexican highlands; and the West Coast Ridgway's rails. However, the new title has not yet been recognized by all USFWS offices; therefore, some appendices to this document continue to use the CA clapper rail nomenclature (e.g., Appendix B7 *USFWS Coordination Act Report*).

ecotone with 100:1 side slopes would be similar to the 30:1 examples shown Figure 3.6-3 *Pond A12 Proposed Ecotone with 30:1 Side Slopes Cross-Section at Year 2020*, with proportionately increased areas of each marsh habitat.

For both bench and ecotone options, grasses will be seeded on the upland levee surface for erosion control. A limited amount of native non-grass short-stature vegetation will be allowed on portions of the levee in accordance with guidance from the USACE Risk Management Center, in recognition of site conditions. Invasive weeds will be controlled. However, under both the bench and ecotone scenarios, the marsh plain itself would not be actively revegetated because regional experience on other salt pond restoration efforts indicate that it would not be needed to achieve restoration objectives.

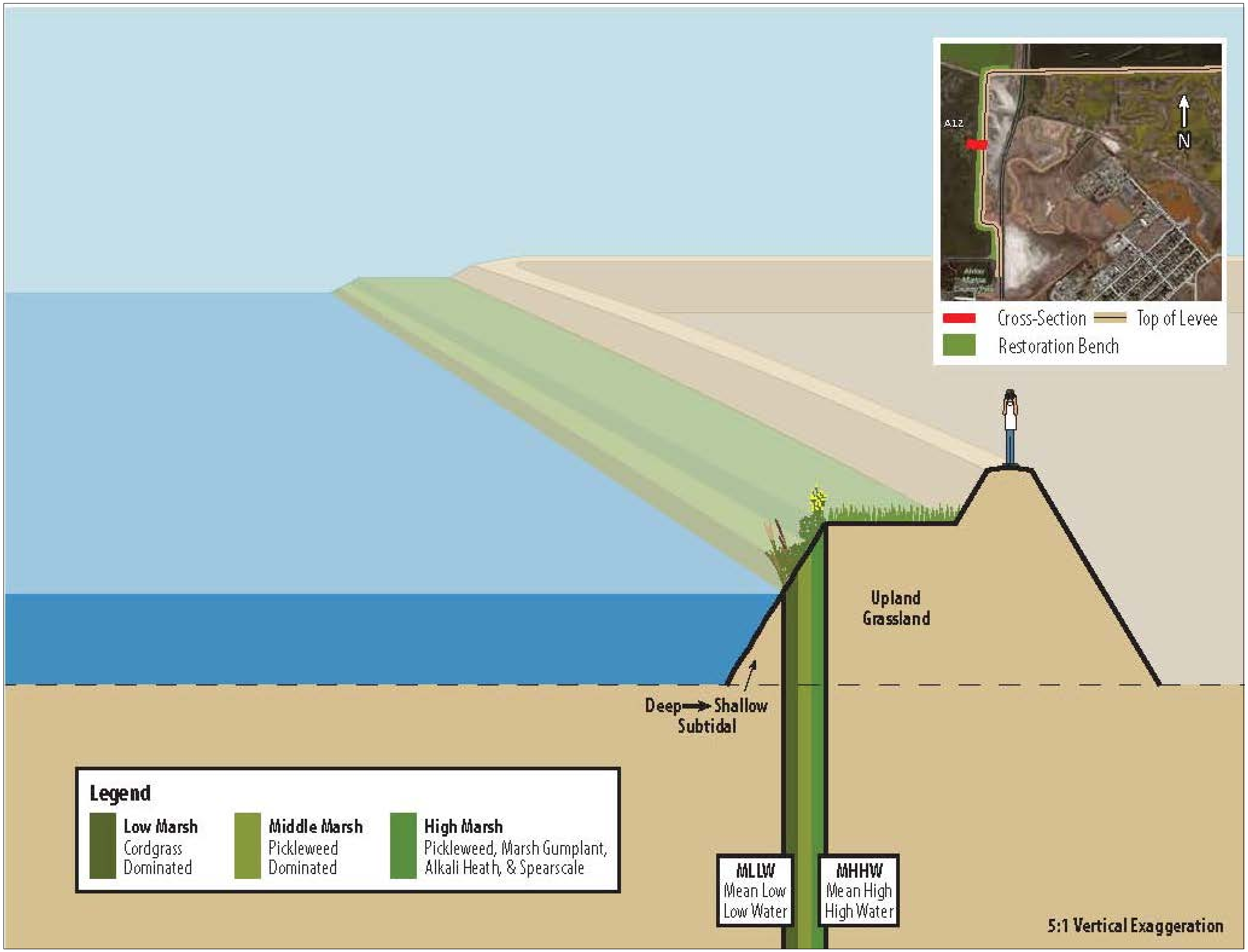

Figure 3.6-2. Pond A12 Proposed Bench Option Cross-Section

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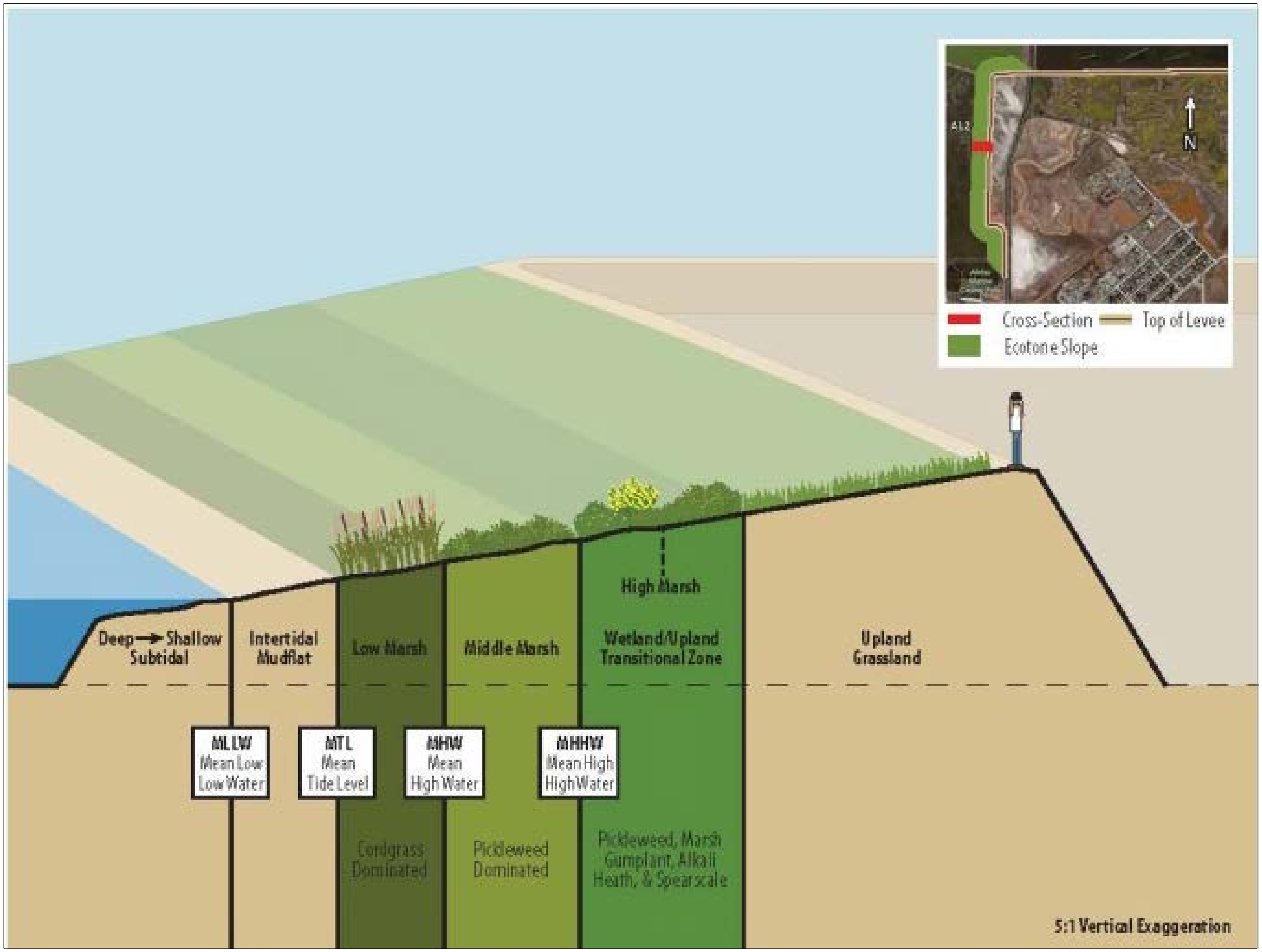

Figure 3.6-3. Pond A12 Proposed Ecotone with 30:1 Side Slopes Cross-Section at Year 2020

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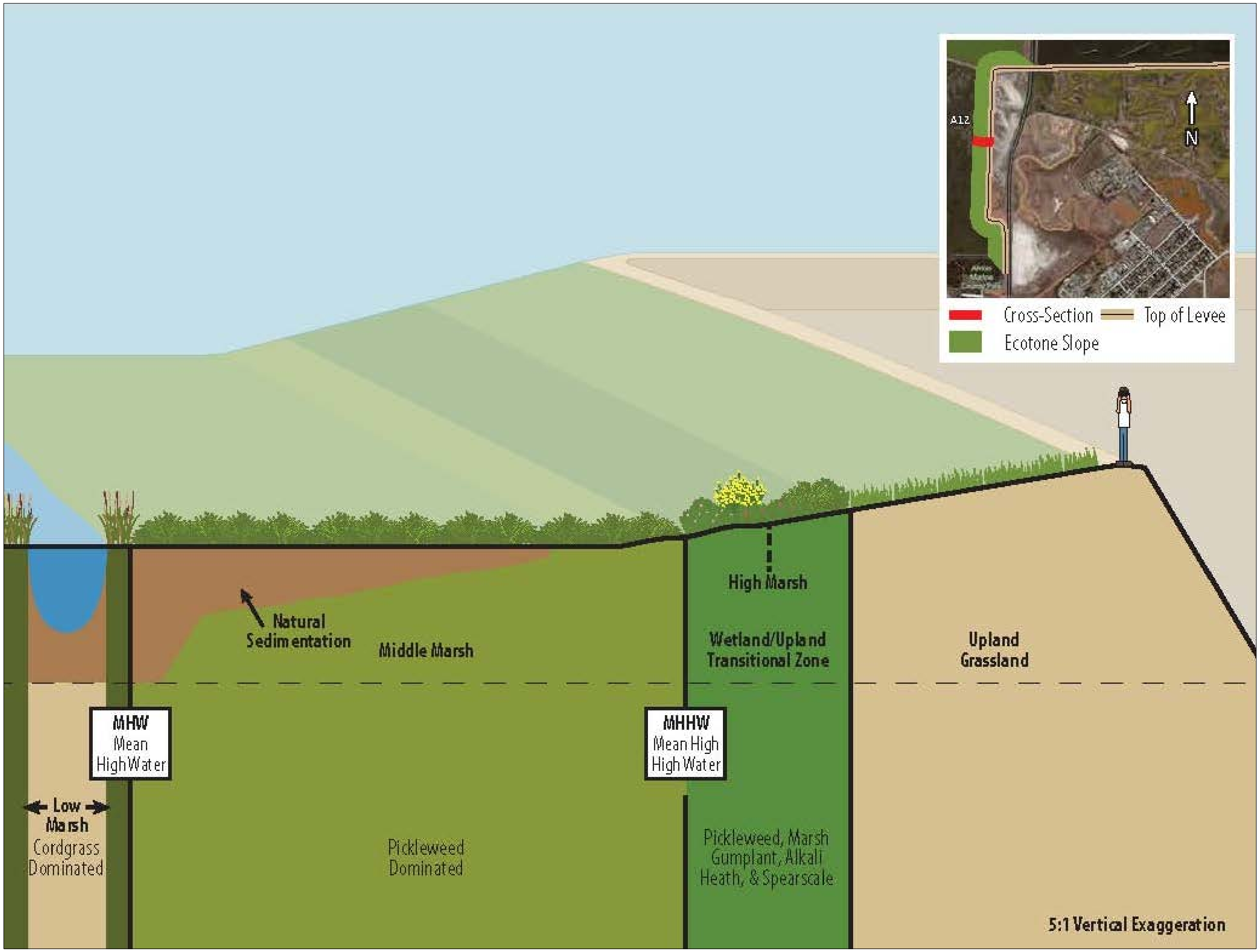

Figure 3.6-4. Pond A12 Proposed Ecotone with 30:1 Side Slopes Cross-Section at Year 2067

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3.6.10 Monitoring and Adaptive Management

Monitoring and adaptive management (MAM) for this project falls into three categories: (1) MAM associated with meeting ecosystem restoration objectives, (2) MAM associated with "adaptive implementation" (i.e., decisions about whether to continue or halt the restoration of tidal marsh habitat), and (3) MAM associated with permit compliance. Although USACE will cost share only activities associated with meeting ecosystem restoration objectives on non-Federal lands, all three types of MAM are important to project success and are described in this document.

This section discusses MAM as it pertains to ecosystem restoration objectives and adaptive implementation. Other aspects of MAM are discussed later in this chapter, under Risks and Uncertainty (Section 3.11 *Risks and Uncertainty*). The Shoreline Study Monitoring and Adaptive Management Plan (MAMP) for Ecosystem Restoration (Appendix F *Shoreline Study Monitoring and Adaptive Management Plan for Ecosystem Restoration*) includes a discussion of MAM's scientific basis and institutional structure, specific MAM activities, and cost estimates.

Adaptive management is an integral component of proposed tidal marsh restoration that allows lessons learned from earlier restoration phases to be incorporated as management plans are updated and the designs of future actions are developed and implemented. This approach to phased implementation acknowledges that risks and uncertainty exist and provides a framework for adjusting management decisions as the cause-and-effect linkages between management actions and the physical and biological response of the system become apparent. A key aspect of the adaptive management approach would be to avoid adverse environmental impacts by triggering specific preplanned intervention measures if monitoring reveals that the ecosystem is evolving (or is responding to prior interventions) along an undesirable trajectory. Figure 3.6-5 *Application of Monitoring and Adaptive Management during Project Implementation* illustrates how MAM would minimize potential impacts during project implementation.

As implementation of the project progresses, adaptive management would guide the selection of the final mix of habitats. Since project construction would occur over more than 14 years, later phases could reflect lessons learned from earlier actions. Adaptive management may also result in corrective measures being implemented for earlier phases.

A crucial element of the MAMP is a feedback loop between information generation (monitoring) and decision-making (adaptive management) while keeping the public informed and involved in the overall process. The loop between science and adaptive management occurs at every phase along the adaptive management process. During each phase, the project partners would assess progress toward the project objectives and decide whether to continue along the trajectory of additional tidal restoration.

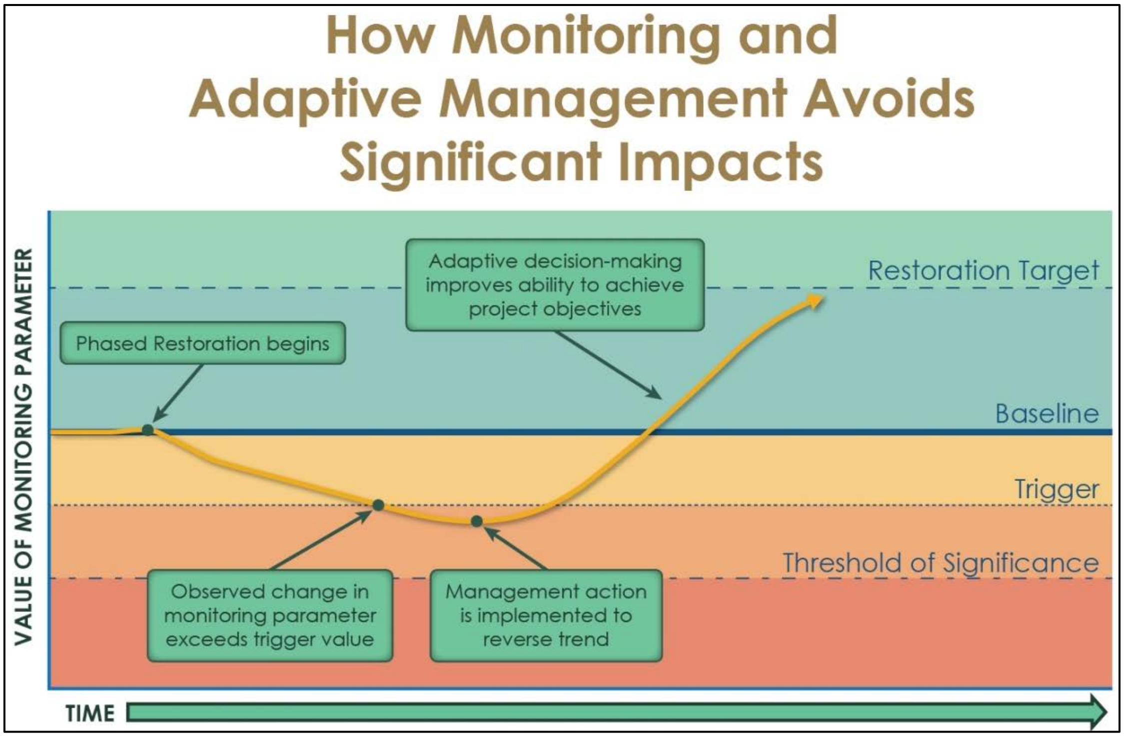

Figure 3.6-5. Application of Monitoring and Adaptive Management during Project Implementation

Adaptive management assessments would be performed as restoration actions progress to address key uncertainties. The first and second phases of pond breaches would each be followed by periods of monitoring and adaptive management. Following the third and final phase of pond breaching, monitoring and adaptive management would be ongoing (see Section 3.8.3 *Construction Schedule*). It is critical to investigate and address uncertainties during the first restoration phase, since some of the monitoring studies may take decades to generate useful information. Ongoing monitoring would provide additional information for adaptive decision-making by tracking progress toward the project objectives.

For example, if monitoring reveals that water levels inside the breached ponds are not at similar levels to waters just outside the ponds—a restoration target—potential adaptive management actions or operation and maintenance (O&M) measures might include widening breaches to encourage better tidal exchange or beginning a study session to review findings and assess whether further action is needed. At this point, if the suggested adjustments were substantial (i.e., costly), a USACE post-authorization change process could be initiated with approval from the non-Federal sponsor.

In another example, monitoring reveals that outboard mudflats are decreasing at too high a rate and would not be sufficiently replaced by the creation of inboard mudflats. Currently, outboard of the ponds are extensive mudflats that provide valuable migratory bird habitat and these would be separate from areas within the newly breached pond(s) which will likely be a mix of mudflats and shallow water habitats until further sedimentation allows marsh vegetation to establish. In a worst-case scenario, post-breaching of the ponds, the inside of a subsided pond would "steal" sediment from the existing outboard mudflats (causing habitat loss) but it would not be enough sediment to raise the bottoms within the ponds to create new, replacement mudflat. Shallow water could be the result both inside and outside the pond instead of mudflat or tidal marsh. The corrective action could then be to remove all remnant levees so that the mudflats can migrate inland into the ponds, thus replacing lost mudflat or to raise pond bottoms with imported fill. This example in particular illustrates the value of study in determining the causes and implications of loss to apply the appropriate corrective action.

In a third example, monitoring reveals that dominant native plant species cover does not get established in transition zones after the ponds have been breached for tidal marsh restoration. Adaptive management actions might include active seeding or planting on bare areas.

The adaptive management decision-making process would determine which public access features would be added as the effects on wildlife and the desire for additional trails and other public access features become better understood over time. For instance, monitoring trail use and related effects on nesting birds may result in seasonal trail access restrictions. In addition, an increase or reduction in pond dike breaches may affect trail connectivity.

The SBSP Restoration Project Management Team includes personnel who represent the specific needs of the Shoreline Study and its project area. The goals and objectives for the Shoreline Phase I Project and the SBSP Restoration Project are similar; however, the geographic footprint of the two efforts is different and each project is of independent utility. Because the Shoreline Phase I Project includes a subset of ponds that were included in the SBSP Restoration Project Programmatic EIS/EIR (specifically, Ponds A9–A15), the Shoreline Phase I MAMP draws from the monitoring and applied studies that were initiated in 2003 and continue to be conducted by the larger SBSP Restoration Project effort. Coordination of the future Shoreline Phase I Project with the SBSP Restoration Project will allow for more complete and consistent information to guide decision-making as bay-wide effects are considered. Activities related to regional changes will be conducted as the continuation of ongoing activities currently performed under the SBSP Restoration Project. Regional monitoring includes monitoring of changes to total mudflat and tidal marsh acreages, changes to bird populations and abundance, and mercury bioavailability.

The planning constraint "Do not increase the bioaccumulation of mercury in humans or wildlife within the study area over the 50-year project study period" would be addressed by the linkage of regional monitoring conducted under the SBSP Restoration Project with the concept of adaptive implementation (i.e., halting the restoration effort) under the Shoreline Study. Previous monitoring work conducted by the SBSP Restoration Project has identified mercury in a number of the ponds adjacent to the current Shoreline Study's study area, within the Alviso Pond Complex. The mercury is present due to historic mining practices upstream from San Francisco Bay. The concern illustrated by the constraint is that cumulative tidal marsh restoration actions along the South Bay (conducted by the SBSP Restoration Project and others) will release mercury in the sediments to an extent where additional tidal marsh restoration activity should be halted. This is a major issue with regional regulatory agencies and a condition placed on local restoration permits. The mercury issue is integral to plan formulation because it has a potential to change the timing of, or halt the progress of tidal marsh restoration in the Shoreline Study - this point is acknowledged in the monitoring and adaptive management plan (although the USACE will not cost share in any monitoring or corrective activities involving mercury).

3.6.11 Criteria for Evaluation and Screening of Ecosystem Restoration Options

P&G criteria (completeness, effectiveness, efficiency, and acceptability) was used to evaluate the ecosystem restoration options and to determine which options would move forward as building blocks for the final array of combined alternatives. These criteria were applied based on the discussion provided in Section 3.5.4 (*Evaluation and Screening Criteria for Flood Risk Management Measures and Options*), with the exception of the efficiency criterion. For ecosystem restoration, efficiency is measured not by comparing monetized benefits to costs, but by comparing quantified habitat outputs to costs.

At the ecosystem restoration option screening phase, the concept of economic efficiency was applied to screen out a particular option if another option provided a similar level of benefits at a lower cost or provided a higher level of benefits at the same or a lower cost. The efficiency criterion at the screening phase is used to ensure that the most cost-efficient options are included as components in the final array of alternatives.

The efficiency of ecosystem restoration options were evaluated by comparing their costs to ecosystem restoration outputs. To determine the best approach to quantifying ecosystem restoration benefits in accordance with USACE planning policy, the project sponsors engaged internal USACE resources, the resource agencies, and a consultant to examine the different available methods for evaluating the value of tidal wetlands. Of these methods, the Combined Habitat Assessment Protocols (CHAP) provided the most complete and sophisticated approach to evaluating fish and wildlife habitat value, and had the additional advantage that USACE planning certification of this model for regional use was in progress. Development and certification of new models to evaluate ecosystem restoration outputs for this study was judged to be impractical given the study schedule and budget. Costs include preconstruction engineering and design, real estate, construction, and ongoing operation, maintenance, and rehabilitation. The CHAP analysis and preceding landscape evolution analysis used a 50-year evaluation period running from 2017 to 2067[7], with construction starting in 2017 and benefits accruing from 2020 to 2067. Effects on ecosystem restoration benefits from this a change in the base year would be nearly identical across all four alternatives due to their similar ER measures and the slow rate of change for environmental conditions affecting the ER process after breaching of ponds. This issue is discussed further in the Combined Habitat Assessment Protocols (CHAP) Results for the With-Project and Without-Project Conditions report in Appendix B2 (*Environmental Benefits Analysis [CHAP] Summary and Model Outputs).* Unlike

[7] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

the FRM options, however, benefits arising from an ecosystem restoration are not monetized. The ecosystem restoration outputs are calculated using the CHAP, which received approval from the HQUSACE Model Certification Team on February 25, 2014, for single-use application in the Shoreline Phase I Study.

CHAP is a method developed by the Northwest Habitat Institute (NHI) for quantifying the value of habitat for wildlife. It builds on older methods such as the USFWS's Habitat Evaluation Procedures (HEP) and the Habitat Accounting and Appraisal (HAB) method. While HEP extrapolates habitat quality from a single species model, CHAP relies on a broad inventory of the ecosystem functions and vertebrate species found in a given habitat area. The habitat team can recommend expanding the species list to include ecologically important invertebrate species. CHAP looks at both the requirements of individual species (Key Ecological Correlates or KECs) and the functions these species provide for their ecosystem (Key Ecological Functions or KEFs). The KEC values are tabulated from the field inventory data for each polygon. Field data forms support consistent identification and recording of all potential functions present for each polygon. This approach reduces errors associated with incorrect sampling or measurements. The field inventory supports cover type validation and revision when appropriate. The KEF values are the number of interactions between vertebrate species, their habitat, and functions as a component of calculating habitat units. These interactions have been tabulated in the Interactive Habitat and Biodiversity Information System (IBIS). IBIS is a peer-review database of Northwest fish, wildlife, and their habitats managed by the Northwest Habitat Institute (www.nwhi.org). CHAP currently does not include local modules for evaluating the synergy of ecotones (edge habitat), where the boundary between two habitat types has a higher benefit for species of interest. The habitat team did not have the resources to identify additional field inventory functions (KEFs) or develop calculations for capturing the ecotone benefits for transitional marsh habitat. The transitional tidal marsh habitat is highly important, with technical and institutional significance, to provide habitat that has been lost throughout the Bay Area.

Efficiency in ecosystem restoration is evaluated through a cost-effectiveness/incremental cost analysis (CE/ICA), which evaluates the relationship between additional monetary investment in ecosystem restoration and the additional outputs generated. The CE/ICA was performed using the USACE-certified version of Institute for Water Resources Planning Suite (version 2.0.6.1). A NED-style benefit-cost analysis is not appropriate for ecosystem restoration studies because the costs and benefits are expressed in different units. The CE/ICA is based on the concept that there are incremental levels of investment represented in an array of options (or alternatives) and that, as the level of investment increases, so will the outputs. Not all incremental investments will be "worth it," however, because some increments will cost more than others. The cost-effectiveness step of the CE/ICA addresses *effectiveness*, meaning that, if outputs do not increase as cost increases, the added element is not cost-effective. The ICA step addresses *efficiency* by calculating the cost per unit of output as project elements are added. The ICA evaluates if additional outputs justify the additional costs incurred and identifies the "Best Buy" plans (i.e., potential NER plans).

3.6.12 Results of Screening Ecosystem Restoration Options

The process of breaching each pond will include grading down exterior levees to near MHHW and breaching of the levees at several locations. This will result in full tidal action being restored to the pond. Because the ponds are subsided, they will consist initially of tidal mudflats (inundated for most of the tidal cycle) and subtidal habitat, totally about 1,000 acres for the two ponds.

The portions of the graded-down levees, other levees adjoining the pond, and the ecotone that are located between approximately mean tidal level and the upper extreme of high tides will quickly develop marsh vegetation. Within approximately one year, about 50 acres of new marsh will have developed. Subsequently, habitat development will proceed more slowly as sediment gradually accumulates within the pond. As the pond bottom gradually reaches sufficient elevation to support marsh vegetation, areas of such vegetation will gradually expand. However, substantial areas of marsh are not expected to develop on the pond bottoms until much later.

3.6.12.1 In-pond Preparation Prior to Breaching

The basic level of in-pond preparation met the all of the screening criteria and was retained for inclusion in the final array of alternatives.

The accelerated in-pond preparation measure meets ecosystem restoration objectives (as a building block for ecosystem restoration options) and is effective (i.e., would generate net environmental benefits), but was eliminated based on the efficiency criterion.

The environmental benefits analysis (CHAP; Appendix B2 *Environmental Benefits Analysis [CHAP] Summary and Model Outputs*) did not show increased benefits as a result of adding in-pond preparation features beyond what is included in the basic in-pond preparation measure. Therefore, the accelerated in-pond preparation measure shows the same level of benefits as the basic in-pond preparation measure at a greater cost. The level of Federal investment therefore includes the basic in-pond preparation measure.

Because the Federal cost share is represented at the basic in-pond preparation level, the non-Federal sponsor would need to pay 100 percent of the costs associated with in-pond preparation above the basic measure. The non-Federal sponsor determined that the basic in-pond preparation measure meets its objectives (as well as Federal objectives) and therefore would not pursue the accelerated measure.

3.6.12.2 Transitional Habitat

The bench refugia measure met all of the screening criteria and was retained.

The 30:1 ecotone met the completeness, effectiveness, and acceptability criteria but did not meet the efficiency criterion because the environmental benefits analysis (CHAP), absent the addition of modules to evaluate the synergy of ecotones, did not show additional benefits when adding an ecotone to the project relative to the benefits provided by the less-extensive and less-expensive bench transitional habitat measure. For purposes of plan formulation and evaluation, the model considered non-tidal habitat values as zero because the goal objective of ecosystem restoration in this area is to return convert more habitat to tidal marsh. Once the tidal marsh habitat was considered effective, then a 30:1 ecotone was proposed as a transitional habitat feature between the tidal marsh and the FRM levee. Given resources constraints that prevented development of ecotone functions and calculations for capturing benefits, CHAP results did not distinguish between two beneficial habitat types, where tidal habitat is the ideal transition. Specifically, greater areas and gentler slopes of fill crossing the tidal/upland interface provide an opportunity to create tidal marsh and transitional habitats that natural sedimentation would not create, because of low pond bottom elevations and limits to the elevation range of sediment deposition. As a result of the efficiency analysis to date, the level of Federal investment was left with the bench refugia measure, and with the additional cost of implementing an ecotone as a non-Federal expense.

The preliminary estimated costs (October 2013 price levels) used for the comparison of these features are:

1. Bench refugia: $0 (incidental to construction of the FRM levee and included in the levee construction cost)
2. Medium (30:1) ecotone: about $21 million
3. High (100:1) ecotone: about $300 million

The cost estimates assume enough material would be available on-site to construct the bench refugia measure and 30:1 ecotone. The cost estimate for the 100:1 ecotone assumes that there is not enough material on-site to construct that large an ecotone and that additional material would need to be purchased and brought to the project site. The non-Federal sponsors have decided that it is willing to bear the additional cost of the 30:1 ecotone but not of the 100:1 ecotone. The non-Federal sponsors have determined that the ecotone with the 30:1 side slopes is preferable to the bench refugia measure based on habitat objectives established in the SBSP Restoration Project planning process. Therefore, the bench and 30:1 ecotone measures were retained for inclusion in the final array, but the 100:1 ecotone was eliminated from further consideration.

3.6.12.3 Cost-Effectiveness/Incremental Cost Analysis

Ecosystem restoration projects incur the same types of financial costs as a traditional USACE project, costs such as preconstruction engineering and design, real estate, construction, and ongoing operation, maintenance, and rehabilitation. However, unlike for a traditional project, benefits arising from an ecosystem restoration project are not monetized. According to USACE *Planning Guidance Notebook*:

> Contributions to national ecosystem restoration (NER outputs) are increases in the net quantity and/or quality of desired ecosystem resources. Measurement of NER is based on changes in ecological resource quality as a function of improvement in habitat quality and/or quantity and expressed quantitatively in physical units or indexes (but not monetary units).

A benefit-cost analysis—a comparison of net benefits and costs of each plan (or option, in the case of this study)—cannot be performed during ecosystem restoration studies because the costs and benefits are expressed in different units. Although a benefit-cost analysis is considered ideal in USACE plan evaluation, cost-effectiveness and incremental cost analyses (CE/ICA) provide essential information for decision-making in its absence.

In order to determine the contribution of a particular project to the Environmental Quality account, it is necessary to characterize and rank the cost-effectiveness of the various options that are part of a particular study. That is, each option can generally be a combination of measures, the sum of which has a particular level of habitat value and a particular monetary cost associated with it. A cost-effectiveness analysis is simply a way of finding, for a given level of habitat output, those combinations of restoration measures that provide the best value.

The first step is to identify options that are inefficient in production and remove them from consideration; this is the cost-effectiveness analysis. An option is defined as inefficient when another option provides the same or greater level of output at less cost. The incremental cost analysis then compares the cost of increasing output between each option. This process helps decision-makers understand cost changes as output levels are increased.

Table 3.6-1 *Costs and Outputs of Restoration Measures* shows the inputs to the CE/ICA. For each measure, the table shows the monetary cost and the environmental output. The environmental output results come from the CHAP model. More information about this model is provided in Appendix B2 *Environmental Benefits Analysis (CHAP) Summary and Model Outputs*.

Seven of the eight ponds being considered for tidal restoration are contiguous (Ponds A9-A15). These ponds formerly were one large tidal marsh, with tidal inflow and drainage provided by numerous small sloughs connecting the interior of the marsh to Alviso Slough and Coyote Creek. Diking of the marsh severed these sloughs at multiple points but did not destroy them.

The perimeter dikes around this cluster of ponds are larger as they must withstand tides and waves from San Francisco Bay. Dikes between ponds are much smaller, and are not capable of withstanding the open waters of the Bay without substantial reinforcement beforehand.

Upon diking of the area for salt production, water control structures were installed to allow brine to proceed sequentially through the ponds on its way to eventual crystallization offsite. These structures were modified upon reconfiguration of the ponds for wildlife use after Federal acquisition.

Thus, restoration of the ponds to tidal action requires consideration of available water control structures, existing dikes, and tidal drainage after breaching. The cost of restoring any given pond is closely related to which adjacent ponds are also restored and in which sequence. Evaluation of the cost-effectiveness of restoring each pond in every possible combination and sequence with other ponds would require evaluation of a very large number of obviously impractical or inefficient combinations of ponds, including development of cost information for all such combinations, which is not necessarily additive.

In addition, clustering and sequencing of pond groupings without reference to future tidal circulation would produce many combinations that would have impaired habitat restoration due to drainage problems. Therefore, pond combinations and restoration sequences were formulated for this area that would utilize existing water infrastructure, historic drainage divides, and former tidal channels to facilitate efficient phased restoration of pond groupings. These restoration increments are A12, A9-A11, and A13-A15, with restoration proceeding in that order

Appendix B1 *Shoreline Study Preliminary Alternatives and Landscape Evolution Memo* includes the output of digital elevation models that were used to project the evolutionary progressions of individual ponds. The landscape evolution modeling and the subsequent CHAP analysis were based on the sequencing of pond restoration presented in the draft Integrated Report (i.e., Pond A12 in first increment of restoration). Subsequently, the pond restoration sequence was adjusted so that Pond A12 and A18 would both be restored initially. This was done to accelerate initial marsh restoration in Pond A18, to more quickly address the initial loss of wetlands caused by FRM levee construction early in project construction.

Pond A18 is not contiguous to the other ponds and can be restored at any time without directly affecting restoration costs or benefits for other ponds. Tidal restoration of this pond was therefore evaluated as a separate increment of ecosystem restoration.

Table 3.6-1 *Costs and Outputs of Restoration Measures* lists the cost and restoration output associated with restoration of each of the groups with two different scales or features for each group. For each pond group, the two options are basic pond restoration and basic pond restoration with a 30:1 slope ecotone. Two additional options were also considered for each pond: accelerated restoration and a 100:1 slope ecotone. Absent additional KEFs and associated calculations for capturing subject benefits, the CHAP, as applied, was generally unable to demonstrate that additional costs associated with accelerating restoration or adding an ecotone would result in additional environmental outputs. Although this was also true for the 30:1 slope ecotone, this option was carried forward for detailed analysis in the CE/ICA because it was identified as important to the non-Federal sponsors and was potentially part of a LPP.

The costs and benefits of the increments are presented in Table 3.6-1 *Costs and Outputs of Restoration Measures.*

Table 3.6-1. Costs and Outputs of Restoration Measures

Restoration Measure	Total Cost	Output (CHAP)	AAC 3.375%	AAC/AAHU
No Action	$0	N/A		
Pond A12 basic restoration	$3,927,540	6,171	$163,689	$27
Pond A12 basic restoration w/ ecotone (30:1)	$14,670,402	6,115	$611,422	$100
Ponds A9 - A11 basic restoration	$11,514,519	15,356	$479,894	$31
Ponds A13 - A15 basic restoration	$10,698,311	12,403	$445,876	$36
Ponds A13 - A15 basioc restoration w/ecotone (30:1) *	$12,833,776	12,400	$534,877	$43
Pond A18 basic restoration	$8,338,038	14,577	$347,507	$24
Pond A18 basic restoration w/ecotone (30:1)	$31,114,203	14,437	$1,296,755	$90

Table is excerpted from Appendix C *Economics*; all dollars rounded to nearest whole dollar; October 2013 price levels.

CHAP=Combined Habitat Assessment Protocol; AAC=Average Annual Cost; AAHU=Average Annual Habitat Units.

CHAP outputs reflect change in fish and wildlife value resulting from an increase in tidal habitat associated with specific restoration actions. The values are annualized over the 50-year study period. Individual units cannot be defined separately from the CHAP computational process but are provided here as a means of comparing modeled environmental outputs in relation to other restoration options.

In order to perform the analysis, it is necessary to describe which measures are combinable, not combinable, dependent, and independent. Following extensive discussions, the following logic was applied in the CE/ICA model:

- Pond A18 could be implemented independently but is combinable with any of the other measures.
- Pond A12 could be implemented independently but is combinable with any other measures of the same scale (basic, accelerated, etc.).
- Ponds A9–A11 are dependent on Pond A12, meaning they would be implemented only with Pond A12.
- Ponds A13–A15 are dependent on Ponds A9–A11 and A12, meaning that they would be implemented only with the Ponds A9–A11 and A12.

Given the relationships and constraints specified above, including the No Action Plan, there are 27 possible combinations of measures; therefore, there are 27 possible options. As noted, the CHAP model was generally unable to demonstrate that additional costs associated with accelerating restoration or adding an ecotone would result in additional environmental outputs. In fact, for Pond A12, Ponds A13–A15, and Pond A18, the model shows that additional cost and additional features result in the same or fewer average annual outputs. This model result does not reflect the real-world result. For example, by implementing the restoration more quickly, an accelerated phased restoration should result in a greater average annual restoration value than a slower phased restoration (i.e., basic phased restoration).

3.6.12.3.1 Cost-Effectiveness Analysis

Table 3.6-2 *All Possible Ecosystem Restoration Plan Combinations* shows the list of combinations of all ecosystem measures in increasing order of output. Cost-effective combinations are those that, for a given level of output, can be produced more cheaply. Since none of the combinations have the same exact output, none of the alternatives are screened out based on this criterion.

Table 3.6-2. All Possible Ecosystem Restoration Plan Combinations

Plan	Output (HUs)	AAC
(A12 with Ecotone)	6,115	$611,422
A12	6,171	$163,689
(A18 with Ecotone)	14,437	$1,296,755
A18	14,577	$347,507
(A18 with Ecotone) + (A12 with Ecotone)	20,552	$1,908,177
(A18 with Ecotone) + A12	20,608	$1,460,444
A18 + (A12 with Ecotone)	20,692	$958,929
A18 + A12	20,748	$511,196
(A12 with Ecotone) + (A9-A11)	21,471	$1,091,316
A12 + (A9-A11)	21,527	$643,583
(A12 + Ecotone) + (A9-A11) + (A13+A15 with Ecotone)	33,871	$1,626,192
(A12 + Ecotone) + (A9-A11) + (A13-A15)	33,874	$1,537,192
A12 + (A9-A11) + (A13-A15 with Ecotone)	33,927	$1,178,459
A12 + (A9-A11) + (A13-A15)	33,931	$1,089,459
(A18 with Ecotone) + (A12 with Ecotone) + (A9-A11)	35,908	$2,388,070
(A18 with Ecotone) + A12 + (A9-A11)	35,964	$1,940,337
A18 + (A12 with Ecotone) + (A9-A11)	36,048	$1,438,822
A18 + A12 + (A9-A11)	36,104	$991,089
(A18 with Ecotone) + (A12 + Ecotone) + (A9-A11) + (A13+A15 with Ecotone)	48,308	$2,922,947
(A18 with Ecotone) + (A12 + Ecotone) + (A9-A11) + (A13-A15)	48,311	$2,833,947
(A18 with Ecotone) + A12 + (A9-A11) + (A13-A15 with Ecotone)	48,364	$2,475,214
(A18 with Ecotone) + A12 + (A9-A11) + (A13-A15)	48,368	$2,386,214
A18 + (A12 + Ecotone) + (A9-A11) + (A13+A15 with Ecotone)	48,448	$1,973,699
A18 + (A12 + Ecotone) + (A9-A11) + (A13-A15)	48,451	$1,884,699
A18 + A12 + (A9-A11) + (A13-A15 with Ecotone)	48,504	$1,525,966
A18 + A12 + (A9-A11) + (A13-A15)	48,508	$1,436,966

HUs=Habitat Units; AAC=Average Annual Cost

Figure 3.6-6 *Cost-Effective and Best Buy Plans* is a scatterplot of the restoration measure combinations (27 options) as shown in the program Institute for Water Resources Planning Suite. The costs shown in the figures and tables of the cost-effectiveness and incremental cost analysis are in average annual terms.

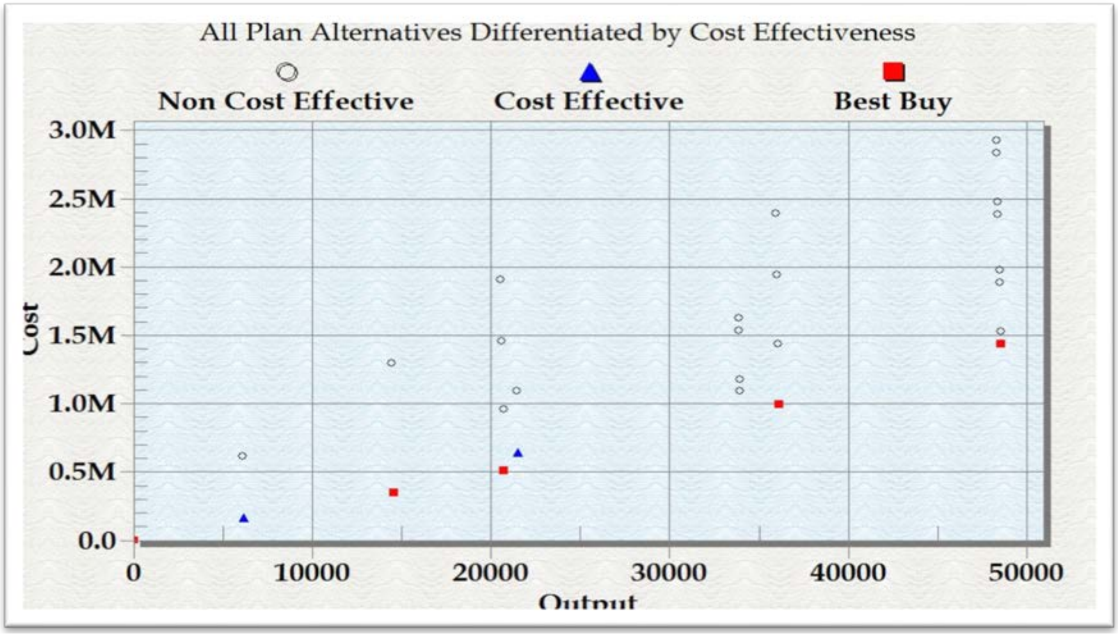

Figure 3.6-6. Cost-Effective and Best Buy Plans

After the inefficient combinations are screened, the remaining combinations are then screened for those that are termed "ineffective" in production. Ineffective plans are those for which greater output can be produced at a lesser or equal cost. Table 3.6-3 *CE/ICA – Identification of Cost-Effective Plans* shows those plans that were screened out as a result of being designated as ineffective. The six plans highlighted in red are the remaining cost-effective plans.

Table 3.6-3. CE/ICA – Identification of Cost-Effective Plans

Plan	Output (HUs)	AAC	Cost Effective?
(A12 with Ecotone)	6,115	$611,422	No
A12	6,171	$163,689	Yes
(A18 with Ecotone)	14,437	$1,296,755	No
A18	14,577	$347,507	Yes
(A18 with Ecotone) + (A12 with Ecotone)	20,552	$1,908,177	No
(A18 with Ecotone) + A12	20,608	$1,460,444	No
A18 + (A12 with Ecotone)	20,692	$958,929	No
A18 + A12	20,748	$511,196	Yes
(A12 with Ecotone) + (A9-A11)	21,471	$1,091,316	No
A12 + (A9-A11)	21,527	$643,583	Yes
(A12 + Ecotone) + (A9-A11) + (A13+A15 with Ecotone)	33,871	$1,626,192	No
(A12 + Ecotone) + (A9-A11) + (A13-A15)	33,874	$1,537,192	No
A12 + (A9-A11) + (A13-A15 with Ecotone)	33,927	$1,178,459	No
A12 + (A9-A11) + (A13-A15)	33,931	$1,089,459	No
(A18 with Ecotone) + (A12 with Ecotone) + (A9-A11)	35,908	$2,388,070	No
(A18 with Ecotone) + A12 + (A9-A11)	35,964	$1,940,337	No
A18 + (A12 with Ecotone) + (A9-A11)	36,048	$1,438,822	No
A18 + A12 + (A9-A11)	36,104	$991,089	Yes
(A18 with Ecotone) + (A12 + Ecotone) + (A9-A11) + (A13+A15 with Ecotone)	48,308	$2,922,947	No
(A18 with Ecotone) + (A12 + Ecotone) + (A9-A11) + (A13-A15)	48,311	$2,833,947	No
(A18 with Ecotone) + A12 + (A9-A11) + (A13-A15 with Ecotone)	48,364	$2,475,214	No
(A18 with Ecotone) + A12 + (A9-A11) + (A13-A15)	48,368	$2,386,214	No
A18 + (A12 + Ecotone) + (A9-A11) + (A13+A15 with Ecotone)	48,448	$1,973,699	No
A18 + (A12 + Ecotone) + (A9-A11) + (A13-A15)	48,451	$1,884,699	No
A18 + A12 + (A9-A11) + (A13-A15 with Ecotone)	48,504	$1,525,966	No
A18 + A12 + (A9-A11) + (A13-A15)	48,508	$1,436,966	Yes

3.6.12.3.2 Incremental Cost Analysis

Table 3.6-4 *CE/ICA – Identification of First Best Buy Plan* shows the six cost-effective plans and their output, cost, and average annual cost per unit of output over the No Action Plan. The highlighted plan (A18) is identified as the first Best Buy plan because it has the lowest incremental cost per unit of output over the No Action Plan.

Table 3.6-4. CE/ICA – Identification of First Best Buy Plan

Plan	Output (HUs)	AAC	AAC/AAHU
A12	6,171	$163,689	$26.52
A18	14,577	$347,507	$23.84
A18 + A12	20,748	$511,196	$24.64
A12 + (A9-A11)	21,527	$643,583	$29.90
A18 + A12 + (A9-A11)	36,104	$991,089	$27.45
A18 + A12 + (A9-A11) + (A13-A15)	48,508	$1,436,966	$29.62

The next Best Buy Plan is identified by calculating and comparing the incremental cost per unit of output over the last identified Best Buy plan (A18). The green highlighted plan in Table 3.6-5 *CE/ICA – Identification of Second Best Buy Plan*, which consists of restoration of Ponds A18 and A12, has the lowest incremental cost per unit compared to the first Best Buy Plan.

Table 3.6-5. CE/ICA – Identification of Second Best Buy Plan

Plan	Output (HUs)	AAC	Incr. HUs over Last Best Buy	Incr. AAC over Last Best Buy	Incr. AAC/HU over Last Bust Buy
A18	14,577	$347,507	14577	$347,507	$23.84
A18 + A12	20,748	$511,196	6171	$163,689	$26.52
A12 + (A9-A11)	48,311	$2,833,947	33734	$2,486,440	$73.71
A18 + A12 + (A9-A11)	36,104	$991,089	21527	$643,583	$29.90
A18 + A12 + (A9-A11) + (A13-A15)	48,508	$1,436,966	33931	$1,089,459	$32.11

Table 3.6-6 *Summary of Best Buy Plans, Annualized Values* shows the final results of the CE/ICA. As shown, there are four Best Buy plans. The table shows both costs and outputs in annual terms. Basic restoration of Pond A18 is the first Best Buy plan, followed sequentially by the incremental addition of basic restoration of Ponds A12, A9–A11, and A13–A15. Figure 3.6-7 *Plot of Cost-Effective Plans – Institute for Water Resources Plan Model Results* shows the results of the CE/ICA analysis, identifying all of the cost-effective and Best Buy plans. In addition, it also shows the results for non-cost-effective plans. Restoration of Pond A18 with a 30:1 ecotone and restoration of all ponds with a 30:1 ecotone are also shown on the graph, since these plans are of interest as potential LPP options.

Table 3.6-6. Summary of Best Buy Plans, Annualized Values

Plan	Output (HUs)	AAC	Incr. HUs	Incr. AAC	Incr. AAC/AAHU
A18	14,577	$347,507	14,577	$347,507	$23.84
A18 + A12	20,748	$511,196	6,171	$163,689	$26.52
A18 + A12 + (A9-A11)	36,104	$991,089	15,356	$479,894	$31.25
A18 + A12 + (A9-A11) + (A13-A15)	48,508	$1,436,966	12,403	$445,876	$35.95

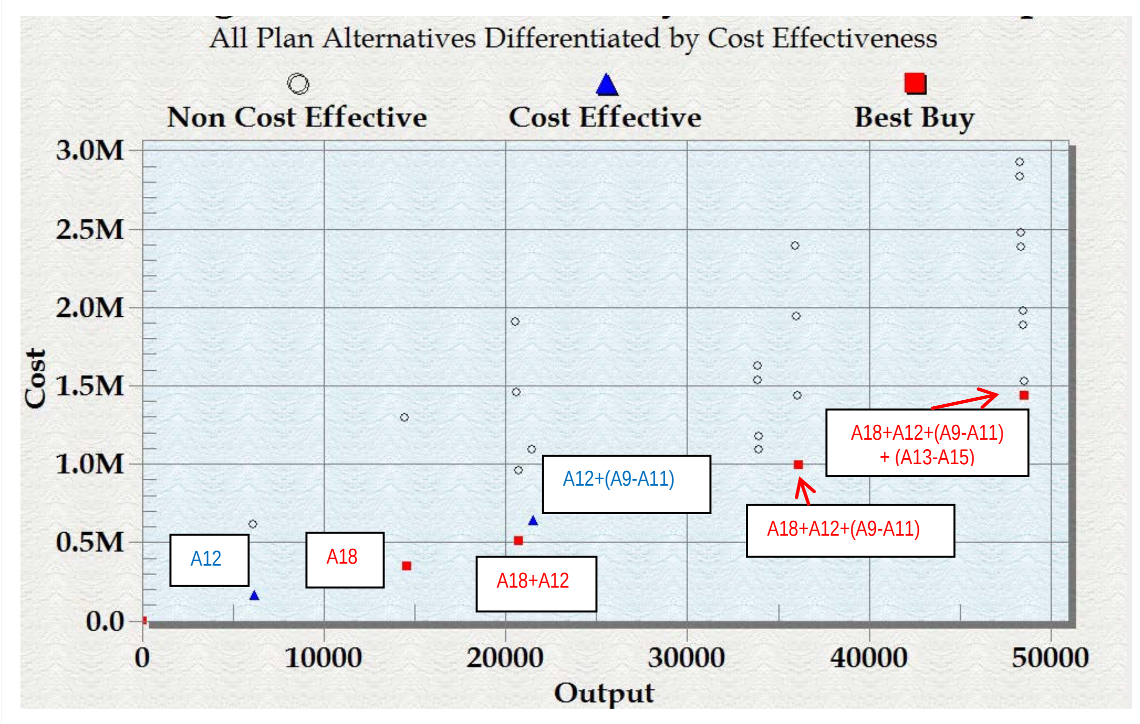

Figure 3.6-7. Plot of Cost-Effective Plans – Institute for Water Resources Plan Model Results

Figure 3.6-8 *Best Buy Plans and Incremental Cost per Unit* shows a box plot of the incremental average annual cost per incremental gain in output for the four Best Buy plans. Of particular note for this graph is that the increases in incremental costs per output are relatively minor for successively larger Best Buy plans.

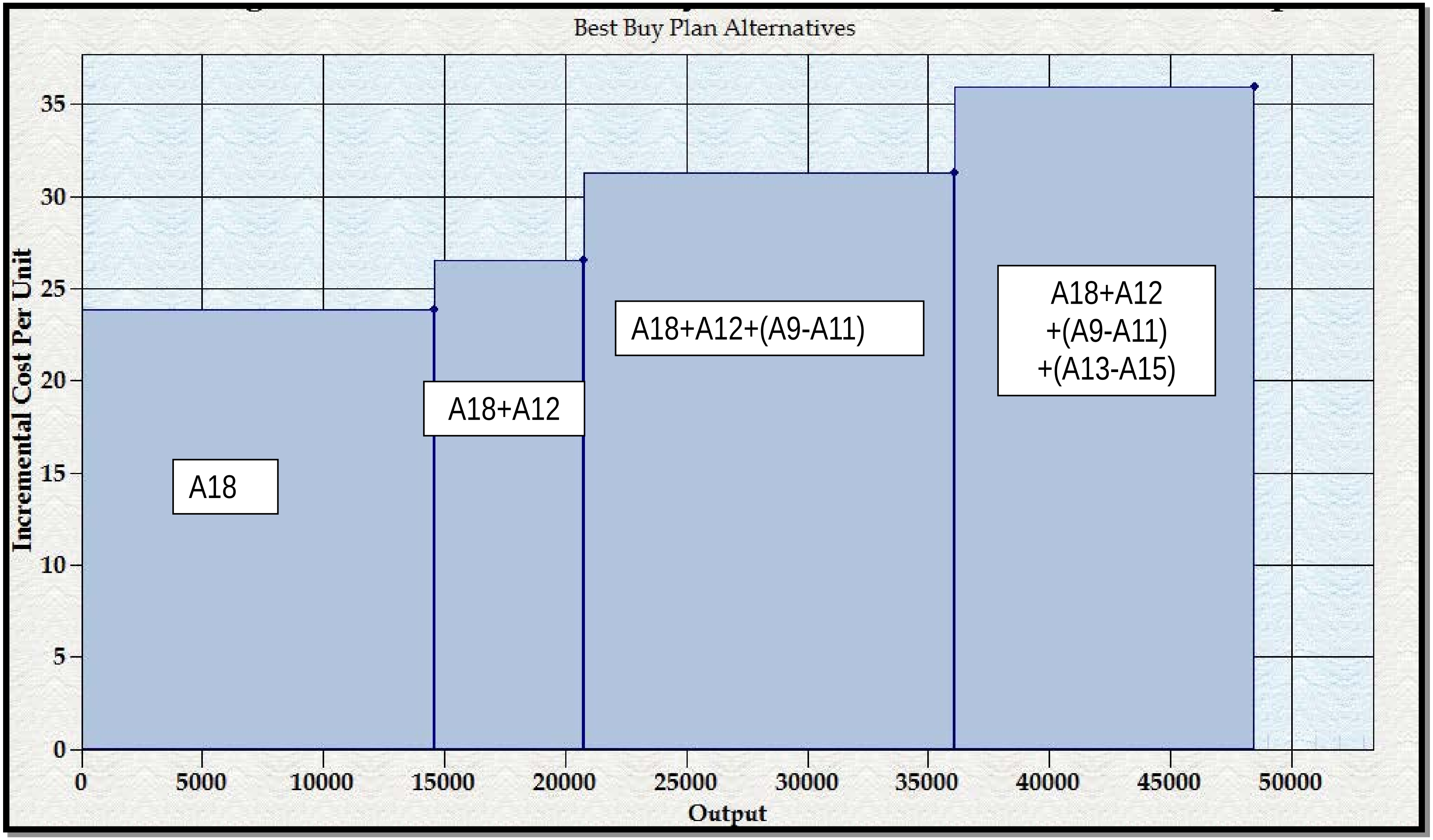

Figure 3.6-8. Best Buy Plans and Incremental Cost per Unit

3.6.12.4 National Ecosystem Restoration

The Planning Guidance Notebook describes the selection of the NER Plan as follows:

> For ecosystem restoration projects, a plan that reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the Federal objective, shall be selected. The selected plan must be shown to be cost-effective and justified to achieve the desired level of output. This plan shall be identified as the National Ecosystem Restoration (NER) Plan.

According to the USACE policy quoted above, the NER Plan should be selected from among the identified cost-effective plans. In practice, the NER Plan is also typically selected from the subset of Best Buy plans. Other solutions identified as non–cost effective in cost-effectiveness analysis, as well as cost-effective plans identified as relatively less efficient in production ("non-Best Buys") in incremental analysis, may, however, continue to be considered for selection.

The six cost-effective plans consist of combinations of basic restoration of the four pond groupings. The four best buy plans involve basic phased restoration of one or up to all four pond groupings. The selected NER option is the largest of the Best Buy Plans, which includes basic phased restoration of all of the pond complexes. As shown in the results of the CE/ICA analysis, the incremental cost per output for the largest plan is modest relative to the smaller Best Buy Plans (i.e., there is not a significant break in the incremental cost curve). The key question is whether these incremental costs are worth the incremental output. The largest Best Buy Plan has a large area of land and the inclusion of the additional pond complex which has important environmental outputs that, according to the State Coastal Conservancy, are critical to the regional restoration effort.

As previously discussed, the CHAP application to date does not include the synergy of ecotones (edge habitat), where the boundary between two habitat types has a higher benefit for species of interest. Therefore, the results do not show additional environmental outputs for restoration measures beyond the baseline restoration of basic in-pond restoration or with addition of an ecotone. Based on current ecological understandings, the environmental community expects that there would, in fact, be an increase in annual habitat outputs as a result of accelerating the restoration process within the pond groupings. However, it is expected that the inclusion of an ecotone would provide a more complete and sustainable restoration plan.

3.7 Final Array of Alternatives

The results of screening of FRM and ecosystem restoration options were used to assemble the final array of alternatives. Screening also reduced the number of measures carried into alternatives. For tidal FRM, the option (combination of measures) that represents the NED includes the Alviso North levee, Artesian Slough tide gate closure system, and the WPCP South levee, with all levees at 12.5 feet NAVD 88 in height. The non-Federal sponsors requested that the Alviso Railroad Spur and Alviso South alignments and 15.2-foot NAVD 88 levee height be included in the final array of alternatives. For ecosystem restoration, the option (combination of measures) that represents the NER is all ponds (A9–A15, A18) combined with basic in-pond preparation. The non-Federal sponsors requested that the 30:1 ecotone also be included in the final array of alternatives.

The No Action options for both tidal FRM and ecosystem restoration were combined to create the No Action Alternative in the final array of alternatives. The remaining four FRM action options (which included three levee alignments and two levee height options) and two ecosystem restoration options were combined to produce the final array of alternatives (Table 3.7-1 *Final Array of Alternatives to Be Carried through Integrated Document for Detailed Evaluation*). Figure 3.7-1 *Alternative 2 – Alviso North with 12.5-foot Levee and Bench; UPRR Flood Gate; Artesian Slough Tide Gate; WPCP South with 12.5- foot Levee and Bench; Restoration of Ponds A9–A15 and A18; and Recreational Features* through Figure 3.7-4 *Alternative 5 – Alviso South with 15.2-foot Levee; Bench; UPRR Flood Gate; Artesian Slough Tide Gate; WPCP South with 15.2- foot Levee and Bench; Restoration of Ponds A9–A15 and A18; and Recreational Features* provide graphic representations of each of the action alternatives, including both FRM and related transitional habitat features. The components of each alternative are described in Section 3.8 *Action Alternatives Component Details*. Recreation features, which are the same across all action alternatives, are described in Section 3.7.1 *Recreation Measures* and displayed in Figure 3.7 6 *Future Project Area Recreational Trails System*.

The bench refugium—included in Alternatives 2, 4, and 5—is predicated on being in a tidal environment, which New Chicago Marsh is not. Excess material from excavation of the new levee for Alternatives 4 and 5 where the alignments go through New Chicago Marsh would need to be placed somewhere. In Alternatives 2, 4, and 5, the proposed bench would follow an existing berm that tracks north along the east side of Pond A12 and then turns east into the southeastern corner of Pond A13 due to the existence of a tidal environment (Figure 3.7-3 *Alternative 4 – Alviso Railroad with 15.2-foot Levee; Bench; UPRR Flood Gate; Artesian Slough Tide Gate; WPCP South with 15.2- foot Levee and Bench; Restoration of Ponds A9–A15 and A18; and Recreational Features* and Figure 3.7-4 *Alternative 5 – Alviso South with 15.2-foot Levee; Bench; UPRR Flood Gate; Artesian Slough Tide Gate; WPCP South with 15.2- foot Levee and Bench; Restoration of Ponds A9–A15 and A18; and Recreational Features*).

Alternatives 2 through 5 include actions that would be implemented by the USACE and the non-Federal sponsors on USFWS and City lands. A bench would not be constructed along Pond A16 because this managed pond was addressed by the SBSP Restoration Project, with the goal of enhancing managed pond habitat, not restoring tidal marsh.

Table 3.7-1. Final Array of Alternatives to Be Carried through Integrated Document for Detailed Evaluation

Alternatives		Flood Risk Management			Ecosystem Restoration	
Alternative	Summary	Alviso Alignment	Levee Height (feet; NAVD 88)	Transitional Habitat	In-pond Preparation	Transitional Habitat
1	No Action – No tidal flood risk management or ecosystem restoration features	None	N/A	None	None	None
2	Alviso North, Artesian Slough Tide Gate System, UPRR Flood Gate, WPCP South with 12.5- foot levee and bench + Basic Restoration of Ponds A9–A15 and A18	North	12.5	50-foot-wide bench	Basic	N/A
3	Alviso North, Artesian Slough Tide Gate System, UPRR Flood Gate, WPCP South with 15.2- foot levee and 30:1 ecotone + Basic Restoration of Ponds A9–A15 and A18	North	15.2	N/A	Basic	Ecotone with 30:1 side slopes
4	Alviso Railroad, Artesian Slough Tide Gate System, UPRR Flood Gate, WPCP South with 15.2- foot levee and bench + Basic Restoration of Ponds A9–A15 and A18	Railroad Spur	15.2	50-foot-wide bench	Basic	N/A
5	Alviso South, Artesian Slough Tide Gate System, UPRR Flood Gate, WPCP South with 15.2- foot levee and bench + Basic Restoration of Ponds A9–A15 and A18	South	15.2	50-foot-wide bench	Basic	N/A

WPCP = Water Pollution Control Plant, now referred to in text as the Wastewater Facility; N/A = not applicable

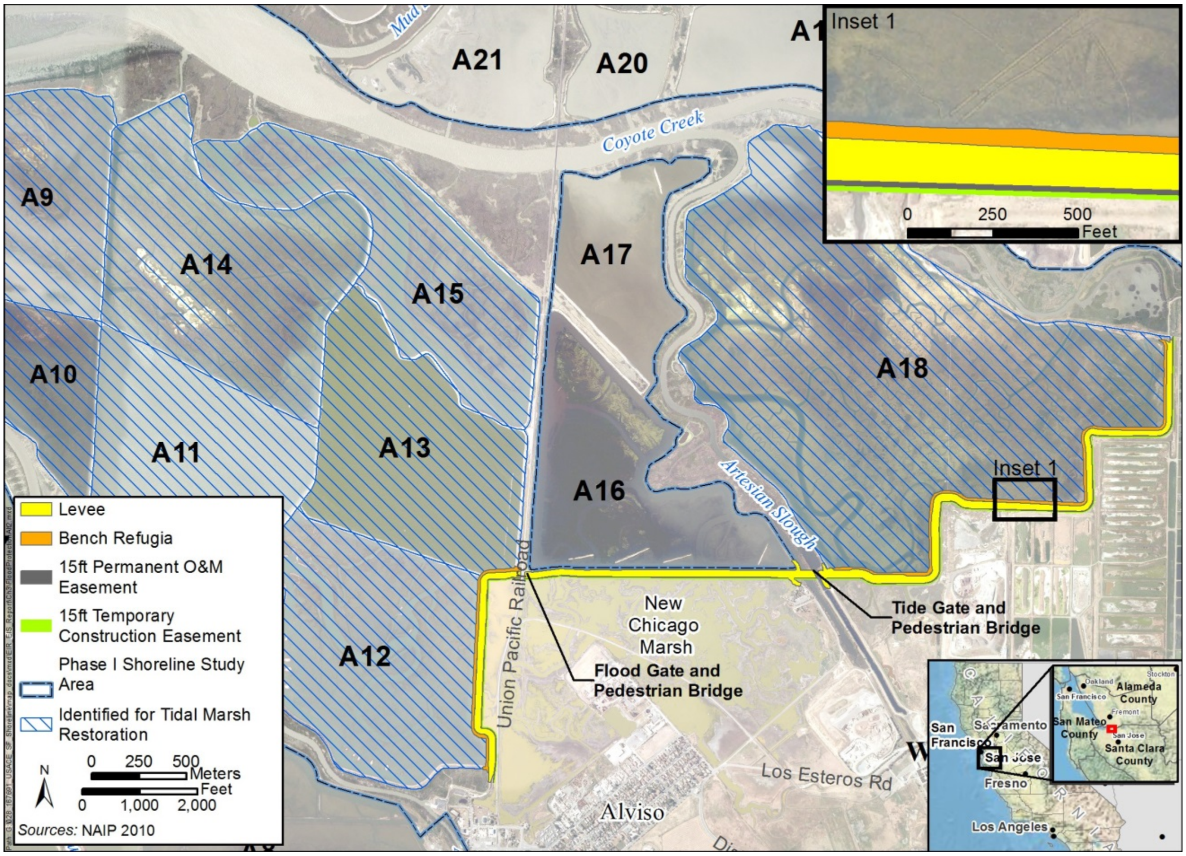

Figure 3.7-1. Alternative 2 – Alviso North with 12.5-foot Levee and Bench; UPRR Flood Gate; Artesian Slough Tide Gate; WPCP South with 12.5- foot Levee and Bench; Restoration of Ponds A9–A15 and A18; and Recreational Features

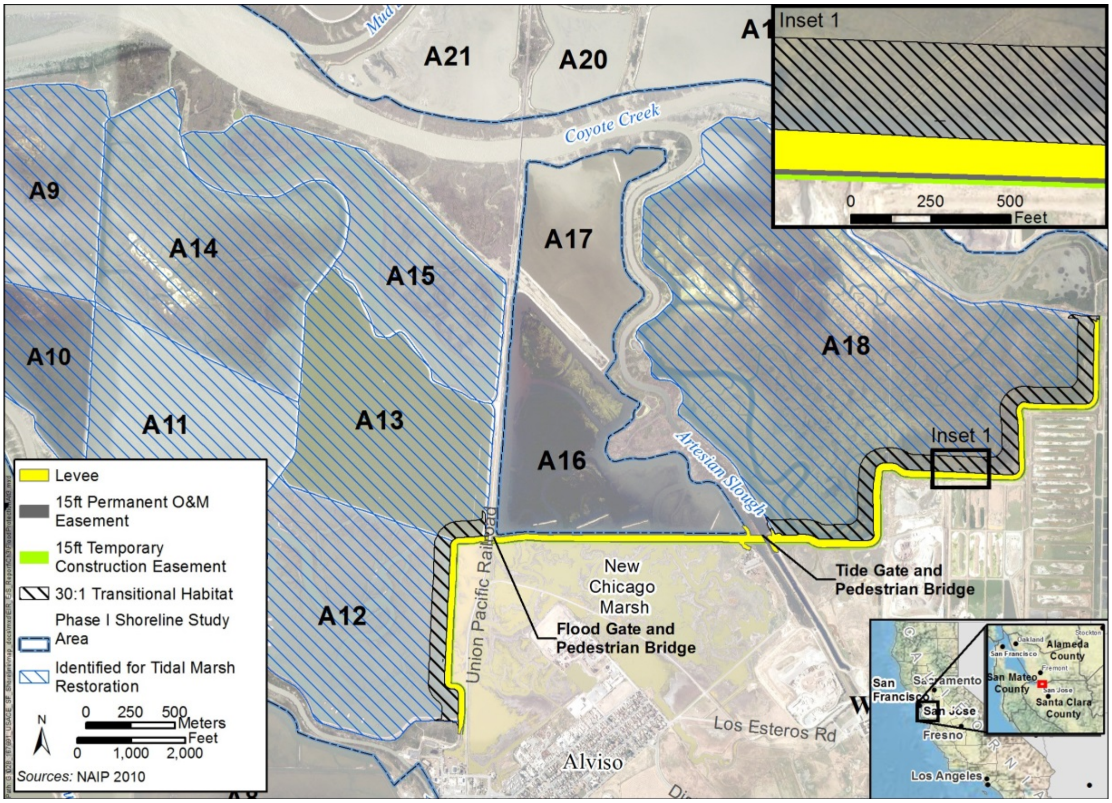

Figure 3.7-2. Alternative 3 – Alviso North with 15.2-foot Levee and 30:1 Ecotone; UPRR Flood Gate; Artesian Slough Tide Gate; WPCP South with 15.2- foot Levee and 30:1 Ecotone; Restoration of Ponds A9–A15 and A18; and Recreational Features

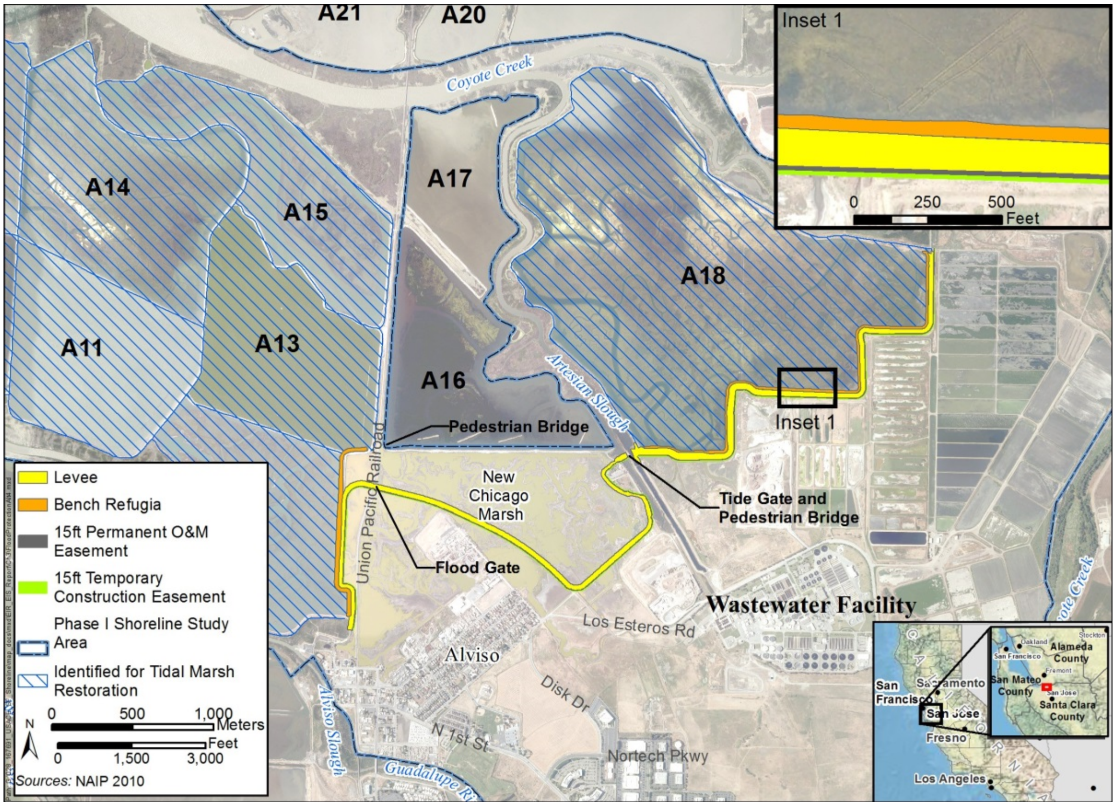

Figure 3.7-3. Alternative 4 – Alviso Railroad with 15.2-foot Levee; Bench; UPRR Flood Gate; Artesian Slough Tide Gate; WPCP South with 15.2- foot Levee and Bench; Restoration of Ponds A9–A15 and A18; and Recreational Features

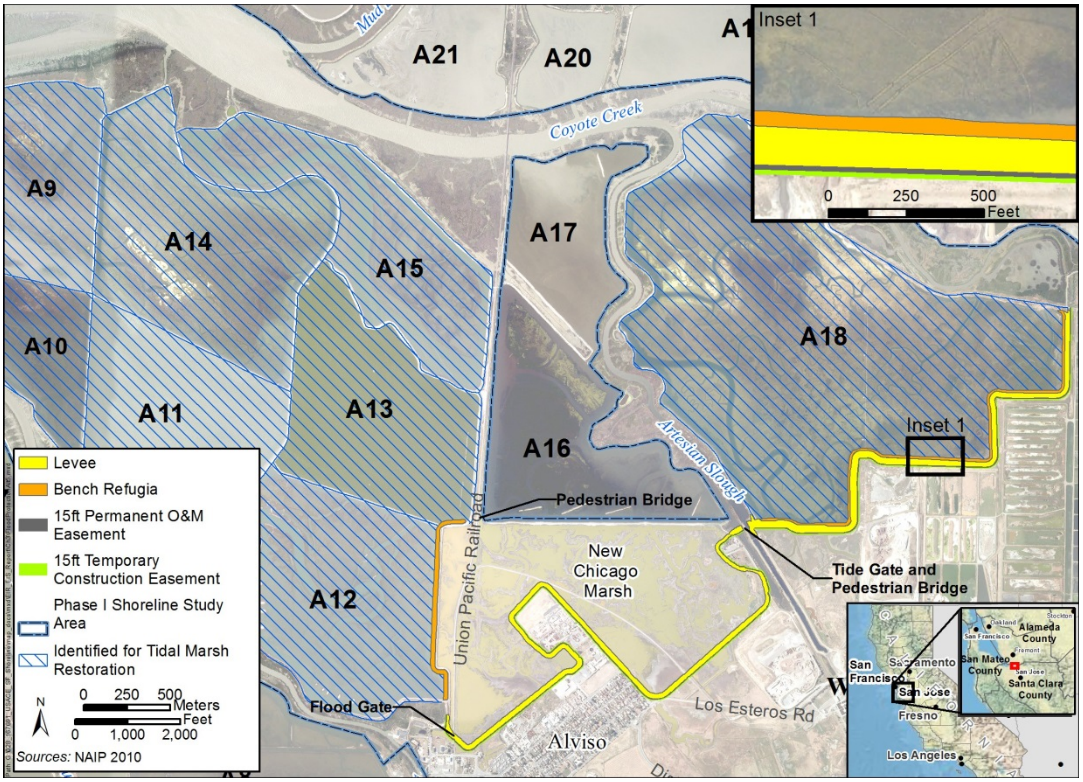

Figure 3.7-4. Alternative 5 – Alviso South with 15.2-foot Levee; Bench; UPRR Flood Gate; Artesian Slough Tide Gate; WPCP South with 15.2- foot Levee and Bench; Restoration of Ponds A9–A15 and A18; and Recreational Features

3.7.1 Recreation Measures

Figure 3.7-5*Existing Project Area Recreational Trails System* shows the existing project area recreational trails system. Recreation measures were incorporated into the final array of alternatives as part of the project objectives and to provide additional recreation benefits associated with proposed ecosystem restoration features. The recreation measures included in the final array are two pedestrian bridges (Artesian Slough and Union Pacific Railroad); for the Alviso segment, an unpaved area either on top of the new proposed FRM levee (for Alternatives 2 and 3) or along the same footprint, but along the existing non-engineered levee with proposed outboard bench (for Alternatives 4 and 5); for the WPCP segment, an unpaved area on top of the new proposed FRM levee; trail connections to the existing Coyote Creek trail and to the Alviso Marina (both of which will facilitate connecting to the Bay Trails network); a multi-use (paved) trail along SR 237 at 100 percent non-Federal cost (i.e., no cost-share by the USACE) that could be used by pedestrians and bicyclists; and viewing platforms, interpretive signs, and benches along existing and new trails in the Refuge. Figure 3.7-6 *Future Project Area Recreational Trails System* shows the proposed with-project recreational trails system in 2031 (i.e., after the last pond restoration sequence is completed; see Section 3.8.3 *Construction Schedule*).

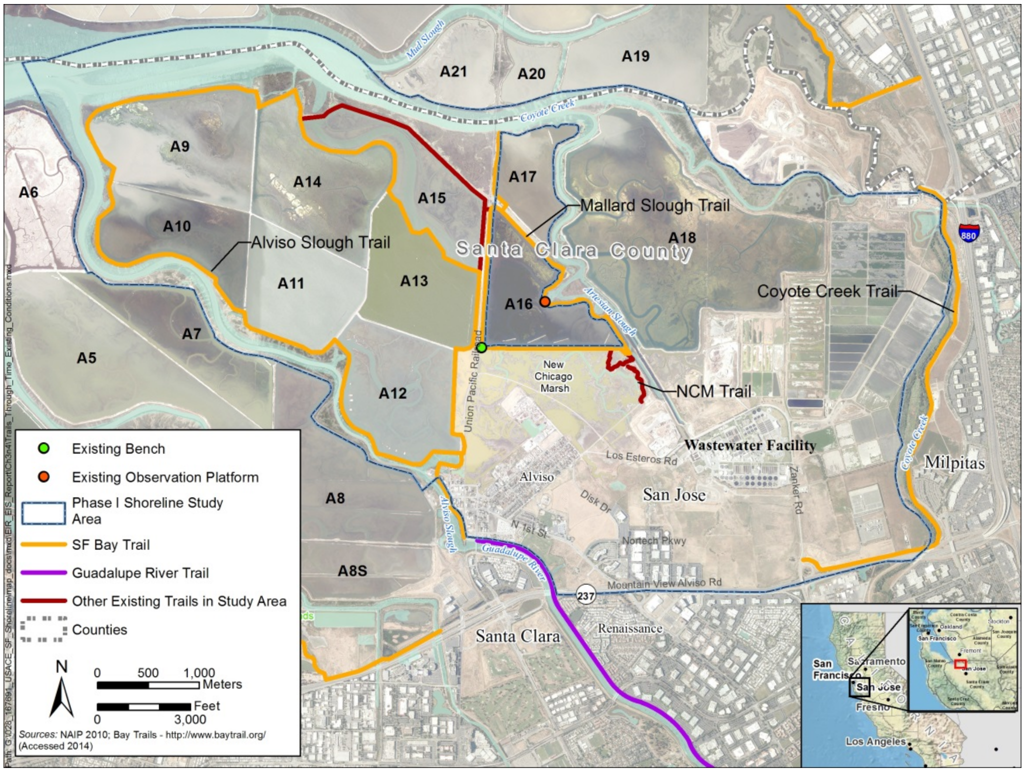

Figure 3.7-5. Existing Project Area Recreational Trails System

The study area currently contains approximately 21 miles of trail that are part of the larger regional Bay Trail.[8] The trails in this study area are of particular value because they are in and around the Refuge, the nation's first urban national wildlife refuge. The Refuge, created in 1974, was largely the result of grassroots efforts by the local community to protect the San Francisco Bay ecosystem. According to the Refuge Manager, approximately 150,000 persons per year use the trail in the study area. The Refuge has a parking lot for several dozen cars as well as an environmental education center (EEC).

Construction of the new FRM levee and pond modifications would affect use and access to trails that follow the existing pond dikes. For instance, outboard pond dike breaches would interrupt pond perimeter trails, severing existing connectivity. Temporary loop trails around ponds not scheduled for breaching until a later phase may be made available to the public by USFWS Refuge staff over the 14-year window of pond restoration construction (Section 3.8.3 *Construction Schedule*). Depending on the extent to which berms are being used by birds for nesting and the current availability of alternative nesting site options nearby, any new trail alignments will be decided post-breach with the goal of providing wildlife-oriented public

[8] According to www.baytrail.org, when complete, the Bay Trail will be a continuous 500-mile recreational corridor that will encircle the entire Bay Area, connecting communities to each other and to the Bay. It will link the shorelines of all nine counties in the Bay Area and 47 of its cities. As of July 22, 2014, baytrail.org indicates that 330 miles of the Bay Trail, or more than 60 percent of its ultimate length, have been developed.

access but also minimizing public impacts on wildlife. The long-term strategy development would continue with Refuge and SBSP Restoration Project staff, and the final plan will include consideration for both the broader San Francisco Bay Trail Plan and public input received.

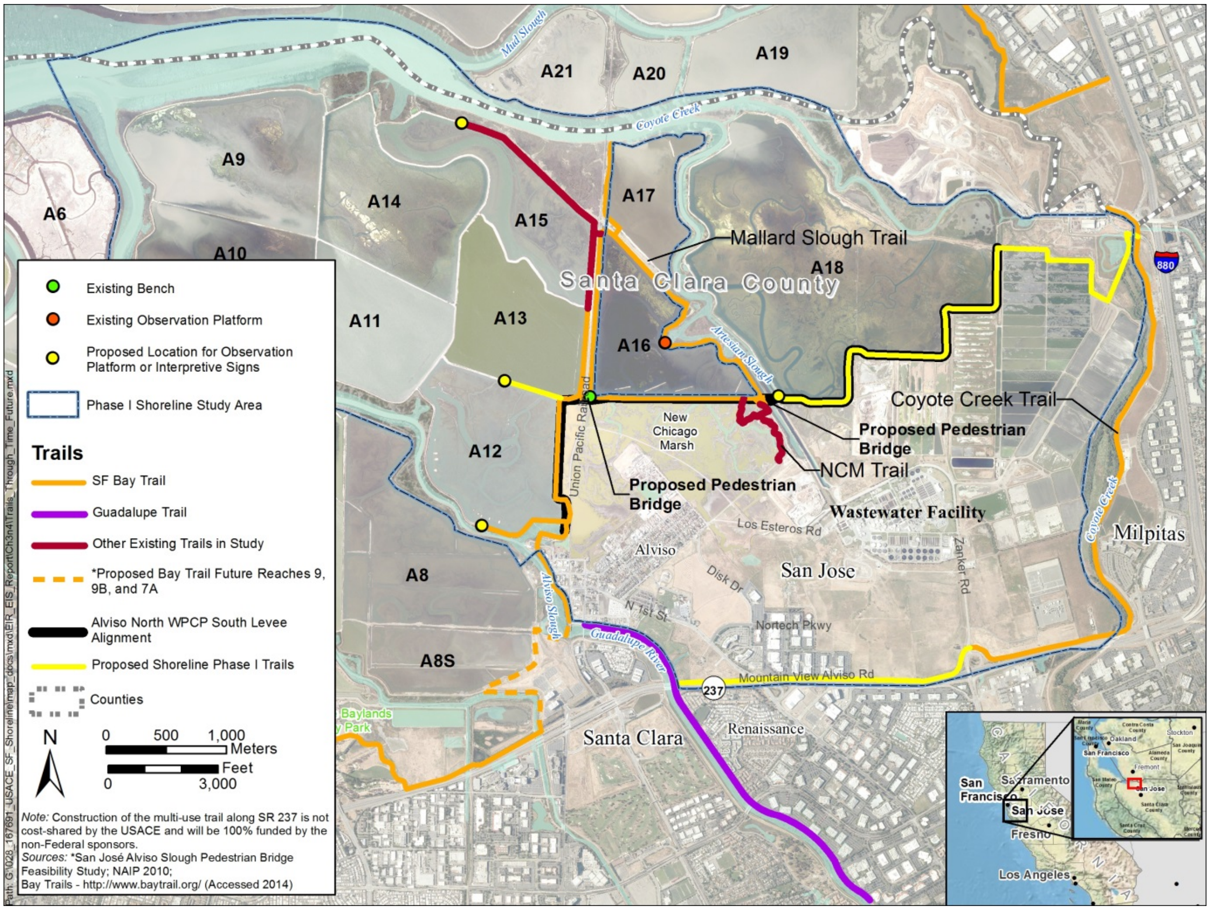

Figure 3.7-6. Future Project Area Recreational Trails System

All action alternatives also include a new unpaved maintenance road along the crest of the new WPCP South levee section, which will be made available for pedestrian traffic at the discretion of USFWS Refuge staff. At Artesian Slough, a pedestrian crossing (Artesian Slough bridge) has been proposed to provide connectivity between the Alviso and WPCP levee maintenance trail segments. Consistent with the Wastewater Facility Plant Master Plan, the eastern extent of the levee maintenance trail would connect to a designated route generally following the ingress route mapped for staging areas #1 and #2 (Figure 3.8-2 *Potential Staging Areas* in Section 3.8.1 *Flood Risk Management Details*) and connecting to the existing bridge at McCarthy Boulevard. The existing pedestrian walkway on the bridge would take recreationists to the Coyote Creek Trail that runs along the east bank of the creek. This proposed trail connection would be refined in final design with consideration of both public safety and the addition of features (e.g., fencing) to limit public access to sensitive wildlife areas.

In addition, because the westernmost extent of the proposed levee's maintenance trail would end (with the levee itself) at existing high ground adjacent to the Alviso Marina, this would facilitate another connection to the Bay Trail when the City of San José's proposed plans to connect the Alviso Marina to the larger trail network are realized. Final design would take into consideration any planning efforts in development at that time by the City and other local and regional authorities. To cross the active Union Pacific Railroad tracks that run north to south along the west side of Ponds A16/A17 and NCM, a 380-foot-long pedestrian bridge (referred to as the railroad bridge) is proposed with Americans with Disabilities Act- (ADA-) compliant approaches on either side. The location of the railroad bridge varies by alternative. For Alternatives 2 and 3, the bridge would be near the northeast corner of Pond A12 and southwest corner of Pond A16. For Alternative 4, the railroad bridge would be where the Alviso levee segment turns east from Pond A12 to connect in to the idle railroad alignment. For Alternative 5, the railroad bridge would be near the Alviso Marina. Regardless of location, the crossing would include installation of a railroad flood gate. For the flood gate, concrete barriers would be installed on either side of the railroad right-of-way and would tie into the earthen levees. Two 60.5-foot-longs by 10.25-foot-wide leaf swing gates would be connected to the barrier and would remain open during normal conditions and closed during flood conditions. The 380-foot-long by 10-foot-wide ADA-compliant pedestrian bridge would be constructed over the flood gate. The bridge would be supported on steel pipe columns to provide rail car clearance. The bridge would be metal with a non-slip surface decking and railing and chain link fence on the bridge sides.

The non-Federal sponsors are proposing constructing an already-planned segment of the Bay Trail just north of SR 237 at 100 percent non-Federal cost. This would create a paved multi-use trail that provides connection at a current gap in the multi-use network between Dixon Landing Road in Milpitas and Zanker Road in Alviso (Figure 3.7-6 *Future Project Area Recreational Trails System*).

Finally, viewing platforms, interpretive signs, and benches would be installed along existing and new trails in the study area. Figure 3.7-6 *Future Project Area Recreational Trails System* shows proposed locations for these features but the exact location and number of these types of facilities would be determined as restoration progresses. This would allow for flexibility that ensures that these features are compatible with the pond area conditions over time. Construction of the viewing platforms, benches, and interpretive signs would be cost-shared between the USACE and non-Federal sponsors.

Section 4.11 *Recreation* provides further information on the recreation impacts for all alternatives as well as new features being introduced as part of the project alternatives.

3.7.1.1 USACE Economic Justification of Recreation Features

For an ecosystem restoration purpose of the project to be implemented, a major portion of the existing approximately 11-mile loop trail located on top of levees surrounding Ponds A9–A15 will have to be removed over time as these levees are breached to establish tidal connections between the ponds and the bay; the current estimate for completing the pond breaches is 2030.

In the absence of other measures taken, removing this loop trail would have an adverse impact on the recreation value in the study area.

This Integrated Document describes recreation features to meet related planning objectives. These features will be implemented by the USACE as part of the project, consistent with Section 1025 of WRRDA 2014.

To quantify recreation values and benefits for recreation areas that are not classified as "high use" (high use is defined by the Planning Guidance Notebook as having greater than 750,000 annual visitors), USACE feasibility studies often use what is known as the Unit Day Value method to value changes in recreational value associated with projects (USACE 2015). This method relies on expert or informed opinion and judgment to approximate the average willingness to pay of users of Federal or Federally-assisted recreation resources. This method was applied to estimate the existing recreation value of the study area trails. Estimated total average annual recreation value is estimated at about $1.142 million.

In order for the ecosystem restoration purpose of the project to be implemented (under either the NER Plan or the Locally Preferred Plan), approximately 7.4 miles of the existing 11-mile loop trail located on top of levees surrounding Ponds A9 through A15 would have to be removed over time as existing levees are breached to establish tidal connections between the ponds and the bay. In the absence of other measures taken, the removal of sections of this loop trail would have an adverse impact on the recreation value in the study area. The following describes the expected impact to recreation values associated with ecosystem restoration project features in place. The projected reduction in recreation value with these features represents an NED loss, and therefore must be evaluated and quantified.

According to a representative from the Refuge, a reasonable estimate for the reduction in visitation due to the loss of the segment of the existing trails would be about 23,000. There would also be a reduction in the value per recreation visit. Accounting for both the decrease in Unit Day Value dollar value per visit and reduced visitation, the overall recreation value is estimated to decline by about $212,000 to a value of $930,000. This is the estimated NED loss to recreation associated with the ecosystem restoration component of the project.

While recreation features were initially formulated with the intent of replacing recreation value lost by the breaching of the pond levees on USFWS lands, USACE policy does not support the provision of recreation features as mitigation for project impacts. Instead, any proposed recreation features must be shown to be economically justified. The primary features of the proposed recreation plan are the two pedestrian bridges. The first bridge (Artesian Slough bridge) would connect trail sections along levee segments to the east and west of the Artesian Slough. The second bridge (railroad bridge) would cross the Union Pacific Railroad tracks, connecting the NCM area to points west including Alviso Slough trail, Alviso Marina, and the Guadalupe River Trail and eventually, when the City completes gaps around Pond A8, other segments of the Bay Trail. The proposed Railroad bridge would cross the Union Pacific Railroad and provide an easier-to-use, safer connection through this area. In addition to the Artesian Slough bridge, the recommended FRM levee alignment along Pond A18 would be available for use as a recreational trail, adding several miles of trail to the system. Finally, the recreation plan includes ancillary recreation facilities, including viewing platforms at the end of the in-and-out trail segments, benches, and interpretive signs.

The baseline for the estimate of recreation benefits attributable to the proposed recreation features is with the FRM/ecosystem restoration components of the project in place (that is, the value that takes into account the negative impact from the loss of trails due to restoration project components (or $930,000)). This is because recreation plans are formulated as added increments to recommended FRM or ecosystem restoration plans, and USACE policy does not support compensatory mitigation for recreation impacts, so any adverse effects of the recommended FRM or ecosystem restoration plans on recreation must be included in the baseline for evaluating the economic effects of recreation plans.

With the proposed recreation features, it is estimated that study area visitation would increase by at least 20 percent, based upon input from the USFWS refuge personnel. The impact to visitation would not be limited to the loop trail, but is rather anticipated to increase overall visitation throughout the study area trails, given the enhanced connections provided by the bridges and the new trail segment along Pond A18. This visitation estimate is slightly higher than the current estimated study area visitation, without implementation of any FRM/ecosystem restoration project components.

Factoring in this increase in visitation, as well as an increase in the value per visit, the total average annual recreation value with the proposed recreation features is estimated at $1.221 million. This value is approximately $291,000 greater than the recreation value under the baseline condition that includes ecosystem restoration project features in place. It also represents the incremental benefit of adding recreation features to the overall project.

The project first cost is estimated at approximately $6.2 million at October 2014 price levels. At an annualized cost of $262,900, the recreation plan is thus estimated to provide approximately $27,700 in annual net economic benefits, and has a benefit-cost ratio of 1.11 (see Table 3.7-2 *Results of Recreation Analysis (October 2014 Price Levels)*). In addition to being economically justified, the increase in study area recreation value with the proposed recreation plan improvements is estimated to more than offset recreation value losses which may result from the loss of recreational trail segments associated with the breaching of USFWS ponds required for the ecosystem restoration component of the project.

Table 3.7-2. Results of Recreation Analysis (October 2014 Price Levels)

Category	Result
Annual Cost	$262,900
Annual Benefits	$290,600
Annual Net Benefits	$27,700
Benefit-Cost Ratio	1.11

For more specific details on costs and calculation of benefits from the USACE justification of recreation features, refer to Appendix C *Economics*.

3.8 Action Alternatives Component Details

Each of the action alternatives (Alternatives 2, 3, 4, and 5) includes FRM, ecosystem restoration, and recreation components as previously described in this chapter. FRM and ecosystem restoration options vary by action alternative, while recreation components are essentially consistent across alternatives, with slight differences in footprint. Detailed information about the project's civil design is presented in Appendix E1 *Civil Design*. Ecosystem restoration phasing is described in Appendix B4 *Draft Memorandum Regarding Shoreline Study Ecosystem Restoration Phasing Alternatives (Ponds A9–A15)*.

3.8.1 Flood Risk Management Details

Because of the nature of the flood risk, all of the action alternatives involve the construction of levees bayward of the community of Alviso and the adjacent Wastewater Facility (i.e., at least partially on USFWS lands). The options differ in alignment, height, or both.

East of Artesian Slough, all of the action alternatives follow the WPCP South alignment, which has an estimated length of 10,000 feet. West of Artesian Slough, there are three potential levee alignments: Alviso North (Alternatives 2 and 3), Alviso Railroad Spur (Alternative 4), and Alviso South (Alternative 5). Table 3.8-1 *Levee Alignment Lengths and Distances from the Alviso* Community gives approximate alignment lengths along the Alviso segments and distances from the community of Alviso.

Table 3.8-1. Levee Alignment Lengths and Distances from the Alviso Community

Alternative(s)	Alviso Alignment	Length (feet) [a]	Length Including Wastewater Facility Segment and Artesian Slough Crossing (feet) [a]	Average Distance from Community (feet) [a, b]
2 and 3	North	9,000	20,000	2,026
4	Railroad	12,200	23,200	782
5	South	14,000	25,000	135

[a] Lengths/distances not exact; for relative comparison only
[b] Addresses southernmost section of each alignment option along Alviso side of proposed levee

For all alternatives, the proposed engineered levee would be earthen. The levee would be either 12.5 feet NAVD 88 or 15.2 feet NAVD 88 in height, with less than 3 feet of difference between alternatives. The average width at the crown of the levee would be 16 feet for all alternatives, with 3:1 (horizontal:vertical; H:V) slopes (Figure 3.8-1 *FRM Example Engineered Levee Cross-Section*). The average width of the base of the levee would be 97 feet (for a 12.5-foot NAVD 88 levee) and 107.2 feet (for a 15.2-foot NAVD 88 levee)—about a 10.2-foot difference. Beyond the physical footprint of the levee itself, on the landside (opposite the ponds), there would be a 15-foot-wide permanent easement (for operation and maintenance) and an additional 15-foot-wide temporary easement for the construction period along the full length of the levee. The waterside would have a 50-foot bench or a 30:1 ecotone (not shown on the figure).

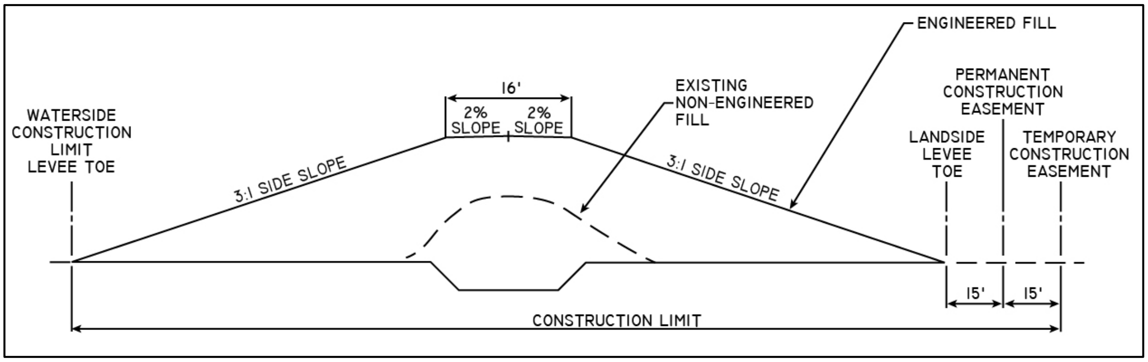

Figure 3.8-1. FRM Example Engineered Levee Cross-Section

Where the FRM levee would cross the active railroad line just east of Pond A12, a railroad flood gate would be installed with an approximately 80-foot-wide opening. Concrete barriers (wing walls) would be installed on either side of the railroad right-of-way and would tie into the earthen levees. The metal swing-type flood gate would be connected to the barrier and would remain open during normal conditions and closed during flood conditions. The gate would be manually operated during flood conditions and supported by the wing walls.

Fill volumes would vary by specific alignment and would be imported from local sources and delivered by truck. Staging areas would vary somewhat by alignment; Figure 3.8-2 *Potential Staging Areas* shows proposed staging areas and ingress (in)/egress (out) proposed routes. Potential staging areas #1 and #2 are both on Wastewater Facility land. Ingress and egress truck routes for these two areas are proposed on existing levee roads used currently by the Wastewater Facility for materials hauling; however, upgrades may be required for use by Shoreline Phase I Project actions (i.e., increased use by large trucks). Potential staging area #3 is on Zanker Landfill land and would be restricted in use for dirt stockpiling only. The haul route identified for potential staging area #4, the only location requiring routing through or adjacent to the Alviso community, is consistent with a Shoreline Phase I Construction Traffic Access Route Plan (Appendix A3 *Shoreline Phase I Construction Traffic Access Route Plan*).

Certain locations may require special structures or treatment as follows:

- Where the levee crosses an existing water feature such as a slough, structures would be installed (i.e., a tide gate closure system) to allow drainage during normal conditions and closure during flood conditions.
- Where the levee crosses an operating railroad, a railroad flood gate would be installed to allow closure during flood conditions.
- Where the levee crosses below-ground infrastructure (utilities, etc.), load-bearing structures may be needed to support the weight of levee materials.

- ◈ The section of the existing Coyote Creek levee downstream of the easternmost connection point with the proposed levee would be decommissioned to allow breaching of Pond A18.

Other materials such as geotextile fabric, stone column, foundation over-excavation, or replacement with stronger soil may also be included in the final design.

In addition to the proposed levee options, nonstructural FRM measures are included for local implementation under all alternatives; these include relocating critical utilities, emergency education for the public, establishing evacuation and flood-response plans, managing disease vectors (e.g., mosquitos), and establishing a local flood warning system (Table 3.4-1 *Management Measures* provides more detail on all non-structural FRM measures considered for inclusion in the action alternatives).

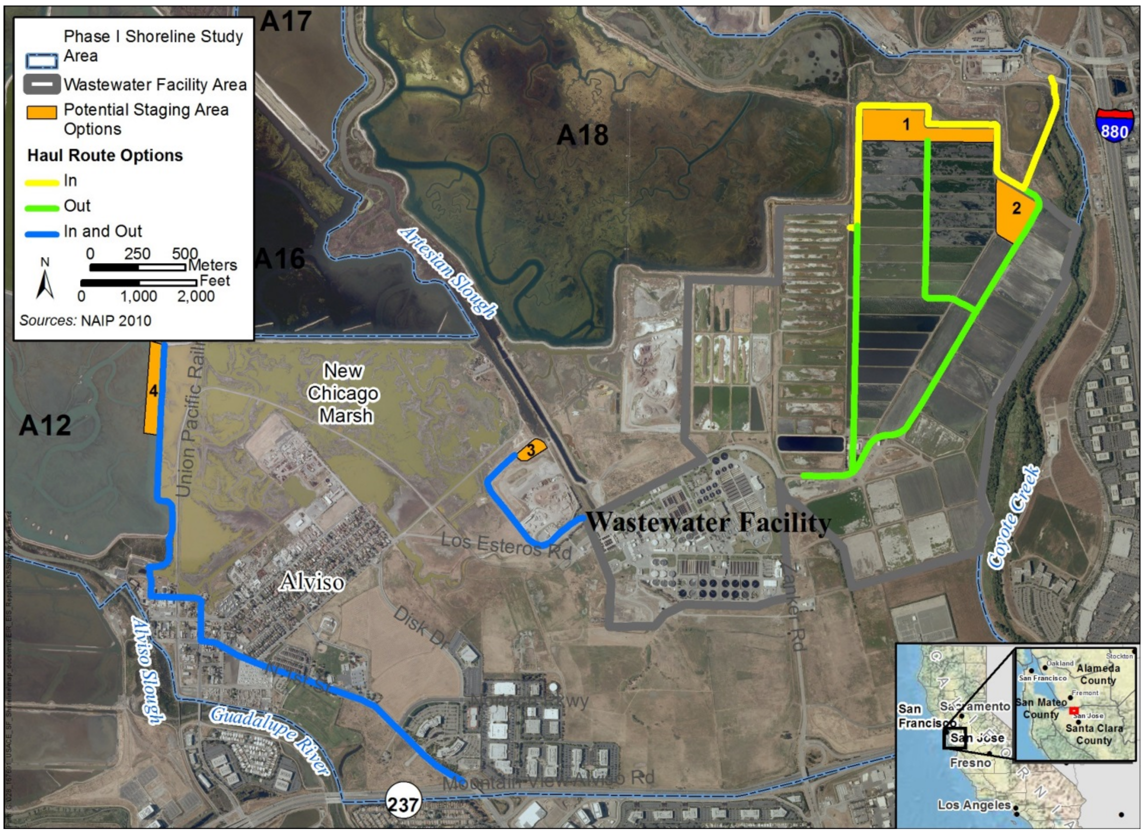

Figure 3.8-2. Potential Staging Areas

3.8.2 Ecosystem Restoration Details

Alternatives 2, 4, and 5 include construction of a 50-foot-wide bayside bench at an elevation of approximately 9.0 feet NAVD 88 in Ponds A12/A13 and A18. Rather than the bench, Alternative 3 includes the construction of an ecotone with 30:1 side slopes along the same three ponds (Ponds A12/A13 and A18), which would add an additional 345 feet to the width of the bay side of the levee footprint (Figure 3.8-3 *Ponds A12/A13 and A18 Bench or 30:1 Ecotone Footprints (Alternatives 2 or 3)*).

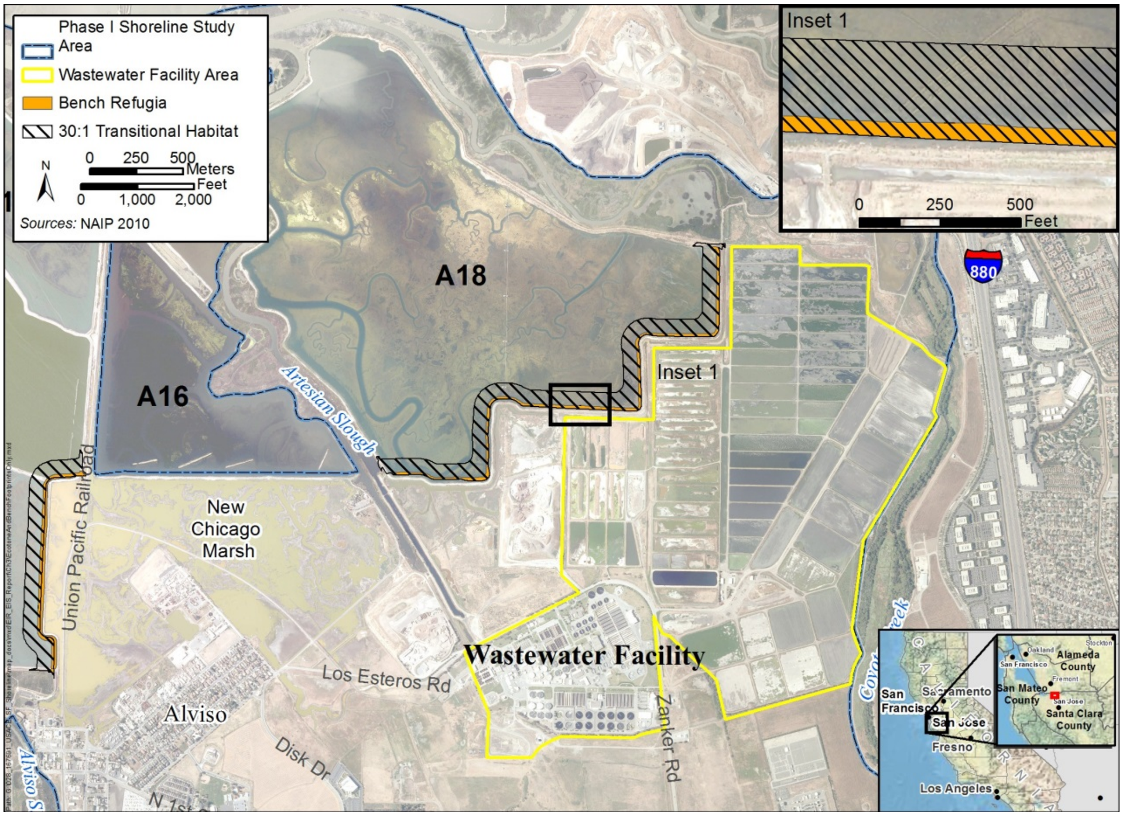

Figure 3.8-3. Ponds A12/A13 and A18 Bench or 30:1 Ecotone Footprints (Alternatives 2 or 3)

For all action alternatives, the transitional habitat along Pond A18 follows the same length of the proposed levee stair steps. In this stage of preliminary design, the Alternative 4 (Alviso Railroad) and Alternative 5 (Alviso South) benches, which do not remain adjacent to their corresponding proposed levee for the full length (Figure 3.7-3 *Alternative 4 – Alviso Railroad with 15.2-foot Levee; Bench; UPRR Flood Gate;* Artesian Slough *Tide* Gate; WPCP South *with 15.2- foot Levee and Bench; Restoration of Ponds A9–A15 and* A18; and Recreational Features and Figure 3.7-4 *Alternative 5 – Alviso South with 15.2-foot Levee; Bench; UPRR Flood Gate; Artesian Slough Tide Gate; WPCP* South with 15.2- foot Levee and Bench; Restoration of Ponds A9–A15 and A18; and Recreational Features), are about 150 feet shorter than Alternatives 2 or 3 (both with Alviso North option) at both the north and south ends of the Ponds A12/A13 bench (a total of 300 feet shorter).

All action alternatives (Alternatives 2 through 5) include modifications to existing managed ponds to allow tidal flow between adjacent sloughs and the existing ponds and support both ecosystem restoration and FRM functions. The types of modifications would be similar for all action alternatives.

All alternatives would have similar ground preparation actions involved in converting to tidal marsh:

1. As necessary, drain ponds. Ponds are usually drained passively and may take several months to dry out; pumping would expedite the process and may be considered. This step is often skipped, but may be necessary in ponds where any extensive groundwork is required prior to breaching. Because of historic pond subsidence, some pond areas are not able to be completely dried. This step also depends on relative closeness to snowy plover nesting season or if bird access to area can be restricted, as dried pond areas invite snowy plover nesting, which can halt construction.
2. Remove vegetation where needed.
3. Commence internal pond work, beginning with excavation, which provides material to create fill features.
4. Construct internal fill features, such as ditch blocks.
5. Stabilize pond dikes inboard of the pond being breached to better manage new tidal inflow (e.g., before a pond is breached, the levees separating the pond from its neighbors are temporarily upgraded so new tidal influence does not affect other ponds to be breached in future phases).
6. Complete any external channel work, such as construction of pilot channels, usually during low tide to improve access and reduce turbidity.
7. Lower outboard levees or breach levee or both.

The tidal marsh restoration approach would be consistent with the approach taken by the SBSP Restoration Project, as follows: modifications would include breaching of outboard levees, modification of internal levees, construction of ditch blocks along existing levee-adjacent channels, and construction of pilot channels along historical contours. Figure 3.8-4 *In-Pond Preparation for Pond A12 and Pond A18 at 2020* through Figure 3.8-6 In-*Pond Preparation for Ponds A13, A14, and A15 at 2030* provide conceptual drafts of the pond work applicable to all action alternatives specific to each construction phase as currently proposed.

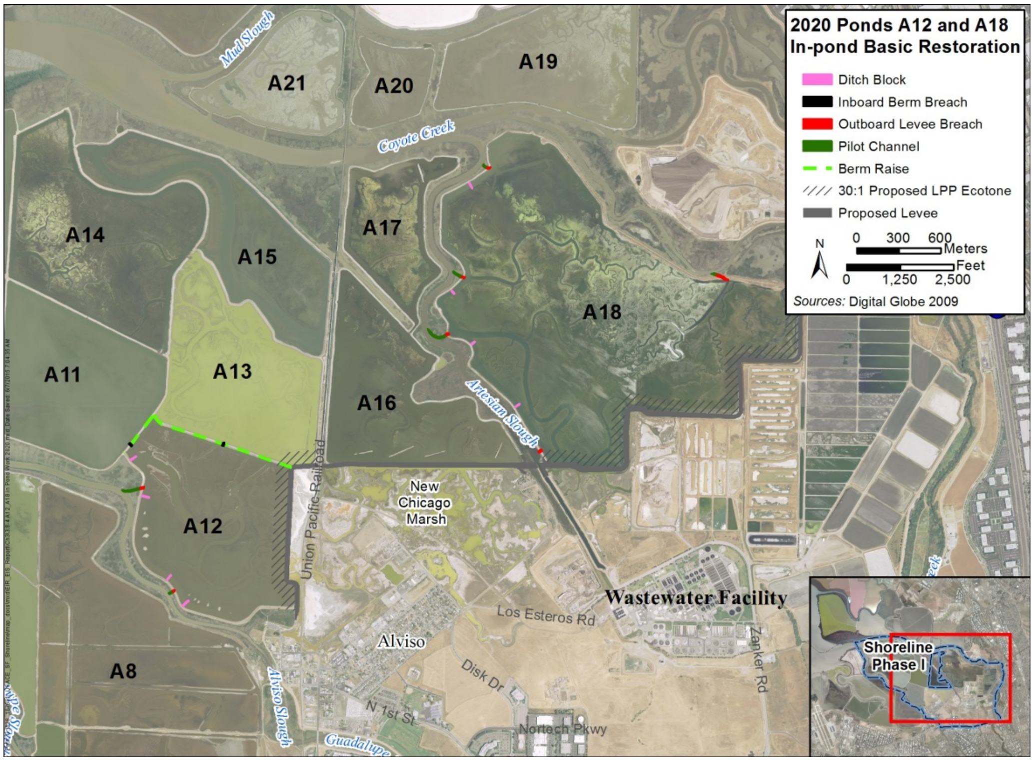

Figure 3.8-4. In-Pond Preparation for Pond A12 and Pond A18 at 2020

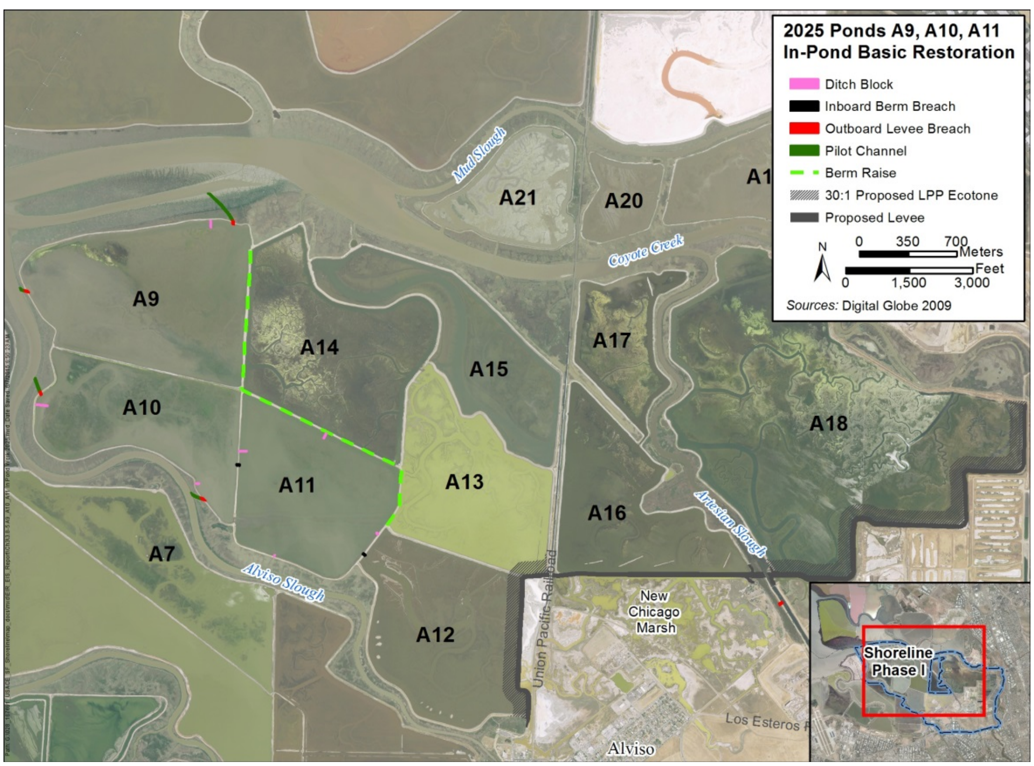

Figure 3.8-5. In-Pond Preparation for Ponds A9, A10, and A11 at 2025

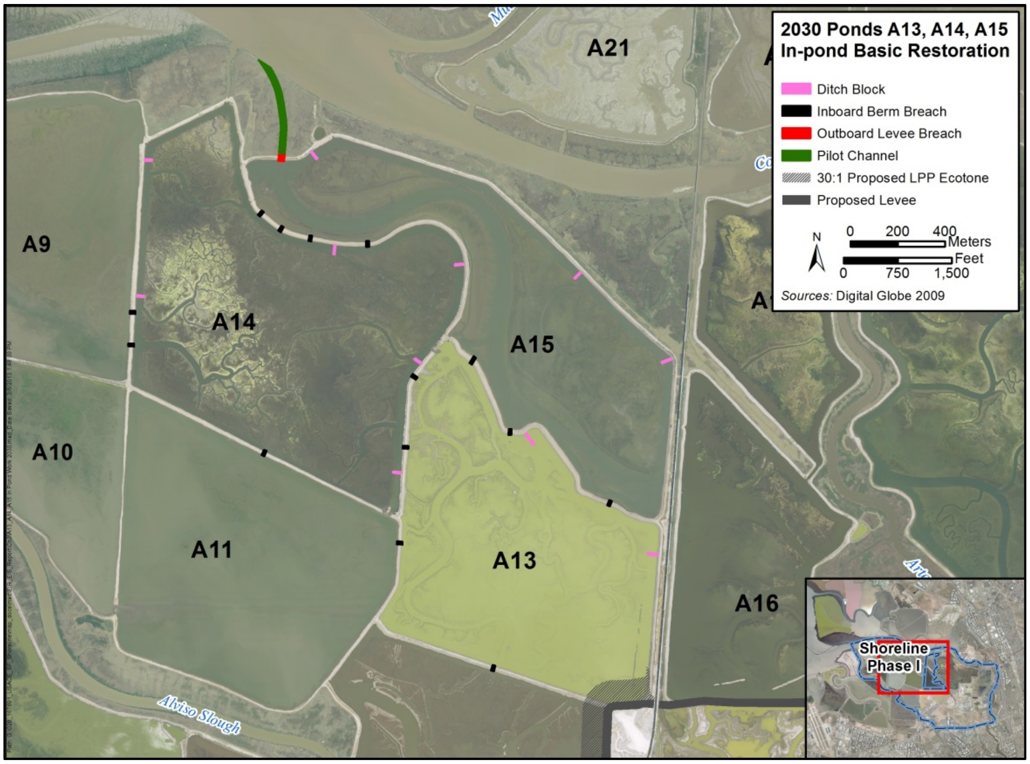

Figure 3.8-6. In-Pond Preparation for Ponds A13, A14, and A15 at 2030

Fill material would not be purchased or specifically imported for in-pond preparation work. Most of the material would come from related pond excavation. For instance, pilot channel excavation material can be used to build ditch blocks. Levee maintenance material is periodically delivered to the existing levees in the Refuge's Ponds A9–A15 pond complex; this material may contribute to pond modifications. Biosolids recovered from the Wastewater Facility may be considered as pond material during future design. The assessment would need to confirm that biosolids could be effectively used without contamination concerns.

3.8.3 Construction Schedule

The construction-phasing schedule for the alternatives is illustrated in Figure 3.8-7 *Shoreline Phase I Construction Schedule*. Under the assumed authorization and appropriation scenario, construction would commence in 2018 beginning with levee construction, followed by preparation of the first two ponds (Ponds A12 and A18) scheduled for breaching. The first breaches are scheduled for 2020, followed by monitoring and adaptive management to inform the next phases of restoration. This period of monitoring and adaptive management would also be used to inform potential adjustments to Ponds A12 and/or A18 and may extend beyond this 4-year period. The second phase of ponds (Ponds A9–A11) would be breached in 2025, assuming that monitoring results from the previous phase indicate that tidal marsh restoration should proceed, and would also be followed by a similar period of monitoring and adaptive management. The last phase of ponds (Ponds A13, A14, and A15) would be breached in 2030, as appropriate, and would be followed by continued monitoring and adaptive management for all areas. MAM principles would be ongoing to provide the best habitat conditions across the restoration areas, including the FRM levee and pond restoration areas.

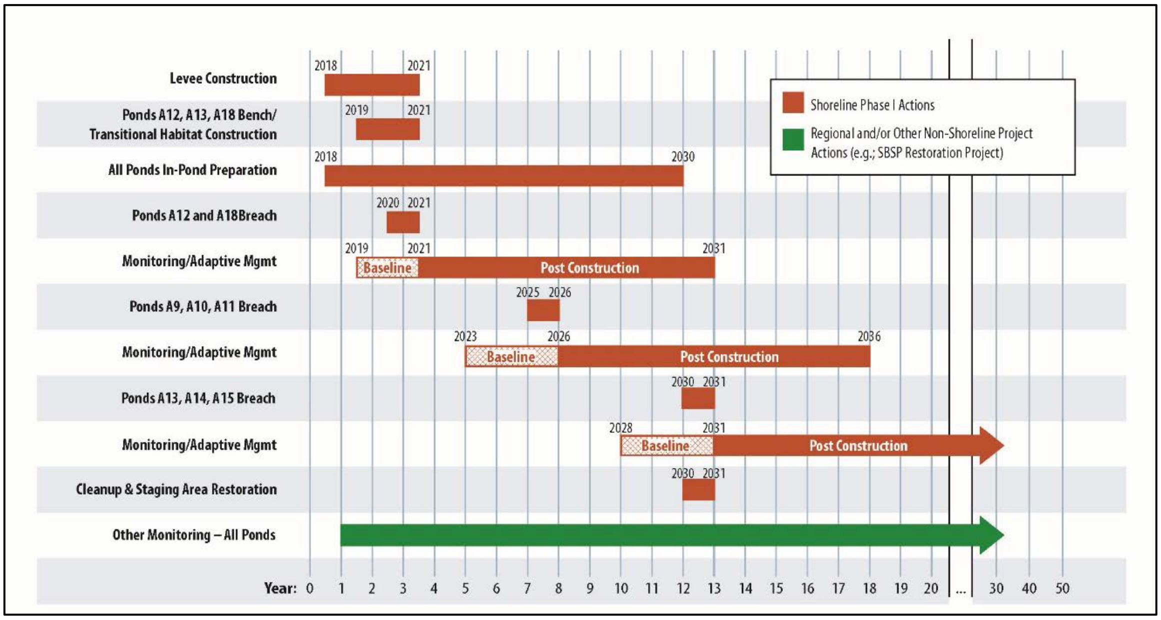

Figure 3.8-7. Shoreline Phase I Construction Schedule

Material for construction of the bench refugia measure or ecotone at both ponds is assumed to be available on site and free of charge. This material is provided through an existing agreement that the Refuge has with local construction companies to acquire materials excavated from other regional construction sites for the purposes of pond dike maintenance before the construction of the FRM proposed under the current study. After the new FRM levees are constructed, the Refuge can use this material for other purposes, such as constructing transitional habitat. Since the grading of this material is unknown at this stage, the assumption that free material would be available is appropriate for constructing transitional habitat but not for constructing FRM levees.

Due to the number of listed and sensitive species present or potentially present in the area, and the differing seasons of their presence or particular sensitivity, it may not always be possible to avoid impacts on one or more species. This is an inherent problem with constructing a project in an intertidal environment in this estuary and has been faced by similar projects in the area.

During the detailed design phase additional coordination will be conducted to ensure these impacts remain minimized, and that if some sort of conflict cannot be avoided, then the optimum practical tradeoffs will be made consistent with regulatory requirements. However, cumulative seasonal restrictions (combined bird and fish restrictions) are not expected to be a problem during construction.

The steelhead construction limitations would only affect two activities, pond breaching and construction of the tide gate on Artesian Slough. Pond breaching can easily be limited to a short period during the year as it takes very little time. No impact on the cost of pond breaching is expected. Steelhead trout are not expected in the vicinity of the tide gate.

Limitations due to bird nesting would be based on seasonal restrictions and/or nesting bird surveys. Surveys provide an opportunity to potentially construct near nesting suitable habitat during a period of seasonal restriction. In the case of the tide gate on Artesian Slough, rail and plover nesting is not anticipated due to local habitat conditions. Nesting surveys may still be required as a compliance measure but are expected to give negative results.

For other project activities such as pond preparation work, levee construction, and ecotone construction, bird nesting could be a limiting factor. However, nesting seasons substantially overlap and are not expected to result in cumulative impacts on construction scheduling. Nesting surveys and seasonal restrictions would be used as needed to expedite construction while meeting needs for impact avoidance.

3.8.3.1 Levee Construction; Pond A12/A13 and A18 Transitional Habitat or Bench

Flood risk management levee construction would take place over the first 3 years (2018–2021) of the project. This activity would require heavy equipment and discharging fill to areas that currently border wetlands and sloughs.

The landscape evolution modeling and the subsequent CHAP analysis were based on the sequencing of pond restoration presented in the draft Integrated Report (i.e., only Pond A12 in first event). Subsequently, the pond restoration sequence was adjusted so that Pond A12 and A18 would both be restored initially. This was done to accelerate initial marsh restoration in Pond A18, to more quickly address the initial loss of wetlands caused by FRM levee construction early in project construction.

It was not feasible to redo the landscape evolution modeling, habitat development modeling, and CHAP analysis to reflect this modest change in restoration sequencing. However, this change would affect the action alternatives equally across the board. The ecosystem restoration benefits presented in this report may be slightly underestimated for all alternatives due to this small acceleration in restoration phasing. This would not affect the recommended investment decision or the selection of the Recommended Plan. The Ponds A12/A13 and A18 ecotone (transitional habitat) or bench would be constructed during the same period. The section of the existing Coyote Creek levee downstream of the new and existing levees’ connection point would be decommissioned to allow subsequent breaching of Pond A18. Improvements to PG&E towers and access boardwalks in Pond A18 would be completed during this period to ensure that this infrastructure will be in place prior to the breaching of the pond.

3.8.3.2 All Ponds In-Pond Preparation

Pond A12, which has experienced the greatest degree of subsidence, is proposed for the first phase of restoration. This position in the construction phasing is intended to combat substantial historical subsidence with an anticipated maximum tidal interaction and deposition that would occur with the new tidal exchange being limited to this pond. Pond A18 is also proposed for the first phase of restoration.

During the first 3 years (2018–2021), Ponds A12 and A18 would be prepared for breaching and inundation through excavation of pilot channels and construction of borrow ditch blocks. Surplus material excavated from pond preparation would be used to contribute to other in-pond construction activities requiring material, such as raising of internal levees at Pond A12, if determined suitable by Refuge staff (free of contaminants, etc.).

Pond preparation for all other ponds would be implemented based on the lessons learned as a result of MAM conducted for Ponds A12 and A18, including whether to breach these ponds and restore them to tidal marsh.

3.8.3.3 Ponds A12 and A18 Breaches; Monitoring and Adaptive Management

During Year 3 (2021), dike breaches would be implemented in Ponds A12 and A18 to introduce tidal flow. Following restoration of tidal flow, monitoring would be conducted to measure the effectiveness of tidal function equilibrium and restorative values. If necessary, corrective measures would be implemented. A period of approximately 4 years (2021–2025) has been established for MAM associated with Ponds A12 and A18. See the *Shoreline Study Monitoring and Adaptive Management Plan for Ecosystem Restoration* for more details and examples (Appendix F *Shoreline Study Monitoring and Adaptive Management Plan for Ecosystem Restoration*),

3.8.3.4 Ponds A9, A10, and A11 Breach; Monitoring and Adaptive Management

Dike breaches for these ponds would be implemented in Year 7 (2025) of the project. MAM principles would also be applied for a 4-year period (2026–2030) following the breach to ensure appropriate tidal function and to continue to learn from each implementation phase.

3.8.3.5 Ponds A13, A14, and A15 Breach

Pond preparation for Ponds A13, A14, and A15 would be implemented based on the lessons learned as a result of MAM conducted for previous ponds, including whether to breach these ponds and restore them to tidal marsh. Levee breaches would be implemented in Year 12 (2030) of the project.

3.8.3.6 Cleanup and Staging Area Restoration

Following the final project actions, any remaining staging areas and temporary easement locations would be restored to preconstruction condition or upgraded to be consistent with the goals of the project (e.g., native plant seeding).

3.8.4 Post-Construction Actions

The following activities are anticipated for all action alternatives; most activities will be conducted as O&M, while some of the monitoring activities that are related to ecosystem restoration objectives may be cost-shared under the MAMP:

- Remove trash and debris (human-made) and green waste (nature-made) along banks and where it is causing obstruction in culverts, etc.

- Remove excess sediment along streams; alternatively, erosion-control activities in areas of scour or undercut.
- Repair damage to levees caused by rodents or small mammals, storms, tree falls, or stump removals.
- Repair concrete FRM structures (if included in plan) and other features, such as bridges and culverts.
- SCVWD and USACE conduct levee inspections.
- Remove graffiti.
- Improve access and upkeep.
- Repairing damage to earthen levees caused by subsidence and surface erosion. Temporarily upgrade outboard dikes at ponds not being breached until future phase(s) to provide FRM while adjacent ponds are being opened to tidal action.
- Vegetation and wildlife monitoring of plant species composition and abundance; population and nest counts for breeding birds; abundance of predator species (e.g., gulls); abundance and health of estuarine fish and migrating salmonids; amount of mercury in fish; abundance and presence of invasive species; and abundance and presence of nonnative species.
- Vector monitoring—presence of mosquitoes and their larvae.
- Monitor sedimentation in ponds, areas of outboard mudflats, subtidal shallows and channels, sediment flux, and mercury deposition in ponds.
- Prevent or deter entry of additional undesirable nonnative species.

3.8.5 Features Built into Design to Avoid or Reduce Adverse Environmental Impacts

The following design features would avoid or reduce adverse environmental impacts for all action alternatives:

- Protection in place or replacement (with possible modifications to meet USACE levee requirements) of existing utility features that will require placement through the proposed levee (e.g., existing siphon between Pond A16 and NCM).
- Tidal marsh restoration would be consistent with the design guidance, goals, and objectives of the SBSP Restoration Project and would take advantage of adaptive management lessons learned from the monitoring of recent restoration efforts.
- Phasing of pond restoration would allow monitoring and the adaptive management process to inform the future of the Shoreline Phase I ponds, consistent with SBSP Restoration Project goals.
- Reuse of earth materials (existing dikes, etc.) would reduce the amount of imported material and stockpile and landfill material.

- Public warning signs and sirens would improve public awareness and response to inundation emergencies (floods, tsunamis).
- Relocating utilities in conflict with FRM features, either before or in conjunction with construction of FRM features, would minimize impacts.
- Recreation facilities and trail segments would maintain an existing trail system, as possible; provide continued public access; and complement the Bay Trail Plan.

3.9 Evaluation and Comparison of the Final Array of Alternatives

Evaluation and comparison, which are the steps in the USACE planning process that follow plan formulation, are based on the assessment of the features and impacts of the alternatives. Under the evaluation step (USACE Planning Step 4), the "with-project condition" resulting from each alternative is compared to the "without-project condition" to quantify FRM and ecosystem restoration benefits and identify other impacts from implementing the alternative. In addition, each alternative is evaluated against the P&G criteria of completeness, effectiveness, efficiency, and acceptability. During the comparison step (USACE Planning Step 5), the benefits, impacts, and performance in consideration of the four P&G criteria are compared across alternatives.

In addition to establishing the four criteria to guide the formulation and evaluation of alternatives, the P&G established four "accounts" to report benefits and impacts:

- **National Economic Development (NED)** – The NED account identifies the beneficial and adverse effects that alternatives may have on the national economy. Beneficial effects are increases in the economic value of the national output of goods and services. Adverse NED effects are primarily flood-related damages.
  - For this study, the NED account relates largely to economic flood damages that are prevented because a plan was implemented, and are associated with the following planning objective: Reduce potential economic damages caused by tidal flooding in areas near the South Bay shoreline in Santa Clara County (Problem 2; Opportunity 1).
  - Provide opportunities for public access, education, and recreation in the study area (Opportunity 4).
- **Environmental Quality (EQ)** – The EQ account reports the nonmonetary effects on ecological, cultural, and aesthetic resources. It reports both positive and adverse effects.
  - For this study, the EQ account relates to the following planning objectives:
    - Reduce the risk to public health, human safety, and the environment caused by tidal flooding along the South Bay shoreline in Santa Clara County (Problem 1; Opportunity 1).
    - Restore ecological function and habitat quantity, quality, and connectivity in the study area for native plant and animal species, including special-status

species such as steelhead trout, Ridgway's rail, and salt marsh harvest mouse (Problem 3; Opportunity 3).

- For this study, positive effects on EQ and NER were calculated using the CHAP model, and adverse effects are presented for each of the significant resources in the study area. Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures* reports detailed effects by resource.

- **Regional Economic Development (RED)** – The RED account pertains to changes in the distribution of regional economic activity, mainly income and employment. It captures the transfer of income or employment from one region in the nation to another when there is no net increase in national value (net increase in national value is captured under the NED account).

- **Other Social Effects (OSE)** – The OSE account captures urban and community impacts such as life, health, and safety factors; displacement; long-term productivity; and energy requirements and energy conservation

  - For this study, the OSE account relates to the following planning objectives:

    - Reduce the risk to public health, human safety, and the environment due to tidal flooding along the South Bay shoreline in Santa Clara County (Problem 1; Opportunity 1).

The data and evaluation results summarized in the following sections are provided in detail in Appendix C *Economics*.

For reference when reviewing the following sections, a summary of the features and costs of the final array of alternative plans is displayed in Table 3.9-1 *Final Array of Alternatives: Features and Costs (October 2014 Price Levels)*. Alternative 2 (Alviso North with 12.5-foot Levee and Bench) is the NED/NER Plan because, compared to the other alternatives, it maximizes net NED benefits under the NED account and reasonably maximizes NER benefits under the EQ account. The non-Federal sponsors have selected Alternative 3 as their preferred alternative/Recommended Plan for reasons that are discussed in the Plan Selection section of this report. Because Alternative 3 is policy-compliant and generates the same types of benefits as the NED/NER Plan, it can be recommended as an LPP, if approved by the Secretary of the Army. Federal participation in funding the LPP will be based on the Federal cost share set by the NED/NER Plan.

Table 3.9-1. Final Array of Alternatives: Features and Costs (October 2014 Price Levels)

Characteristic	Alt. 1	Alt. 2 (Tentative NED/NER Plan)	Alt. 3 (LPP)	Alt. 4	Alt. 5
Alternative Description	No Action	Alviso North with 12.5-foot Levee and Bench	Alviso North with 15.2-foot Levee and 30:1 Ecotone	Alviso Railroad with 15.2-foot Levee and Bench	Alviso South with 15.2-foot Levee and Bench
General Features					
Levee length (feet)	N/A	20,000	20,000	23,200	25,000
Levee height (feet; NAVD 88)	N/A	12.5	15.2	15.2	15.2
Length of transitional habitat (bench or ecotone; feet) in Ponds A12/A13 and A18	N/A	Ponds A12/A13: 4,380 Pond A18: 10,300; Total Length combined = 14,680			
Transitional habitat extent from levee (feet) for Ponds A12/A13 and A18	N/A	50	345	50	50
Transitional habitat constructed: total acreage for Ponds A12/A13 and A18	N/A	17	116	17	17
Costs*					
Lands, Easements, Relocations, Rights-of–Way, and Disposal Sites					
Real Estate (COA 01)	N/A	$14,700,000	$14,700,000	$14,700,000	$14,700,000
Construction, Flood Risk Management					
Flood Risk Management features (COA 11)	N/A	$52,136,000	$63,436,000	$64,478,000	$65,641, 000
Bank Stabilization (COA 16)	N/A	$1,074,000	$1,074,000	$1,074, 000	$1,074, 000
Utility Relocations (COA 02)	N/A	$397,000	$397,000	$397,000	$397,000
Construction, Ecosystem Restoration					
Transitional Habitat (COA 06)	N/A	$0	$29,283,000	$0	$0
Pond Restoration (COA 06)	N/A	$8,216,000	$8,216,000	$8,216,000	$8,216,000
Monitoring (COA 06)	N/A	$1,769,000	$1,769,000	$1,769,000	$1,769,000
Adaptive Management (COA 06)	N/A	$6,618,000	$6,618,000	$6,618,000	$6,618,000
Construction, Recreation					
Recreation (COA 14)	N/A	$2,978,000	$2,978,000	$2,978,000	$2,978,000
Other Costs					
Preconstruction Engineering and Design (COA 30)	N/A	$14,726,000	$22,892,000	$17,511,000	$17,775,000
Construction Management (COA 31)	N/A	$7,186,000	$11,267,000	$8,563,000	$8,692,000
Project First Cost	N/A	$109,800,000	$162,630,000	$126,304,000	$127,860,000

Alt.=Alternative; N/A = Not Applicable; COA = Code of Accounts

* The final array cost comparison was performed using October 2014 Price Levels. The benefits and costs for the NED/NER Plan (Alternative 2) and the LPP (Alternative 3) have been updated to current price levels and discount rates, and are presented later in Chapter 9 *Findings and Recommended Plan*.

3.9.1 System of Accounts

3.9.1.1 National Economic Development

In calculating the economic flood damages prevented by the alternatives, the primary categories of costs evaluated under the NED account were:

- Structure and Content Damages
- Cost to Temporarily Displaced Residents
- Automobile Damages
- Emergency and Cleanup Costs
- Cost to Relocate Residents
- Cost to Reduce the Flood Risk to the Wastewater Facility
- Traffic Delay and Detour Costs

As discussed during the evaluation and screening of FRM options, the NED analysis generates two particular outputs to evaluate effectiveness and efficiency for each plan: net benefits and a BCR. While Table 3.9-1 *Final Array of Alternatives: Features and Costs (October 2014 Price Levels)* displays costs updated from October 2013 to October 2014 price levels, this NED account analysis continues to use October 2013 price levels. Updating this analysis with October 2014 prices would not change the conclusion. The costs and benefits used in the NED analysis are limited to the FRM components of the combined alternatives (i.e., the FRM option included in the alternative); the EQ account quantifies the effects of the ecosystem restoration components. Mitigation for the loss of wetlands and related impacts to wetland species from construction of the levees would be required if this were a USACE single-purpose FRM project. Because the project also includes restoration of managed ponds to tidal marsh, however, and this restoration will provide much more habitat than would be lost to the levee construction, no mitigation is proposed.

The economic damages reported for Alternative 1 (No Action) represent the maximum economic benefit that can be achieved by any action alternative, since Alternative 1 economic damages represents the maximum level of damages that can be reduced by implementing a plan. The No Action damages also represent the economic damages that would occur under the without-project condition.

Alternative 2 has the greatest annual net economic benefits under the Low and Intermediate SLC Scenarios, with $15 million, $19.3 million, and $35.4 million under the USACE Low, Intermediate, and High SLC scenarios. The 13.5-foot levee maximizes net economic benefits under the High SLC scenario. The 12.5 foot levee was identified as the NED levee height because: 1) it provides positive net benefits under all three SLC scenarios; 2) maximizes net benefits under the Low and Intermediate SLC scenarios; 3) provides substantially greater risk reduction than smaller scale levees; and 4) is adaptable and can be raised in the future if necessary to accommodate sea level rise under the High SLC scenario.

This alternative has the lowest levee elevation of those considered within the final array and is the least costly.

Alternative 3 has slightly higher equivalent net benefits ($14.6 million, $19 million, and $36.6 million under the USACE Low, Intermediate, and High SLC scenarios), a higher construction cost and less residual risk as a result of a greater levee height.

3.9.1.2 Environmental Quality Account

As explained above, the EQ account involves documenting both the positive and negative environmental impacts of alternative plans. The positive effects of tidal marsh restoration were quantified using the CHAP and compared them using CE/ICA, as explained during the discussion of screening ecosystem restoration options. This process helps to identify the NER Plan.

In this analysis, the No Action concept (the future without-project condition) was the baseline for calculating ecosystem restoration outputs. The outputs for each of the action alternatives represent improvements beyond the future without-project condition, which was assigned zero habitat outputs. In reality, there is a value associated with the future without-project condition because managed pond habitat provide habitat benefits to certain species, although that value is not relevant in the comparison of the action alternatives.

This section presents a qualitative overview of positive and negative effects on significant resources (e.g., ecological, cultural, and aesthetic), with detailed analysis provided in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures.*

3.9.1.2.1 National Ecosystem Restoration

The Planning Guidance Notebook describes the selection of the NER Plan as follows:

> For ecosystem restoration projects, a plan that reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the Federal objective, shall be selected. The selected plan must be shown to be cost-effective and justified to achieve the desired level of output. This plan shall be identified as the National Ecosystem Restoration (NER) Plan.

According to the USACE policy quoted above, the NER Plan should be selected from among the cost-effective plans identified. In practice, the NER Plan is also typically selected from the subset of Best Buy plans (Figure 3.9-1 *Best Buy Plans and Incremental Cost per Unit*).

As described earlier, the six cost-effective plans consist of combinations of basic restoration of the four pond groupings. The four best buy plans involve basic phased restoration of one or up to all four pond complexes. The selected NER option is the largest of the Best Buy Plans, which includes basic phased restoration of all of the pond complexes. As shown in the results of the CE/ICA analysis, the incremental cost per output for the largest plan is modest relative to the smaller Best Buy Plans (i.e., there is not a significant break in the incremental cost curve).

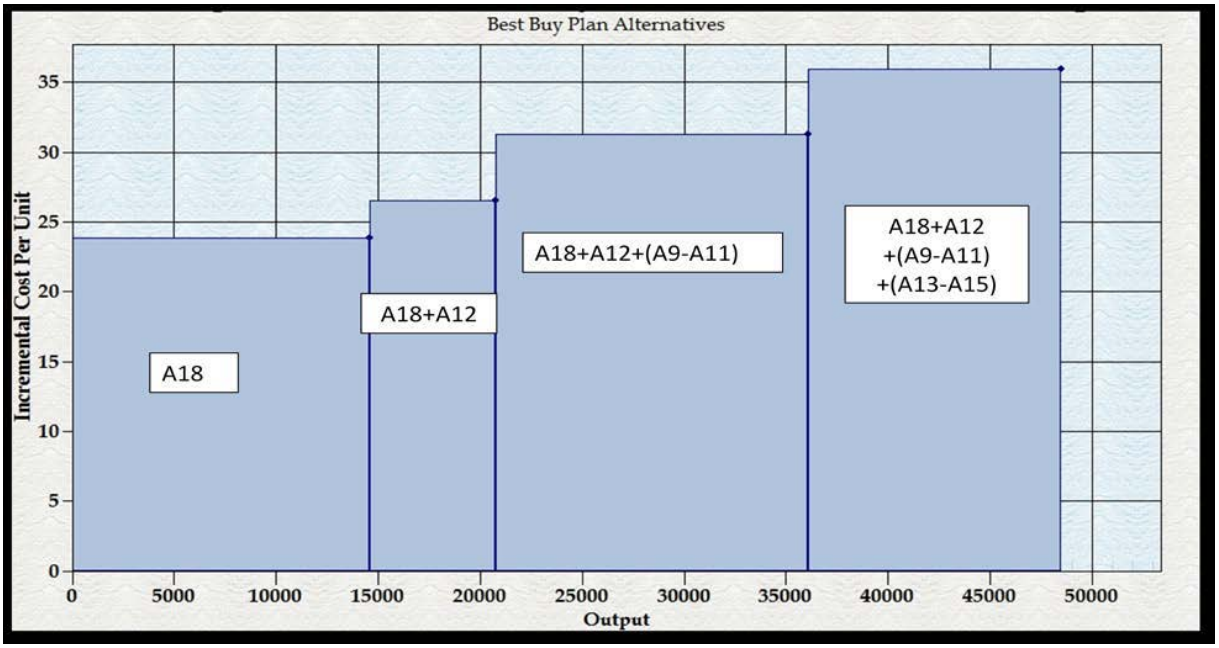

Figure 3.9-1. Best Buy Plans and Incremental Cost per Unit

3.9.1.2.2 Summary of Impacts on Significant Resources

Table 3.9-2 *Summary of Environmental Quality Account Impacts* summarizes the effects that the array of alternatives would have on EQ resources (significant resources). The impacts under the No Action Alternative (Alternative 1) represent the future without-project condition for these resources. Beneficial effects in the EQ account would include favorable changes in the ecological, aesthetic, and cultural attributes of the natural and cultural environment. In the context of this study, the positive changes include an increased acreage of tidal marsh habitat and the direct effect that this additional habitat would have on Threatened and Endangered species. Adverse effects in the EQ account are unfavorable changes in these same resources. As described in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures* and in Table 3.9-2 *Summary of Environmental Quality* Account Impacts, there would be minor, unavoidable ecological- and cultural/aesthetic-related impacts associated with construction activities.

Table 3.9-2. Summary of Environmental Quality Account Impacts

Characteristic	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Alternative Description	No Action	Alviso North with 12.5-foot Levee and Bench	Alviso North with 15.2-foot Levee and 30:1 Ecotone	Alviso Railroad with 15.2-foot Levee and Bench	Alviso South with 15.2-foot Levee and Bench
Ecological Attributes (Physical and Biological Aspects of Ecosystem)					
Water Quality	No impact	Negative short-term impacts from temporary increase in salinity in sloughs and remobilization of mercury in ponds and sloughs; potential positive long-term effects for ponds as system equilibrates			
Air Quality/Greenhouse Gases	No impact	Minor negative construction-related impacts	Moderate negative construction-related impacts	Same as Alternative 2	
Aquatic Habitat Value	No impact	Minor negative construction-related impacts; potential positive long-term effects			
Marsh Habitat Value	Loss of historical habitat continues to strain communities	Substantial positive long-term effects; establishment of marsh communities in ponds takes longer to develop than for Alt. 3	Substantial positive mid- and long-term effects; additional ecotone provides for early evolution of marsh communities in ponds	Moderate permanent negative impacts on NCM existing marsh; benefits to ponds same as Alt. 2	Minor permanent negative impacts on NCM existing marsh; benefits to ponds same as Alt. 2
Upland Habitat Value	No impact	Minor negative temporary construction-related impacts			
Threatened and Endangered Tidal Marsh Species	Continued strain on species from limited habitat and refugia	Substantial positive effects over the long term; potential for minor and temporary negative effects during construction.	Substantial positive mid- and long-term effects; potential for minor and temporary negative effects during construction.	Same as Alternative 2 for most species; however, moderate permanent negative impacts for species found in NCM.	Same as Alternative 2
Cultural and Aesthetic Environment					
Cultural Resources	No impact	Potential disturbance to unknown sites			
Noise	No impact	Minor negative temporary construction-related impacts			
Aesthetics	No impact	Minor negative temporary construction-related impacts			Substantial construction and permanent negative effects due to levee proximity to Alviso community

Alt.=Alternative; NCM = New Chicago Marsh

3.9.1.3 Regional Economic Development

All of the action alternatives are expected to have positive regional economic impacts resulting from a reduction in flood risk and the expenditure of funds to implement the projects. The benefits from the reduction in flood risk are generally captured in the NED analysis, while this section aims to quantify the regional impact from the expenditure of construction funds.

Project implementation would result in a substantial construction expenditure and demand for both construction labor and construction support services, thereby providing short-term regional economic benefits. In addition to increased construction and manufacturing labor demand (from a greater need for construction materials), the private sector may benefit from the project through contracted construction management and architectural and landscaping employment opportunities. Expenditure on construction materials, labor, and services would in turn have a "trickle down" effect throughout the region as increased employment opportunities and higher overall earnings generate spending and inter-industry economic activity.

The RECONS model, which is used to estimate the regional economic impact of the expenditure of funds for projects or studies, is a USACE-approved web-based model. The model was run using the default spending profile (assumptions about how cost is distributed across different tasks) and local purchase coefficients (assumptions about what percentage of the spending stays in the local economy and what percentage goes to the broader region and nation). Table 3.9-3 *RED Impacts – NED/NER and LPP Plans, By Project Purpose* and Table 3.9-4 *RED Impacts – NED*/NER and LPP Combined Plans (including Recreation) show the results from the RECONS model for the NED/NER Plan and LPP.

Table 3.9-3 RED Impacts – NED/NER and LPP Plans, By Project Purpose

October 2014 Price Levels

Impacts		NED FRM Option	Locally Preferred FRM Option	NER Plan Features	LPP Ecosystem Restoration Features	Recreation
Total Spending		$73,468,000	$88,877,000	$17,474,000	$63,599,000	$6,212,000
Direct Impacts	Output	$63,926,346	$77,334,102	$13,754,883	$50,062,766	$5,061,143
	Jobs	1035	1252	148	538	45
	Labor Income	$47,114,770	$56,996,507	$6,148,131	$22,376,960	$2,713,315
	GRP*	$52,958,146	$64,065,459	$6,879,859	$25,040,181	$3,046,476
Total Impacts (Direct & Indirect)	Output	$121,896,266	$147,462,493	$25,631,946	$93,290,955	$9,441,966
	Jobs	1463	1770	234	850	78
	Labor Income	$66,828,905	$80,845,438	$10,362,247	$37,714,809	$4,281,377
	GRP	$87,057,218	$105,316,387	$13,844,975	$50,390,670	$5,667,632

Table 3.9-4 RED Impacts – NED/NER and LPP Combined Plans (including Recreation)

October 2014 Price Levels

Impacts		NED/NER Plan	LPP FRM/Ecosystem Restoration Plan
Total Spending		$97,154,000	$158,688,000
Direct Impact	Output	$82,742,372	$132,458,011
	Jobs	1228	1835
	Labor Income	$55,976,216	$82,086,782
	GRP*	$62,884,481	$92,152,116
Total Impact (Direct & Indirect)	Output	$156,970,178	$250,195,414

Following are explanations of the RED characteristics included in the table:

- **Output** – This measure represents the total sales activity attributable to the expenditure.
- **Jobs** – This measure represents the total number of jobs (both full-time and part-time) attributable to the expenditure. The jobs estimated are simply annual equivalents and are not necessarily new or permanent jobs.
- **Labor Income** – This measure represents labor income associated with the total number of jobs attributable to the expenditure.
- **Gross Regional Product** – This measure is equal to gross industry output (i.e., sales or gross revenues) minus its intermediate inputs (i.e., the consumption of goods and services purchased from other United States industries or imported).

The RED impact of each combined FRM/Ecosystem Restoration option can be estimated by summing the impacts for each of the two options shown in Table 3.9-3 *RED* Impacts – NED*/NER* and *LPP* Plans, By Project Purpose.

3.9.1.4 Other Social Effects

The OSE account typically includes long-term community impacts in the areas of public facilities and services, recreational opportunities, transportation and traffic, and human-made and natural resources. These impacts are difficult to quantify; however, qualitative assessments can be made (Table 3.9-5 *Summary of Other Social Effects Account Impacts*). For example, connecting the local trail system to the broader South Bay trails network would improve the quality of life regionally. The impacts of the No Action Alternative (Alternative 1) represent the future without-project condition for these social characteristics.

There are approximately 2,100 people living in the floodplain, mostly low-income minority families. There are estimated to be another 3,400 individuals that work in the area and are considered part of the overall “population at risk”.

Under the without-project condition, the increasing future flood risk represents a real risk to human health and safety in the study area. Also, in the aftermath of a flood event, the temporary or long-term displacement of people and businesses would adversely alter the community and the lives of those affected. If the flooding were severe enough to damage an unprotected Wastewater Facility, the potential release of raw sewage into the bay and the loss of service would have catastrophic impacts on the region. In the long-term, the increasing flood risk would be expected to force people to relocate out of the floodplain, and the community of Alviso would either be significantly adversely impacted or cease to exist altogether. The relocation of structures out of the area would be expected to include an elementary school, several churches, and potentially the San Jose Fire Department Station #25. The without-project condition would be associated with very significant adverse consequences across all of the factors listed in Table 27 (OSE Social Factors [from IWR Report 2013-R-13]) – especially in the community of Alviso that would be affected most severely.

Table 3.9-5. Summary of Other Social Effects Account Impacts

Characteristic	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Alternative Description	No Action	Alviso North with 12.5-foot Levee and Bench	Alviso North with 15.2-foot Levee and 30:1 Ecotone	Alviso Railroad with 15.2-foot Levee and Bench	Alviso South with 15.2-foot Levee and Bench
Public Health and Safety	Continued risk of tidal flooding, especially as sea level changes. Ponded areas would continue to support mosquito breeding habitat, and long-term vector control would continue.	Would reduce potential public health and safety risks associated with flooding. Tidal areas could continue to support mosquito breeding habitat, so long-term vector control would continue.			
Public Facilities and Services	Fire station, school, Wastewater Facility, railroad, and utilities would continue to be subject to flood risk.	Long-term benefit to Wastewater Facility by providing increased flood protection. Potential reduced need for emergency response related to flood incidents. Potential short-term rail service interruption effects during construction. Potential short-term utility service interruption effects during construction.	Same as Alternative 2.	Same as Alternative 2. Additional effect: permanent loss of railroad spur for rail use.	Same as Alternative 2.
Recreation and Public Access –Trail System	No impact.	Short-term nuisance effects (noise, dust, access) during construction. Net loss of between 4.5 and 5.2 miles of existing trails in the Refuge. Includes construction of new segment of Bay Trail with long-term contribution to the regional trail system.			
Recreation and Public Access –Environmental Education Center	No immediate impact; long-term effects of flooding could directly affect the facility and use of the site for its intended purpose.	Short-term nuisance effects (noise, dust, access) during construction. In the long term, would provide improved flood risk protection to the facility.		Short-term nuisance effects (noise, dust, access) during construction. Placement of levee could adversely affect the experience of people using the facility and how land around the facility is used to support environmental education. In the long term, would provide improved flood risk protection to the facility.	
Traffic and Transportation	No impact.	Short-term adverse effects on intersection function and freeway operation during construction.			
Displacement of People and Businesses	No immediate impact; long-term effects of continued flooding are likely to cause displacement of people and businesses.	No impact in the short term; depending on magnitude of SLC, some people and businesses could be displaced in the long term.			

3.9.2 Associated Evaluation Criteria

The alternative plans were evaluated against the specific P&G criteria (completeness, effectiveness, efficiency, and acceptability) also presented in the USACE Planning Guidance Notebook. These four criteria, described as follows, are used to evaluate project plans under Federal guidelines. These criteria were considered during the plan formulation process and then used to screen the array of FRM and ecosystem restoration options. In this stage of the planning process, the criteria were used to evaluate the final array of alternatives to assist in plan selection.

3.9.2.1 Completeness

Completeness is the extent to which a given alternative provides and accounts for all necessary investments or other actions to realize the planned effects (i.e., benefits) for a particular plan. This criterion assures that all measures required to achieve the expected outputs are included in the alternative, or are at least addressed. All of the alternatives meet the completeness criterion because they can achieve their planned benefits without requiring additional actions.

3.9.2.2 Effectiveness

Effectiveness is the extent to which an alternative plan meets the planning objectives.

- The No Action Plan (Alternative 1) is not effective because it does not meet the planning objectives.
- All action alternatives (Alternatives 2–5) meet the effectiveness criteria.

3.9.2.3 Efficiency

Efficiency can be evaluated in either economic or ecological terms for this project. Economic efficiency measures the amount of project outputs (such as flood damages prevented) per unit of economic cost. Ecological efficiency measures the amount of project cost per unit of ecological output.

- The No Action Alternative (Alternative 1) is not efficient because it does not provide FRM or ecosystem restoration benefits and would require financial expenditures in the future to manage flood risk in the study area as sea level increases.
- The NED/NER Plan (Alternative 2) is the most efficient plan, since it produces the highest net FRM benefits (per NED analysis) and includes the largest Best Buy plan for ecosystem restoration (NER Plan, per EQ account).
- The remaining alternatives are efficient because they generate benefits in return for the implementation cost.

3.9.2.4 Acceptability

Acceptability is viewed from the Federal perspective and is judged in terms of the alternative's reasonableness. State and local laws, plans, and policies do not necessarily determine what is acceptable from the Federal perspective but are considered when evaluating plan effects.

- **Alternative 1** (No Action) is acceptable from the Federal perspective.
- **Alternative 2 (Tentative NED/NER Plan)** is acceptable to the Federal government, and, as the identified Tentative NED/NER Plan, it provides the basis for implementation cost-sharing between the Federal and non-Federal partners.
- **Alternative 3 (LPP)** is acceptable to the Federal government, although the cost share would be based on the NED/NER Plan (Alternative 2). The non-Federal sponsor considers Alternative 3 more acceptable than Alternative 2 because of its lower residual flood risk and the expected ecological performance of the ecotone compared to the bench.
- **Alternative 4**, which includes the Alviso Railroad Spur levee alignment, is acceptable from the Federal perspective.
- **Alternative 5**, which includes the Alviso South levee alignment, is acceptable from the Federal perspective.

3.10 Plan Selection

The following designations are made in the selection process.

3.10.1 Designation of the NED/NER Plan

Alternative 2 (Alviso North with 12.5-foot Levee and Bench) is the plan that provides the best mix of contributions to net NED and national ecosystem restoration (NER). It attempts to maximize the sum net of net economic and ecosystem effects. This plan is designated as the Tentative NED/NER Plan for the following reasons:

- Alviso North and WPCP South levee alignment with a 12.5-foot NAVD 88 levee maximizes net national economic benefits while maximizing the reductions of residual tidal flood risk compared to the FRM components included in the other alternatives.
- It includes all ponds at the basic in-pond preparation level and the bench refugia measure, which is the combination that is both cost-effective and considered to be a Best Buy plan.
- Nonstructural measures, including relocating critical utilities, emergency education for the public, establishing evacuation and flood-response plans, managing disease vectors (e.g., mosquitos), and establishing a local flood warning system, are also included for local implementation.

3.10.2 Recommended Plan (Proposed Project)

Alternative 3, the LPP, is the Recommended Plan (Proposed Project) for the reasons listed below. The Recommended Plan is the same as the Tentatively Selected Plan that was identified in the Draft Integrated Report. The non-Federal sponsor is aware of and agrees to the cost-share implications of recommending a LPP, which means that the non-Federal sponsor will be responsible for all costs above the cost of the identified NED/NER Plan.

The LPP recommended by this feasibility study includes basic ecosystem restoration of Ponds A9–A15 and Pond A18 with a 30:1 ecotone adjacent to Ponds A12/13 and A18.

The FRM levee that is part of the Recommended Plan is 15.2 feet NAVD 88 and would tie into existing 1-percent ACE FRM features in the study area. Figure 3.10-1 *Recommended Plan Flood Risk Management Levee Connections to Existing Flood Risk Management Levees* shows the tie-in locations. As part of the Recommended Plan, the section of the existing Coyote Creek levee downstream of the easternmost connection point would be decommissioned to allow breaching of Pond A18.

Nonstructural measures, including relocating critical utilities, emergency education for the public, establishing evacuation and flood-response plans, managing disease vectors (e.g., mosquitos), and establishing a local flood warning system, are also included for local implementation.

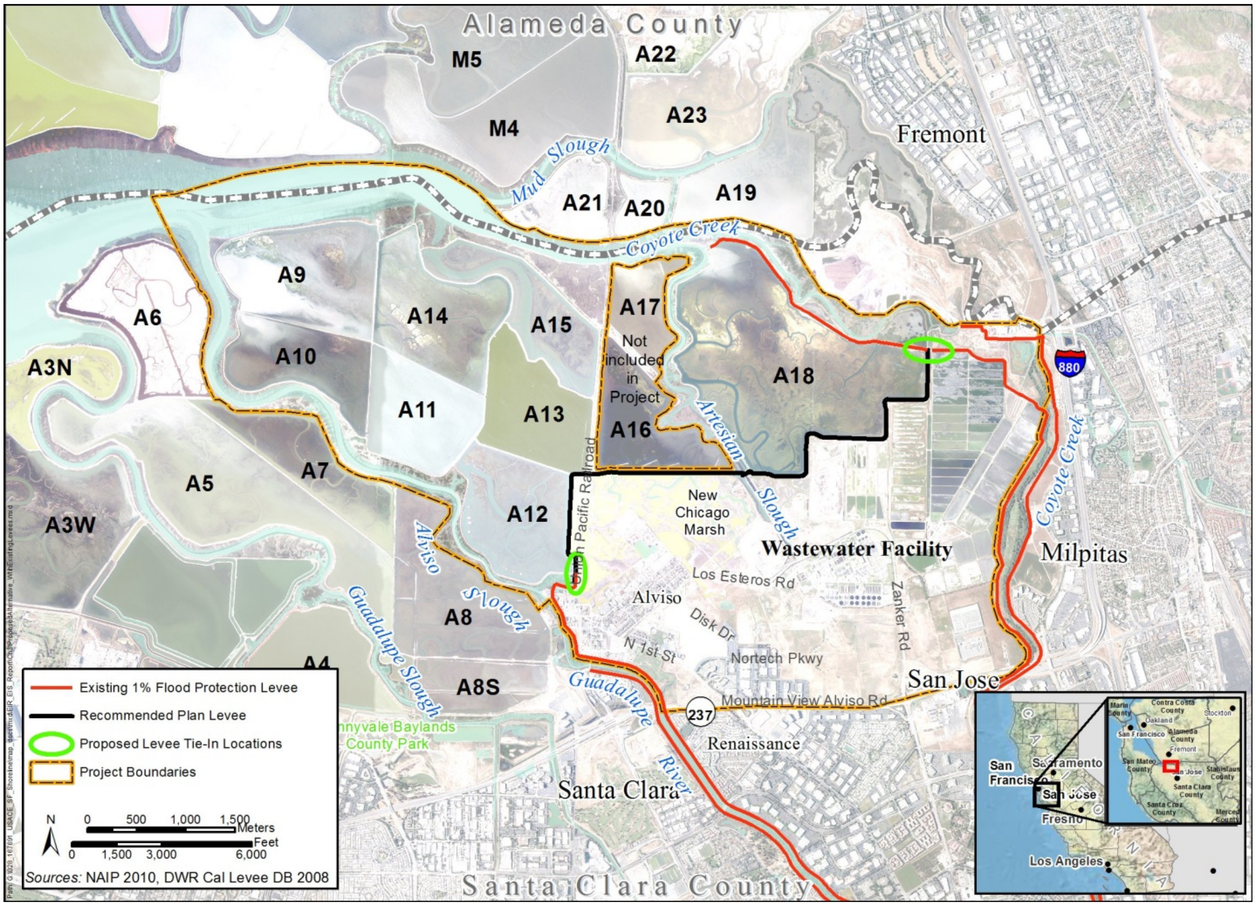

Figure 3.10-1. Recommended Plan Flood Risk Management Levee Connections to Existing Flood Risk Management Levees

The reasons Alternative 3 is identified as the Recommended Plan include:

- Alternative 3 meets Federal and local planning objectives and addresses regulatory agency concerns regarding environmental impacts.
- The levee height of 15.2 feet NAVD 88 corresponds to a 1-percent ACE at Year 50 (2067) under FEMA criteria, which allows one of the non-Federal sponsor (SCVWD) to meet its local FRM requirements.
- The ecotone establishes a larger area of transitional habitat than that identified in the NED/NER plan. Compared to the habitat bench that is included in the NED/NER plan, the ecotone provides more high-tide refugia and increases the resiliency and longevity of the outboard tidal wetlands, and subsequently increases all of the concomitant flood benefits they provide, such as wave attenuation. Constructing a larger transitional habitat feature also creates more tidal marsh habitat in deeply subsided areas adjacent to the FRM levees, where tidal marsh is less likely to develop through natural sedimentation.

The other alternatives were not supported by the non-Federal sponsors for the following reasons:

- **Alternative 1 (No Action)** does not meet planning objectives.
- **Alternative 2 (NED/NER Plan)** does not provide for the 1-percent ACE level of performance in 2067[9] under FEMA criteria and is associated with a higher residual tidal flood risk under the USACE High SLC scenario in 2067. Alternative 2 also does not provide the additional transitional habitat for Ponds A12/A13 and A18 to accelerate evolution of the marsh habitat necessary to immediately benefit special-status species.
  - Table 3.10-1 *Project Performance Statistics at 2067 – 12.5-foot NAVD 88 NED and 15.2-foot NAVD 88 LPP Levees* displays the project performance statistics from the HEC-FDA modeling for the 12.5-foot NAVD 88 and 15.2-foot NAVD 88 levees at the end of the period of analysis. The results indicate that there is a very low risk of coastal flood damage with either of the levee heights under the Low and Intermediate SLC scenarios. In general, the performance of the levees is very similar, and the only significant difference between the two emerges under the USACE High SLC scenario. As noted previously, there is significant residual risk with the 12.5-foot NAVD 88 levee at the end of the period of analysis under the High SLC scenario.

Table 3.10-1. Project Performance Statistics at 2067 – 12.5-foot NAVD 88 NED and 15.2-foot NAVD 88 LPP Levees

SLC Scenario	FRM Option	Average Annual Exceedence Probability in 2067	Long Term Risk (30 yrs) 2067	Assurance/Conditional Non Exceedance Probability by Event 2067			
				10%	2%	1%	0.20%
Low	12.5' Levee	0.08%	2.6%	99.9%	99.9%	99.9%	94.9%
	15.2' Levee	0.01%	0.2%	99.9%	99.9%	99.9%	99.9%
Intermediate	12.5' Levee	0.08%	2.0%	99.9%	99.9%	99.9%	92.6%
	15.2' Levee	0.01%	0.2%	99.9%	99.9%	99.9%	99.9%
High	12.5' Levee	8.51%	93.1%	66.7%	3.2%	0.7%	<.01%
	15.2' Levee	0.02%	0.6%	99.90%	99.9%	99.9%	99.9%

  - Table 3.10-2 *Summary of Results for 12.5-foot NAVD 88 and 15.2-foot NAVD 88 Levees* compares some of the important overall FRM outputs of the two levee heights, including the net benefits, BCR, and residual damage in both equivalent annual terms and at the end of the period of analysis (2067).

[9] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

Table 3.10-2. Summary of Results for 12.5-foot NAVD 88 and 15.2-foot NAVD 88 Levees

Dollars in 1,000s, October 2014 (FY15) price levels, 3.375% discount rate

SLC Scenario	FRM Option	Total Equivalent Annual Benefits	Net Benefits	BCR @ 3.375%	Residual Equivalent Annual Damage	Residual Annual Damage in 2067	Average Annual Exceedence Probability in 2067
Low	12.5' Levee	$18,914	$15,398	5.38	$17	$244	0.08%
	15.2' Levee	$18,932	$14,774	4.55	$0	$0	0.01%
Intermediate	12.5' Levee	$23,551	$20,035	6.70	$21	$300	0.08%
	15.2' Levee	$23,573	$19,415	5.67	$0	$0	0.01%
High	12.5' Levee	$40,443	$36,927	11.50	$1,694	$21,000	8.51%
	15.2' Levee	$42,137	$37,979	10.13	$0	$0	0.02%

- **Alternative 4**, which includes the Alviso Railroad Spur levee alignment, is not preferable to non-Federal sponsors, resource agencies, or the public because of impacts on existing NCM habitat. The Alviso Railroad Spur alignment would fragment this muted tidal salt marsh (possibly constraining permitting). Fragmentation of the NCM muted tidal salt marsh habitat would require substantially more mitigation for impacts (see Section 4.7 *Terrestrial Biological Resources* for more details on project impacts). Because a new siphon has been installed in NCM in order to improve water quality and circulation, this marsh no longer depends on a constricted channel for its connection to bay waters. By either maintaining the siphon or avoiding it, the Alviso North and Alviso South alignment options are anticipated to have fewer impacts on aquatic and terrestrial biological resources compared to the Alviso Railroad Spur alignment. Both the Alviso North and South alignments would go around NCM and would not fragment the habitat. In addition, the Alviso Railroad Spur levee alignment is associated with a potential for land acquisition issues, since some parcels in the NCM tract are privately owned. In this respect, the Alviso Railroad Spur levee alignment is less preferable to project partners than the Alviso North or Alviso South alignments.
- **Alternative 5**, which includes the Alviso South levee alignment, is the least preferred by the local community because of its proximity to residential and commercial properties. The community of Alviso would prefer a levee alignment that is as far away from residences as possible. The community therefore prefers the Alviso North or the Alviso Railroad Spur levee alignments to the Alviso South option, which is adjacent to the community (Table 3.10-3 *Levee Alignment Distances from Alviso* Community). In terms of aesthetic impacts to the community, the Alviso North and Alviso Railroad Spur levee alignments would have fewer impacts than the Alviso South alignment. Alternative 5 also would have significant environmental impacts from filling NCM and is not consistent with the Refuge plans for long-term management of NCM (for further discussion of impacts to NCM, see Section 4.7 *Terrestrial Biological Resources*).

Table 3.10-3. Levee Alignment Distances from Alviso Community

Alviso Alignment	Average Distance from Community [a, b] (feet)
North	2,026
Railroad Spur	782
South	135

[a] Distances not exact; for relative comparison only

[b] Addresses southernmost section of each alignment option along Alviso side of proposed levee

3.10.3 The Least Environmentally Damaging Practicable Alternative

Alternative 3 is the plan that is the least environmentally damaging practicable alternative. This LEDPA designation is based on the following considerations:

- Alternative 1, while it would have no immediate impacts to wetlands and other waters of the U.S., would not be resilient to SLC. Some existing non-tidal wetlands would be lost in the long term. Marsh species listed under the Endangered Species Act would not recover within the study area due to needed habitat not being restored. Opportunities for increased wetland area and consequently improved water quality would be foregone. Breaching of existing managed ponds due to SLC would occur too late for sediment accumulation to form marshes in these areas.
- Alternatives 4 and 5 would have increased impacts to wetlands and other waters of the U.S. (relative to other alternatives) because of the levee alignment through New Chicago Marsh, with no offsetting improvements in aquatic resources.
- Alternative 2 would have the least short-term impacts to wetlands and other waters of the U.S. It would be less resilient to SLC, both in terms of the marsh transition zone adapting to rising sea levels and in the ability of the FRM levee to protect New Chicago Marsh from eventual drowning caused by its elevation being below mean sea level. The marsh transition zone would be much less useful for maintenance and recovery of listed marsh species.
- Alternative 3 would have slightly greater immediate impacts to wetlands and other waters of the U.S. because of the additional areas of fill for the wider levee and the ecotone. This alternative would provide tidal marsh ecotone with a much better ability to adapt to SLC and in doing so would provide additional assistance towards recovery of listed species. In addition, the increased FRM levee height would better protect New Chicago Marsh and its important population of salt marsh harvest mouse from risk of inundation due to SLC. The "Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California" (USFWS, 2014) provides a detailed blueprint for recovery of a number of endangered and threatened species inhabiting tidal marshes in northern and central California. For the salt marsh harvest mouse and the Ridgway's rail, the plan

proposes restoration of tidal marsh/upland ecotone which is regarded as very important to recovering these species. The ecotone in Alternative 3 would provide this important habitat feature, enabling this alternative to better implement a portion of the recovery plan. The bench proposed in the other alternatives would provide minimal ecotone and would not be consistent with this plan.

3.10.4 The CEQA Environmentally Superior Alternative

Alternative 3 was identified as environmentally superior. Alternative 2 and 3 both avoid land use and biological impacts to New Chicago Marsh from a levee alignment that splits the marsh (Alternative 4) and leaves the marsh a risk from tidal flooding (Alternatives 4 and 5). Also avoided are aesthetic impacts from locating the levee close to the community of Alviso that would block views. The No Action Alternative is deemed to have substantial long-term impacts to flood risk and terrestrial biological resources when compared to the action alternatives, and not considered environmental superior to Alternatives 2 and 3.

Alternative 2 would have incrementally fewer impacts that Alternative 3 based on the slightly smaller footprint of the levee. This would result in slightly fewer impacts to construction related traffic, air quality, and noise, and less area of tidal wetlands and managed ponds in the construction footprint. Alternative 2 does not meet the flood protection objective of the CEQA Lead Agency (the Santa Clara Valley Water District) to provide 100 year tidal flood protection over 50 years with assumed SLC. As Alternative 3 would meet all the project objectives with only slightly increased impacts, with the addition of the 30:1 ecotone providing transitional habitat and upland refugia for marsh dependent species; it is the environmental superior alternative.

3.11 Risks and Uncertainty

The plan selection process involves analyzing areas of risk and uncertainty, both to understand how they affect the selection process and to determine how to address the reliability of costs and outputs generated by the selected plan.

Risk involves both the likelihood and the consequences (desired and undesired) of a particular event. In the context of this assessment, the concern is with risk associated with undesired events. Uncertainty describes any situation lacking absolute surety. Uncertainty can arise from natural variation that is outside of human control, or it can arise from human limitations in forecasting future events.

Monitoring and adaptive management would address some areas of risk and uncertainty associated with the implementation of the selected plan [specifically, achieving the desired ecosystem restoration objectives described further in the MAMP (Appendix F *Shoreline Study Monitoring and Adaptive Management Plan for Ecosystem Restoration*)] and would address potential adjustments to respond to situations that could affect plan performance or costs. Other areas of risk and uncertainty (e.g., related to FRM, public access, and future SLC) that result in future actions to implement necessary changes would be addressed through O&M of the completed project or a post-authorization-change process. The following section describes major sources of risk and uncertainty and how they could affect both plan selection and implementation.

3.11.1 Increased Sea Level Change

As stated in Section 3.8.1 *Flood Risk Management Details*, tidal flood risk was analyzed under a range of SLC rates bookended by the USACE Low SLC scenario (consistent with local historical SLC) and USACE High SLC scenario (consistent with the NRC Curve III scenario and the State's planning requirements [Appendix D2 *Tidal Flood Risk Analysis Summary Report*]). The analysis also included the USACE Intermediate SLC scenario, which is consistent with the NRC Curve I scenario. For the ecosystem restoration analysis, the USACE High SLC scenario was assumed.

Increasing sea level affects the tidal FRM and ecosystem restoration aspects of the project. If sea level increases at a slower rate (e.g., USACE Low SLC scenario), then the project justification would not be negatively affected (the ecosystem restoration outputs would increase because of faster tidal marsh development, and the tidal FRM features would still yield positive net benefits); however, the project partners may have invested in a larger (more expensive) project than what was necessary to meet their tidal FRM objectives. If sea level increases at a faster rate than the USACE High SLC scenario, then changes may need to be made to the FRM features to retain FEMA levee certification in the future and to the ecosystem restoration features to develop or retain tidal marsh habitat.

With respect to ecosystem restoration, a faster rate of SLC could convert emergent wetlands to shallow open water, and shallow open water to deeper water habitat, thereby reducing or eliminating the effectiveness of restoration plans. Proposed restoration features adjacent to open water are more susceptible to the effects of increased SLC than are more interior areas.

With respect to FRM, a faster rate of SLC could be addressed by raising the levees, either through a post-authorization change process involving the Federal and non-Federal partners or through a Section 408 process, which allows a non-Federal sponsor to modify a constructed project. The non-Federal sponsors are also encouraged to consider relocating structures and residents from shoreline areas as the sea level and associated flood risk increase.

A slower rate of SLC would mean that the Federal government and non-Federal partners invested in a larger project than what was necessary to meet the Federal and local objectives for FRM. To assess the consequences of overinvesting, discussion of what would happen if sea level were to increase at either the USACE Low SLC scenario (consistent with the local historical rate) or the USACE Intermediate SLC scenario were considered (consistent with the NRC Curve I scenario), both of which are lower than the USACE High SLC scenario (consistent with the NRC Curve III scenario and the State's planning requirement).

All of the alternatives in the final array (i.e., containing a 12.5-foot NAVD 88 levee or a 15.2-foot NAVD 88 levee) would provide a high level of tidal flood risk reduction throughout the entire fifty-year period of analysis and be associated with very low residual tidal flood risk. If the sea level changes more quickly than assumed with the USACE High SLC scenario, the residual risk (remaining risk after implementing tidal FRM actions) would be higher. The annual tidal flood risk would continue to increase beyond the period of analysis in line with the continued rise in sea level.

While no levee can eliminate all risk of failure below the top of levee elevation, the likelihood of structural failure would be low if the project is properly maintained. The consequences of a failure would be substantial in terms of property damage and the risk to human health and safety. Residual risk can be reduced with effective floodplain management and flood warning and evacuation plans.

It is important to emphasize that, no matter which levee is implemented, over time that project's performance (the likelihood of preventing damage from storms of a particular size) would decrease as the sea level changes.

3.11.1.1 Near Term versus Future Pond Restoration

There are two primary reasons for starting tidal habitat restoration in the interim study area defined in the SBSP Restoration Plan Initial Stewardship Plan in the near future rather than several decades from now. The Shoreline Phase I Study Area is within the interim study area.

3.11.1.1.1 Contribution toward Recovery of Listed Species

The Federally and State listed SMHM and Ridgway's rail are endangered because of degradation and loss of habitat. Thus, restoration of adequate habitat for these species to allow for even partial recovery is a high priority. Further, given that tidal marsh restoration in this area can require 10 to 40 years lead time to create large areas of suitable habitat for these two species, an early start to habitat restoration is considered very important.

Existing habitat restoration projects within and near the interim study area are slowly improving the situation for these two species. Nevertheless, these projects will not provide adequate contiguous restored habitat acreage to meet the requirements for recovery for these two species in this portion of San Francisco Bay (the Guadalupe Slough–Warm Springs marshes segment), as stated in the Final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (USFWS 2013). Only a large, contiguous tidal restoration would achieve this goal for the Guadalupe Slough–Warm Springs marshes segment, if conditions are sufficient to form suitable acreage and characteristics of tidal marsh in the restored areas.

3.11.1.1.2 Lead Time for Marsh Formation

The second reason for starting tidal habitat restoration soon in the interim study area is to give the sedimentation process in breached ponds enough lead time to bring the pond bottoms up to marsh elevation prior to the acceleration of SLC later in the century. All of the ponds in the interim study area lie within the zone of subsidence created by groundwater withdrawals during the middle decades of the 20th century. (The deep aquifer in question extends under the bay from the Santa Clara Valley and is hydrologically isolated from bay waters). Although all these ponds formerly consisted of tidal marshes, subsidence after their diking for salt production lowered their elevations by several feet or more.

Therefore, when the ponds are breached, their bottom elevations will be too low for marsh to form. Several feet of sediment will need to be deposited by natural processes before pond bottoms reach sufficient elevation for marsh vegetation to grow. This sedimentation process, which has been modeled for various pond restoration sequences, is expected to proceed at rates determined in part by suspended solids concentrations as well as by factors causing re-suspension of sediment, such as wave action and tidal currents, in the breached ponds (ESA-PWA 2012).

Once tidal marshes have formed in the former ponds, the rate of sedimentation will increase as the vegetation slows the water, catches sediment, and retains it. Past experience with rapid land subsidence in the sediment-rich tidal waters of the interim study area has shown that tidal marshes in this environment can keep pace with a high rate of relative SLC as long as there is adequate sediment available. Thus, the key factor in making tidal marsh restoration work in this area is breaching the ponds early enough to allow sedimentation to bring the pond bottoms up to marsh elevation before the start of rapid SLC. Once SLC is occurring at a sufficient and accelerating rate, sedimentation in breached ponds will fall behind the rate of SLC, and the marsh will be unable to form even as the pond bottom continues to rise with sediment accumulation.

If a much lower estimate of SLC is assumed, then this issue would seem to be less acute. In principle, restoration could be deferred for a few decades while the sea level changes slowly, after which the combined FRM/ER project could be constructed. Under this scenario, the option of implementing the project sooner if SLC occurs at a higher rate should be retained to ensure a flexible response to uncertain conditions.

If this approach (deferring restoration) is taken, however, it then raises the problem of determining whether SLC is occurring slowly or rapidly. Reliably demonstrating a sustained new trend in SLC would take a number of years, since the local record contains considerable statistical noise. This can be seen in the long-term sea level record from San Francisco (Figure 3.11-1 *San Francisco Tide Gauge Record Showing Relative Sea Level Change Increases during Major El Niño Events*). As shown in the graph, periods of up to 10 years may appear to have an increased or decreased rate of SLC because of extraneous factors such as episodes of El Niño, without substantially affecting the long-term trend.

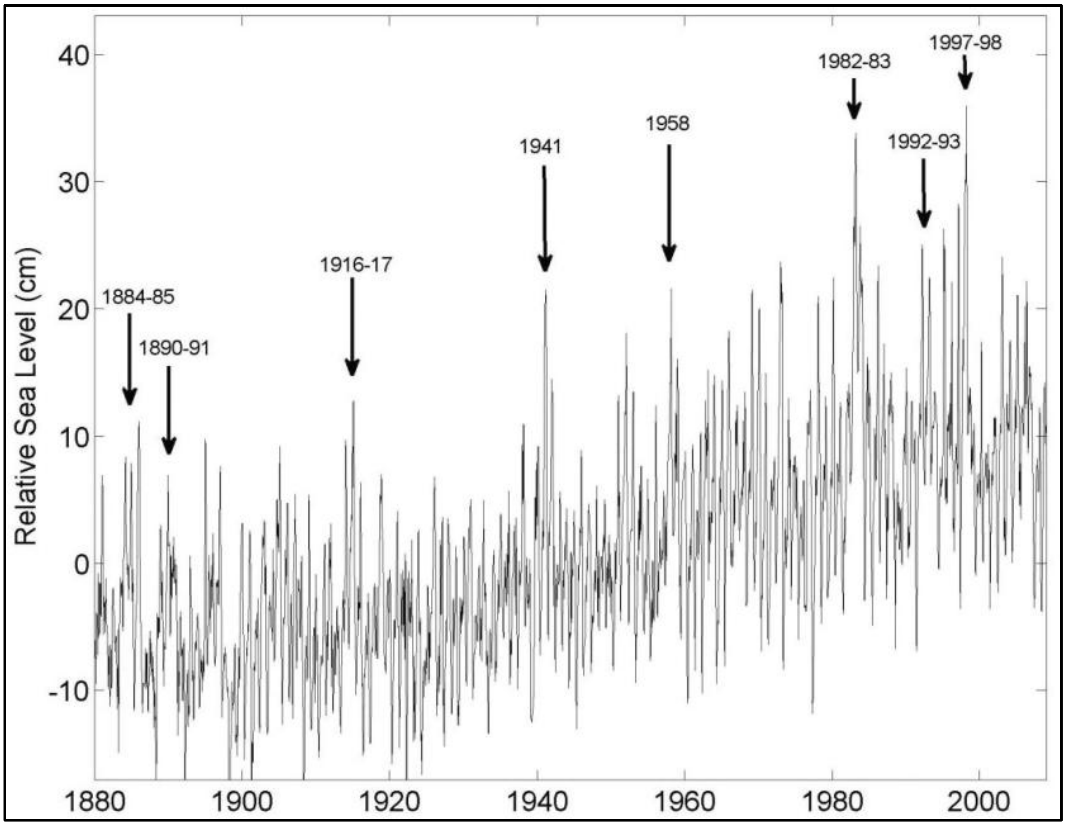

Figure 3.11-1. San Francisco Tide Gauge Record Showing Relative Sea Level Change Increases during Major El Niño Events
Source: NRC 2012

Thus, if SLC appears to be accelerating, it still might take 15 years or more to demonstrate a reasonable probability that this trend is sustained rather than being short term. Additional delay would be incurred from the need to make a new report to the Administration and Congress, obtain Congressional authorization and funding, and then complete design, permitting, and construction of an updated project. The result could be a delay of 20 to 25 years from the start of the new trend until initiation of tidal restoration, with corresponding delays in the following phased restoration process and associated sediment accumulation in the breached ponds.

In addition to the uncertainties around SLC, the other part of the equation for adequate marsh accretion rates is the amount of suspended sediments in San Francisco Bay. Current levels are quite high in the interim study area, and recently restored marshes are benefiting from those levels as evidenced by high accretion rates. Recent research from the USGS, however, indicates that San Francisco Bay is becoming less turbid and that current levels of suspended sediments are not likely to remain the same in coming decades. With increasing sea levels and decreasing sediment supplies, restoration practitioners and researchers in San Francisco Bay are encouraging proceeding with a sense of urgency to create sustainable marshes.

Delaying restoration would create a substantial risk of the ponds being restored to tidal action too late for their bottom surfaces to reach marsh elevation before the acceleration of SLC renders the natural sedimentation process inadequate for marsh restoration to occur. Waiting for confirmation of the future rate of SLC would create the risk of not being able to respond in a timely manner to a genuine change in the long-term trend.

3.11.1.2 Impact on Plan Selection and Implementation

Because of the residual tidal flood risk associated with the NED/NER Plan (Alternative 2; Alviso North with 12.5-foot Levee and Bench) toward the end of the period of analysis and the relatively small cost for constructing a higher levee (approximately $15 million of non-Federal funds for FRM), Alternative 3 was selected (Alviso North with 15.2-foot Levee and 30:1 Ecotone) to recommend for implementation as a LPP. The additional transitional habitat (ecotone) under the LPP also provides the ability for tidal marsh habitat to retreat inland in case SLC greater than assumed under the USACE High SLC scenario. Additional changes to address risk and uncertainty associated with SLC would be occur after project implementation through either a post-authorization change process that amends the Congressional authorization or a Section 408 process under which the non-Federal sponsor receives permission to modify the authorized project.

3.11.2 Sediment Dynamics

The movement and availability of sediment in the waters of southern San Francisco Bay are uncertain. The habitat evaluation modeling assumed that a certain quantity of sediment would be available to convert the ponds into tidal marsh habitat. Based on these results, the habitat restoration effort determined for the suite of ponds west of Artesian Slough (Ponds A9 through A15) needed to begin with Pond A12; local sediment dynamics would not allow this pond to convert to tidal marsh if the other ponds closer to the bay were converted first.

3.11.2.1 Impact on Plan Selection and Implementation

The alternative plans would be similarly affected by uncertainty in sediment dynamics during the establishment of tidal marsh. The plan that includes an ecotone (Alternative 3) allows the project partnership to create a larger area of critical transitional habitat (versus the bench refugia measure) that is not subject to natural sedimentation processes. For this reason, the study partners have identified Alternative 3 as the Recommended Plan (Proposed Project).

During the phased implementation of the tidal marsh restoration, the project partnership will monitor the extent to which estuarine sedimentation will be sufficient to convert mudflats to vegetated marsh. The monitoring results may indicate that additional material must be imported to create tidal marsh. Additionally, the SBSP Restoration Project will monitor the extent to which tidal habitat restoration within the Shoreline Phase I Project area might result in regional loss of slough and tidal mudflat habitat regionally. Future phases of the Shoreline Phase I Project may be adjusted based on these regional impacts.

3.11.3 Climate Change

Extreme changes in climate could result in conditions that cannot support the types of habitat restored, thereby reducing the effectiveness of the restoration plan

3.11.3.1 Impact on Plan Selection and Implementation

Climate change risk and uncertainty would equally affect all of the action alternatives and therefore did not factor into plan selection. After project construction, the non-Federal sponsor may need to adjust the use of vegetative plantings under routine operation and maintenance. The non-Federal sponsor would also decide whether a post-authorization change or Section 408 process is necessary to make substantial adjustments to the project.

3.11.4 Seismic Activity

The greater San Francisco Bay Area is one of the most seismically active regions in the U.S. Significant earthquakes that occur in the San Francisco Bay Area are generally associated with tectonic movement along the well-defined, active fault zones of the San Andreas fault, which is located approximately seven miles west of the study area. The Hayward fault, another major active fault, is located about two miles east of the study area.

The USGS 2007 Working Group on California Earthquake Probabilities has reported that it is a near certainty (93-percent chance) that at least one magnitude 6.7 earthquake or greater will occur in northern California within the next 30 years, with a 63-percent chance of occurrence in the San Francisco Bay Area. Among the faults in the region, the Hayward fault is the most likely source, with a 31-percent chance of producing a 6.7 or greater seismic event within the next 30 years. The Hayward fault produces a large earthquake approximately once every 140 years; the last major earthquake on the Hayward fault occurred in 1868, approximately 148 years ago.

Seismic hazards in the Shoreline Phase I Study Area will continue to be a concern. Strong ground shaking and liquefaction of saturated loose granular soils during an earthquake may cause damaging lateral spreading or ground settlement within the Shoreline Phase I Study Area.

A potential earthquake hazard that exists throughout the San Francisco Bay region is strong ground shaking (EDAW et al. 2007). Ground shaking is a complex vibratory motion in both the horizontal and vertical directions. The amplitude, duration, and frequency of ground shaking experienced during an earthquake event at any given location depends on several factors, including the magnitude of the earthquake, fault rupture characteristics, distance of the fault rupture from the site, and types and distributions of soils beneath the site.

The seismic hazards for the Shoreline Phase I Project site are generally related to strong ground shaking and seismically induced liquefaction. To compensate for the seismic hazard, all of the levees under consideration were designed with 3:1 horizontal-to-vertical side slopes. This inclination is generally recognized as good practice for mitigating some of the risk associated with earthquakes. In addition, all of the alternatives include either a bench or an ecotone, which would further increase levee stability.

3.11.4.1 Impact on Plan Selection and Implementation

Seismic activity would equally affect all of the action alternatives and therefore did not factor into plan selection. After project construction, the non-Federal sponsors will address any levee damage caused by seismic activity under routine operation and maintenance. The non-Federal sponsors would also decide whether a post-authorization change or Section 408 process is necessary to make substantial adjustments to the project.

3.11.5 Mercury and Methylmercury Bioavailability as a Result of Pond Breaches

The extent to which the ecosystem restoration and management actions might result in an increase in bioavailable mercury in the food chain is uncertain, although design features would incorporate results from the current SBSP Restoration Project mercury studies to best manage changes in the water chemistry.

The legacy of mercury contamination in San Francisco Bay dates back more than 150 years to the California Gold Rush. Although mines developed during the Gold Rush have largely been cleaned up, the mercury released is still cycling through the sediment carried from the upper reaches of the watersheds to the bay. Although elevated levels of mercury have been observed throughout San Francisco Bay for decades, regulations with respect to mercury levels have been adopted only recently.

On September 15, 2004, the San Francisco Bay Regional Water Quality Control Board adopted Resolution No. R2-2004-0082, amending the San Francisco Bay Water Quality Control Plan (Basin Plan) to incorporate a mercury Total Maximum Daily Load (TMDL) and implementation plan to reduce mercury in San Francisco Bay. The primary purposes of the TMDL and plan were to accelerate achievement of water quality objectives for mercury in the bay, be more protective of fish and other wildlife, ensure the maximum practical pollution prevention by municipal and industrial wastewater dischargers, and more clearly incorporate risk reduction measures addressing public health impacts on subsistence fishers and their families.

On February 12, 2008, the USEPA approved a Basin Plan amendment incorporating a TMDL for mercury in San Francisco Bay and an implementation plan to achieve the TMDL. Section 4.5 *Surface Water and Sediment Quality* provides more detail regarding actions taken for San Francisco Bay that address mercury and other water quality constituents of concern.

Mercury can pose a serious public health risk. The State Water Resources Control Board has listed 860,000 acres of estuaries, lakes, and reservoirs and 303 miles of rivers and creeks as mercury-impaired, including the entire San Francisco Bay. Additionally, the U.S. Agency for Toxic Substances and Disease Registry and the USEPA have issued a joint alert to the public regarding the hazards of mercury to the general public. Locally, Santa Clara County has issued a fish consumption advisory for mercury contamination associated with the Guadalupe River watershed. Elevated mercury concentrations in fish tissue also pose a threat to wildlife, such as birds, amphibians, and mammals. Bioaccumulation of mercury is a primary concern for species that are higher in the food web.

In humans, elevated mercury levels can cause serious health problems. Children and fetuses are most vulnerable. Health effects can result from short- or long-term exposure, and exposure can cause harm before symptoms arise. When symptoms arise, health problems can include tremors, changes in vision or hearing, insomnia, weakness, difficulty with memory, headache, irritability, shyness, and nervousness. In young children, exposure to metallic mercury can damage the central nervous system. Long-term mercury exposure can cause children to have learning disorders. The USEPA considers metallic mercury to be a possible human carcinogen. Under Proposition 65, the Safe Drinking Water and Toxic Enforcement Act of 1986, the State of California has listed all forms of mercury as reproductive toxicants (poisons) and methylmercury compounds as carcinogens (tend to cause cancer).

3.11.5.1 Impact on Plan Selection and Implementation

Mercury risk and uncertainty equally affect all of the alternatives and therefore did not factor into plan selection.

During project implementation, the SBSP Restoration Project will monitor the regional effects of restoration actions both within and outside the Shoreline Phase I Project area on the presence and movement of mercury in the ecosystem. Adverse effects, as defined by the permit issued by the Regional Water Quality Control Board to the SBSP Restoration Project, would result in either remedial actions or halting the restoration effort under the adaptive implementation concept.

3.11.6 Model Limitations and Errors in Analysis

Future conditions are inherently uncertain. The forecast of the future condition is limited by existing science and technology. The future condition described in this study is based on an analysis of historical trends and the best available information. Some variation between the forecast condition and reality is certain. Restoration features were developed in a risk-aware framework to minimize the degree to which these variations would affect planning decisions, but errors in analysis or discrepancies between the forecasted and actual condition could affect the effectiveness of plans.

All of the models used in this study are abstract mathematical representations of reality. Models simulate complex systems by simplifying real processes into expressions of their most basic variables. These tools assist with finding optimal solutions to problems, testing hypothetical situations, and forecasting the future condition based on observed data. No model can account for all relevant variables in a system. The interpretation of model outputs must consider the limitations, strengths, weaknesses, and assumptions inherent in model inputs and framework. Inaccurate assumptions or input errors could change benefits predicted by models used in this study. Technical review, sensitivity analyses, and quality assurance procedures have reduced the potential for substantial changes caused by errors. There is inherent risk, however, in reducing complex natural systems into the results of mathematic expressions driven by the simplified interaction of key variables.

The CHAP model used to assess environmental benefits, as applied to date, did not reveal that additional costs associated with accelerating restoration, or adding transitional habitat greater than the minimal refugia bench, would result in additional environmental outputs. Model results are presented in Appendix B2 *Environmental Benefits Analysis (CHAP) Summary and Model Outputs*. For the Pond A12, Ponds A13–A15, and Pond A18 increments considered as part of the CE/ICA process, current CHAP results show that additional cost and additional features result in the same or fewer average annual outputs. The CHAP application was not refined, either, to balance the relative benefits of transitional pond habitat, which are rich in functions, and salt marsh habitat. The utility of a model's application to capture ecosystem complexities depends on the extent to which unique local settings such as this are captured in functions identified, and in calculations applied. The model results are different than would be expected, for example, adding transitional marsh habitat (with 30:1 side slopes) to the restoration effort should result in greater outputs than what would be realized with the smaller bench refugia measure.

3.11.6.1 Impact on Plan Selection and Implementation

The results of the CHAP analysis affected the screening of ecosystem restoration options, the identification of the NED/NER Plan, and the non-Federal sponsor's plan preference.

- Screening of ecosystem restoration options:
  - The accelerated in-pond preparation measure was identified as not efficient because it did not provide additional outputs above the basic in-pond preparation measure. Because the non-Federal sponsor was not willing to fund the additional cost of the accelerated in-pond features (as part of a LPP), the accelerated in-pond preparation measure was not included in the final array of plans.
  - The medium (30:1) and high (100:1) ecotone measures were identified as not efficient because they did not provide additional outputs above the bench refugia measure. Because the non-Federal sponsor was willing to fund the additional cost of the medium (30:1) ecotone (as part of a LPP) but not the additional cost of the high (100:1) ecotone, the high (100:1) ecotone was not included in the final array of plans.
- Identification of the NED/NER Plan – As a result of the CE/ICA that used the CHAP outputs, the NER Plan was identified as the one that includes basic restoration and the bench refugia measure.
- Non-Federal sponsors' plan preference – Prior to the completion of the CHAP analysis, the non-Federal sponsors desired a plan that included accelerated in-pond preparation measures and the high (100:1) ecotone measure. The CHAP and CE/ICA results identified that the Federal investment would be limited to the Federal cost share associated with basic in-pond preparation and the bench refugia measure, and the non-Federal sponsor would pay for the incremental cost of the accelerated in-pond preparation features and ecotone. The non-Federal sponsors then decided based on financial considerations that they would be willing to pay for the medium (30:1)

ecotone, but not the high (100:1) ecotone of the accelerated in-pond preparation measure.

3.11.7 Timing of Implementation

The timing and availability of financial resources for implementation can affect project output. If project implementation is delayed, the problems in the study area will intensify and opportunities will not be realized. The delayed implementation could increase restoration costs, decrease restoration benefits, or both. Delaying implementation also increases the likelihood of flood damages prior to constructing the project.

3.11.7.1 Impact on Plan Selection and Implementation

The consequence of delayed funding for implementation is the same for all action alternatives; however, it is more likely that funding shortfalls will affect the more expensive plans than the ones that are of lower cost. The selection of a LPP over the Tentative NED/NER Plan means that the non-Federal sponsor will have a much higher financial burden, not only because the LPP is more expensive than the NED/NER Plan, but because the non-Federal sponsor must pay for the difference in cost for both the FRM and ecosystem restoration features.

Despite the higher non-Federal cost share associated with the LPP, this uncertainty did not dissuade the non-Federal sponsors from selecting Alternative 3, because the non-Federal sponsor has stated that it can cover its share of implementation costs. Financial considerations, however, did factor into the non-Federal sponsor's decision not to request that the high (100:1) ecotone and accelerated in-pond preparation features be included in the Recommended Plan (Proposed Project).

As with all alternatives within the final array, the Recommended Plan (Alternative 3) involves phased implementation over a construction period that lasts 14 years. This construction schedule reduces the consequences of delayed funding, since costs are expended (and required) periodically, rather than all at once. Phased implementation also provides the opportunity to adjust project design and develop lessons learned from projects built in the initial phase, which may result in cost savings. If Federal appropriations do not match the implementation schedule, the non-Federal sponsors have the opportunity to provide advance funds (ahead of the Federal cost share) to provide in-kind design and construction services. This arrangement would be associated with administrative requirements under Section 221 of the Flood Control Act of 1970. For example, the non-Federal sponsors would need to enter into a memorandum of agreement with the Federal government, and USACE would need to determine that the work is integral to the authorized project before credit is provided.

4.0 Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures

4.1 Approach to the Environmental Analysis

In accordance with NEPA, this chapter evaluates the effects on the social, economic, and natural environmental that would result from the final array of alternatives identified in Section 3.7 *Final Array of Alternatives* in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*, including the No Action Alternative. This chapter fulfills the NEPA and CEQA requirements by also evaluating the consequences and avoidance and minimization measures.

4.1.1 Organization of This Chapter

Section 4.1 *Approach to the Environmental Analysis* provides background information such as the general approach to evaluation; application of significance thresholds; descriptions of the Shoreline Phase I Study Area and regional setting; descriptions of the existing setting, National Environmental Policy Act (NEPA) and U.S. Army Corps of Engineers (USACE) Planning Guidance baseline project condition (2018 for start of construction, with a period of analysis of 2021 to 2071); major characteristics of natural and human resources in the study area; descriptions of resources found to be potentially significant or important in the study area; a listing of resources considered but not studied in detail; and a description of the social environment. The section concludes with a listing of past, present, and reasonably foreseeable future projects considered for the cumulative effects analysis and a discussion regarding climate change.

Detailed evaluations of specific resource topics are included in Section 4.2 *Geology, Soils, and Seismicity* through Section 4.16 *Public Utilities and Service Systems* (Table 4.1-1 *Resources Evaluated in Detail*). Information is presented in narrative, tabular, and graphic form as appropriate for the topic being evaluated.

Table 4.1-1. Resources Evaluated in Detail

Section	Topics	Page
4.2	Geology, soils, and seismicity	4-39
4.3	Land use and planning	4-53
4.4	Hydrology and flood risk management	4-85
4.5	Surface water and sediment quality	4-127
4.6	Aquatic biological resources	4-183
4.7	Terrestrial biological resources	4-259
4.8	Hazards and hazardous materials	4-401
4.9	Transportation	4-427
4.10	Air quality/greenhouse gases	4-467
4.11	Recreation	4-501

Table 4.1-1. Resources Evaluated in Detail

Section	Topics	Page
4.12	Aesthetics	4-531
4.13	Noise	4-567
4.14	Public health	4-591
4.15	Cultural resources	4-603
4.16	Public utilities and service systems	4-633

The analysis of each resource topic is organized into the following subsections:

- **Affected Environment.** This section describes the regulatory framework for each topic (i.e., the applicable Federal, State, and local regulations that apply to the topic being discussed). This section also describes the local and regional conditions that provide the baseline condition and sufficient context for evaluating effects of the Proposed Project.
- **Environmental Consequences.** This section provides the analysis of the potential effects of the project alternatives, including the No Action Alternative. This section begins by defining avoidance and minimization measures, any topic-specific methodology used, and any significance thresholds applied in the evaluation.
  - **Avoidance and Minimization Measures** Avoidance and minimization measures are those parameters that have been built into the design of the Proposed Project and are committed to as part of project implementation. These measures are generally included in the alternatives description of this report (Section 3.8.5 *Features Built into Design to Avoid or Reduce Adverse Environmental Impacts* in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*), but, where appropriate, the specific measures related to the impact evaluations are also summarized in the resource section.
- **Alternatives Evaluation.** This section, which is part of the environmental consequences discussion, provides detailed analysis of the No Action and action alternatives.
  - **No Action Alternative.** This section describes the effects of not implementing an Action Alternative with respect to the topic being evaluated and provides a useful comparison against the action alternatives. This section also includes a significance determination regarding the impacts resulting from the No Action Alternative.
  - **Action Alternatives.** This section begins by describing the impacts common to all action alternatives, including effects from construction, operation and maintenance, and implementation of the Monitoring and Adaptive Management Plan (MAMP), if appropriate for the topic being evaluated. In addition, this section highlights any differences among the action alternatives.

- **Mitigation Measures.** This section describes mitigation measures that are needed to avoid, reduce, or minimize identified significant environmental impacts.
  - Mitigation measures are measures that would be required to be implemented to avoid or minimize the adverse effects of the Proposed Project. Mitigation measures are requirements that have not been specifically included as part of the overall project (or alternative) description.
  - The word *mitigation* is defined in the NEPA regulations 40 CFR Sections 1508.20(a)–(e) as:
    - (a) Avoiding the impact altogether by not taking a certain action or parts of an action.
    - (b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
    - (c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
    - (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
    - (e) Compensating for the impact by replacing or providing substitute resources or environments.
  - The South San Francisco Bay Shoreline Study does not require compensatory mitigation for the ecosystem restoration portions of the project, so additional measures that are identified to address ecosystem restoration-related impacts of the project are referred to as *additional minimization measures* in Section 4.6 *Aquatic Biological Resources* and Section 4.7 *Terrestrial Biological Resources*.
- **Residual Impacts and Additional Measures Necessary to Mitigate.** This section describes any new impacts that would result from the implementation of mitigation measures discussed in the previous section. If needed, additional measures to address adverse environmental effects are identified. These measures are called mitigation measures or minimization measures depending on the context. For example, a measure to address land use impacts in Section 4.3 *Land Use and Planning* is labeled M-LND-2, where M means *mitigation measure*. A measure in Section 4.7 *Terrestrial Biological Resources* that addresses impacts on snowy plover, a Federally-listed species, is labeled MM-TBR-2b, where MM means *minimization measure*.
- **Cumulative Effects.** This section describes the cumulative effects of the action alternatives. See Section 4.1.8 *Cumulative Impacts Setting* for more information on the evaluation approach.
- **Summary.** Based on the preceding analysis, this section provides a summary of the NEPA and California Environmental Quality Act (CEQA) dispositions resulting from the evaluation. See Section 4.1.2 *National Environmental Policy Act/California*

Environmental Quality Act General Criteria for Determining Environmental Impact Significance for additional discussion on criteria for determining environmental impact significance under the NEPA and the CEQA.

- **NEPA.** For the NEPA, the disposition may include the nature, magnitude, duration, potential, or geographic extent of an impact (Section 4.1.2.2 *Determining Impacts under the NEPA and NEPA Thresholds for Impact Assessment*).
- **CEQA.** For the CEQA, a brief explanation, along with a determination regarding the significance of the impact, is given. The determination would indicate that the action alternative(s) would result in no impact, a less-than-significant impact, or a significant impact.

4.1.2 National Environmental Policy Act/California Environmental Quality Act General Criteria for Determining Environmental Impact Significance

The NEPA and CEQA processes use several tools for determining thresholds for environmental impacts. For the CEQA, these include the CEQA initial study checklist, defined mandatory findings of significance, agency thresholds of significance, and the active role of consultation with those agencies that manage resources with the potential for impacts.

For the NEPA process, *significance* requires considerations of context and intensity (40 Code of Federal Regulations 1508.27). *Context* means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend on local effects rather than on effects in the world as a whole. Both short- and long-term effects are relevant.

Intensity refers to the severity of impact. The following should be considered in evaluating intensity:

- Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.
- The degree to which the proposed action affects public health or safety.
- Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
- The degree to which the effects on the quality of the human environment are likely to be highly controversial.
- The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
- The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

- Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
- The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
- The degree to which the action may adversely affect an Endangered or Threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.
- Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

Following are additional details regarding the CEQA and NEPA guidelines that are considered in the environmental evaluation for the Shoreline Phase I Study.

4.1.2.1 Determining Impacts under the CEQA and CEQA Thresholds of Significance

The CEQA requires Environmental Impact Reports (EIRs) to evaluate the following types of impacts:

- **Direct impacts:** reasonably foreseeable impacts caused by the project that occur at the same time and place
- **Indirect impacts:** reasonably foreseeable impacts caused by the project that may occur later in time or some distance away
- **Irreversible environmental changes:** generally include loss of nonrenewable resources
- **Growth-inducing impacts:** the extent to which the project directly or indirectly fosters growth, removes an obstacle to growth, further taxes community services and facilities, or facilitates other activities that may cause significant environmental effects
- **Cumulative impacts:** incremental impacts of the proposed project when added to other closely related past, present, or reasonably foreseeable future projects

Direct, indirect, and cumulative impacts are described in resource topic Section 4.2 *Geology, Soils, and Seismicity* through Section 4.16 *Public Utilities and Service Systems*. In addition, the approach to cumulative impact evaluation is described in Section 4.1.8 *Cumulative Impacts Setting*, and a summary of the cumulative impact evaluation is provided in Section 5.5 *Other Required Analyses* in Chapter 5 *National Environmental Policy Act/California Environmental Quality Act Considerations and Other Required Analyses*.

For each resource studied, the potential for significant impacts to occur is determined by identifying significance criteria (that is, the conditions that would result in a significant impact) and measuring the expected project impacts against those criteria. If an impact is determined to be significant, and specific and enforceable mitigation to reduce or eliminate the impact is available, then the mitigation is listed in the appropriate resource section of this Integrated Document. This document also identifies instances in which mitigation reduces the effect but the effect remains significant.

The impact evaluation must take into account the whole action involved, including off-site as well as on-site impacts, cumulative as well as project-level impacts, indirect as well as direct impacts, and construction as well as operational impacts. In general, impacts found significant under the CEQA would typically also be considered significant under the NEPA.

4.1.2.2 Determining Impacts under the NEPA and NEPA Thresholds for Impact Assessment

The NEPA requires Federal agencies to study the proposed action's effects on the quality of the human environment, including aspects of the natural environment, built environment, and human health. Federal agencies can use a qualitative or quantitative approach to evaluating effects and may also rely on thresholds used by other agencies. For instance, Federal agencies may also consider the analysis under the CEQA in determining project effects.

Determining whether proposed actions substantially affect the environment requires consideration of context and intensity. These terms can be further characterized as follows:

- Nature of impact (neutral, positive, or negative)
- Magnitude (major, moderate, or minor)
- Duration (long term, medium term, or short term)
- Potential for occurrence (probable, possible, or not likely)
- Geographical extent (extensive, local, or limited)

According to the courts, the review process should be a "reasonably thorough" discussion of "probable environmental consequences" and does not have to be an exhaustive evaluation of them (Kreske 1996).

4.1.2.3 USACE Planning: Inventory and Forecast Conditions

As described in Section 1.8 *USACE Planning Process Summary* in Chapter 1 *Study Information*, the USACE uses a six-step planning process that provides a structured approach to problem solving. This chapter of the Integrated Document addresses Step 2 of the USACE planning process, which is to inventory and forecast the study area condition.

This second step of the planning process is used to develop an inventory and forecast of critical resources (such as physical, demographic, economic, and social resources) relevant to the problems and opportunities under consideration (see Chapter 2 *Need for and Purpose of Action* for a description of the problems and opportunities being addressed by the Shoreline Phase I Project). Information developed during this step is used to further define and characterize the problems and opportunities. This chapter describes the current and future conditions of the resources quantitatively and qualitatively and is used to define the existing and future without-project conditions.

The physical setting, which represents the baseline used for purposes of the Integrated Document's CEQA analysis, consists of the physical environmental condition as it existed in 2014; the publication date of the project notice of preparation (NOP). In some cases, the date of background information used to describe the physical setting varies by resource. For most resources, the physical setting is based on conditions present in 2007 through 2014. When technical studies, reports or other baseline information refer to a data other than 2014, the Integrated Document will explain why that information is representative of the 2014 condition for purposes of its CEQA analysis.

This Integrated Document also focuses on another baseline year under NEPA as 2018 to reflect the expected start of construction. This document also addresses the future without-project condition, which provides the basis from which alternative plans are assessed. Since impact assessment is the basis for plan evaluation, comparison, and selection, clear definition and full documentation of the without-project condition is essential. Each resource section in this Integrated Document identifies the timeframe on which the physical setting is based, why that timeframe is representative of the 2014 condition, and how the 2017 condition might be different from the physical setting that is described. See Section 1.9.2 *Project Study Timeline and Assessment Review Milestones* in Chapter 1 *Study Information* for an explanation of how the NEPA and USACE Planning Guidance Baseline year was selected.

Please note that throughout this section, the terms *12.5-foot levee NAVD 88* and *15.2-foot levee NAVD 88* are used to distinguish the Alternative 2 levee footprint from the Alternative 3 levee footprint, respectively. Alternatives 4 and 5 are also at the 15.2-foot levee NAVD 88 height, but have different levee footprints, which differentiate them and their impacts from Alternatives 2 and 3. Alternatives 2 and 3 run along the same alignment but since the Alternative 3 levee is 1.7 feet higher, the two alternatives will have different impacts (e.g., more filling would be required to raise Alternative 3 higher). See Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* for a discussion of how these two levee heights were selected for consideration in the final array of alternative plans.

4.1.3 Shoreline Phase I Study Area

The Shoreline Phase I Study Area includes areas within which work would take place (project footprint) and adjacent areas that could be indirectly affected by or could affect project implementation. For example, the Shoreline Phase I Study Area includes Alviso Complex ponds that are part of the South Bay Salt Pond (SBSP) Restoration Project (Ponds A16 and A17 but that are not part of the Shoreline Phase I Study. Because these SBSP Restoration Project ponds could be affected by or affect the Shoreline Phase I Study, they are included in the study area even though the Shoreline Phase I Project would not include activity in Ponds A16 or A17. The SBSP Restoration Project also addresses activity in ponds that are adjacent to but not within the Shoreline Phase I Study Area, including Ponds A8, A8S, A19, A20, and A21.

This section describes the potential project footprint area, the regional setting, the baseline condition, and the future-without-project condition.

4.1.3.1 Potential Project Footprint

Figure 4.1-1 *Alviso Pond Complex and Shoreline Phase I Study Area* depicts the Alviso Pond Complex and Shoreline Phase I Study Area, which is composed of the referenced pond complex and an inland area roughly bounded by Coyote Creek on the north, Interstate 880 (I-880) on the east, and SR 237 on the south. The actual project footprint of disturbance is more concentrated to the specific areas of activity and development, varies by specific alternative, and would include the following areas:

- The Alviso Pond complex including Ponds A9, A10, A11, A12, A13, A14, A15, and A18 proposed for modification and tidal restoration. Other areas within the Shoreline Phase I study area (e.g., designated construction easements) may also be temporarily affected during active construction. Ponds A16 and A17 will not be effected. In addition, the roads or routes that would facilitate the movement of equipment and access to these areas for modification are also considered part of the footprint.
- The various FRM levee alignments, with the footprint of either a 12.5-foot NAVD 88 levee or a 15.2-foot NAVD 88 levee (depending on the alternative) representing the maximum footprint for the levee features (Figure 4.1-1 *Alviso Pond Complex and Shoreline Phase I Study Area*), as well as related construction staging areas (Figure 3.8-2 *Potential Staging Areas* in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*) and routes for material and equipment is support of FRM levee construction.
- Portions of the Union Pacific Railroad right-of-way, the community of Alviso, the New Chicago Marsh, the San José–Santa Clara Regional Wastewater Facility (Wastewater Facility), the Don Edwards San Francisco Bay National Wildlife Refuge, and the South Bay.

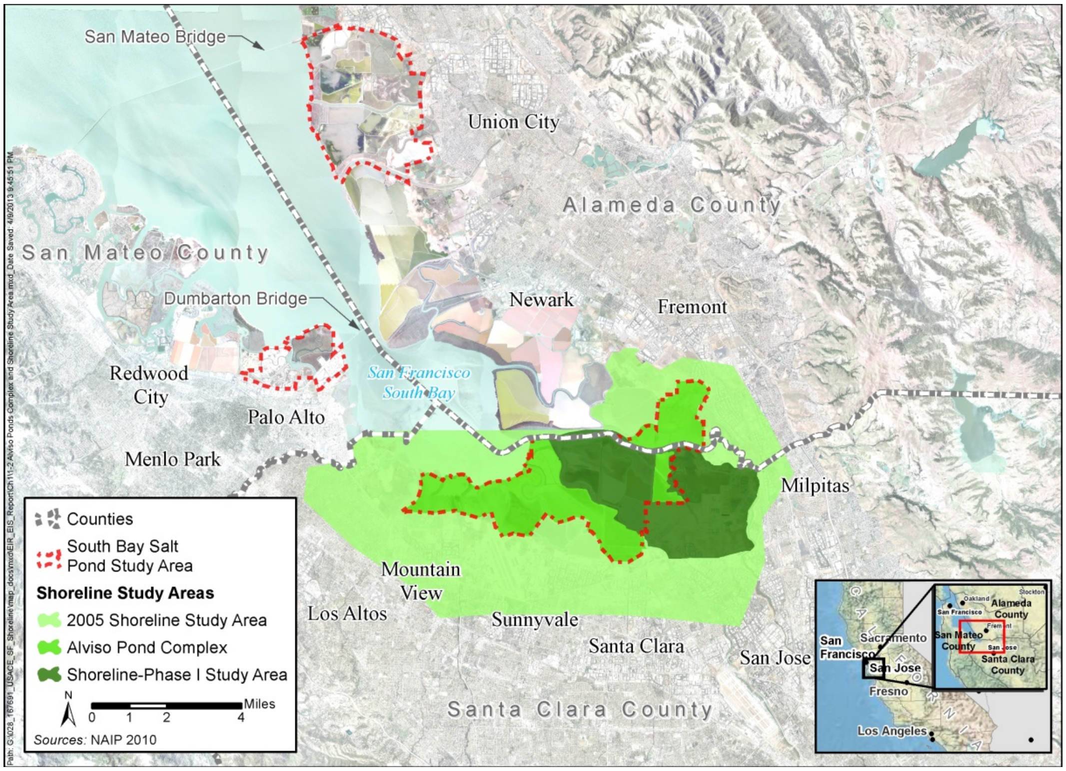

Figure 4.1-1. Alviso Pond Complex and Shoreline Phase I Study Area

4.1.3.2 Regional Setting

The study area is located in the southern portion of the South Bay, which is characterized by select Alviso Ponds and other land and waters stretching from southwest Fremont following the western border of Milpitas to the south (Figure 4.1-2 *Shoreline Phase I Study Area*), and is all within Santa Clara County. A subset of this larger area, the Alviso Pond Complex, includes approximately 9,000 acres of former salt production ponds and 15 miles of shoreline between Palo Alto and southwest Fremont.

The Alviso Pond Complex consists of 25 ponds and resides at the bay's southern extremity in Santa Clara and Alameda Counties. The study area, which does not include all of the Alviso Pond Complex ponds, is located within Santa Clara County and consists of the area between the mouth of the Guadalupe River (to the west) and the mouth of Coyote Creek (to the east) and extends south to include both the community of Alviso and the Wastewater Facility.

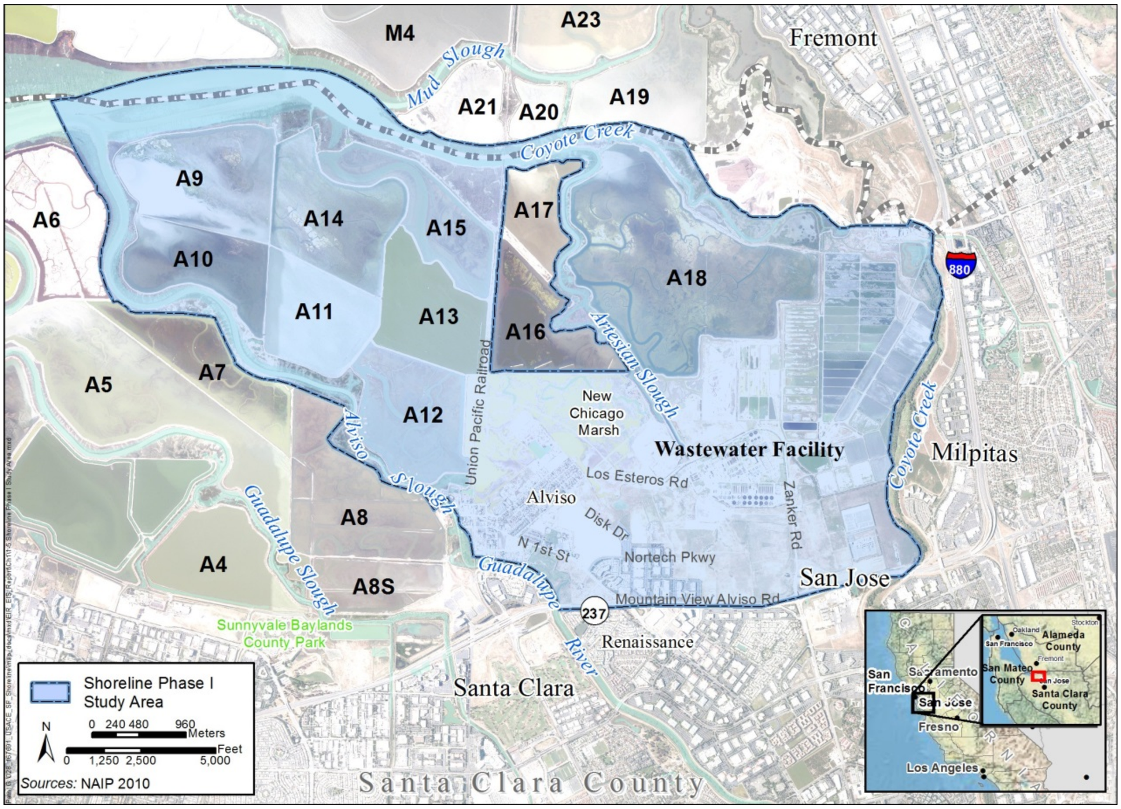

Figure 4.1-2. Shoreline Phase I Study Area

See topic-specific resource evaluations in this Integrated Document (Section 4.2 *Geology, Soils, and Seismicity* through Section 4.16 *Public Utilities and Service Systems*) for regional setting information specific to the topic being evaluated.

4.1.3.3 Baseline and Future Without-Project Conditions

To determine whether a project's impacts are significant, CEQA requires an EIR to compare those impacts with existing environmental condition, typically referred to as the "baseline" for the impact analysis. Under CEQA Guidelines § 15125(a), the baseline normally consists of the physical condition of the area affected by the project at the time the EIR process begins, typically at the time the NOP is published. The NOP for the Shoreline Phase I Project was published in September 2014. Therefore, unless otherwise specified, any reference to the "CEQA Baseline" refers to the physical condition as of 2014. In resource areas where the physical setting discussion references information and data for a range of years, or from years other than 2014, the Integrated Document explains why such data represents the environmental condition as it existed in 2014.

For purposes of analysis under NEPA and for its planning process, USACE chose the year 2018 as its baseline year, anticipating that construction of an authorized project and subsequent benefits accrual would begin during that year (Section 4.1.2.3 *USACE Planning: Inventory and Forecast Conditions*). The planning period of analysis for the Shoreline Phase I Study is 2021 to 2071. This section summarizes the NEPA Baseline (2018) and future without-project conditions assumed in this Integrated Document. Much more detailed information about each resource studied in this Integrated Document is presented in Section 4.2 *Geology, Soils, and Seismicity* through Section 4.16 *Public Utilities and Service Systems* later in this chapter. In many resource areas, the condition in 2014 (i.e., the physical setting) is expected to be the same as the 2018 condition. For this reason, the NEPA baseline year discussion frequently refers to general information about the physical setting to inform a description of the year 2018 condition. In resource areas where conditions in 2014 and 2018 are expected to differ, the Integrated Document explains these differences.

4.1.3.3.1 Physical Setting (CEQA Baseline)

4.1.3.3.1.1 Current Management

The Shoreline Phase I Study Area condition is influenced and guided by the SBSP Restoration Project Initial Stewardship Plan (ISP), which describes operations and maintenance of the Alviso Ponds before a long-term restoration plan is implemented for the entirety of the Alviso Pond Complex. Tidal marsh restoration is one option for restoration of Ponds A9 through A15; these ponds could remain as ponds if the results of monitoring and adaptive management show that the conversion of these ponds to tidal marsh results in adverse effects on shorebirds and waterfowl. Pond A4, owned by the Santa Clara Valley Water District (SCVWD), and Pond A18, owned by the City of San José, are not part of the SBSP Restoration Project; therefore, the condition of these ponds was assessed through coordination with the respective landowner.

In general, the following elements of the ISP define the physical setting of the Shoreline Phase I Study Area:

- Circulation of bay waters through reconfigured pond systems and release of pond contents into the bay. New water-control features were installed, consisting of intake structures, outlet structures, and additional pumps to maintain the existing shallow, open-water habitat. Generally, an attempt was made to maintain the conditions of existing levees and water-control structures through basic maintenance and repair activities. Information collected during the ISP period, however, was used to determine the need for modifications to existing structures to achieve ISP objectives. Implementing any maintenance, repair, or modification activity was contingent on funding availability during the ISP period. The pond complex, previously managed as a single system, was subdivided into several systems within which water would circulate. (Smaller systems allow faster circulation of water, and thus shorter pond residence time, resulting in less evaporation and, therefore, reduced salt concentration.)
- Management of a limited number of ponds as seasonal ponds (ponds are allowed to fill with rainwater in the winter and to dry down in the summer), to reduce management costs and optimize habitat for the Threatened western snowy plover.
- Management of different summer and winter water levels in a limited number of ponds to reduce management costs and optimize habitat for migratory shorebirds and waterfowl.

- ◈ Restoration of a limited number of ponds to full tidal influence, under the "Island Pond Restoration" (Ponds A19, A20, and A21).
- ◈ Management of several ponds within the Alviso system as higher-salinity "batch ponds," where salinity levels will be allowed to rise to support specific wildlife populations.

4.1.3.3.1.2 Hydraulics, Hydrodynamics, and Sediment Dynamics

The South Bay is a complex system, both geographically and hydrodynamically, with freshwater tributary inflows, tidal currents, and wind interacting to create complex circulation patterns that vary over time. The most obvious hydrodynamic response to these forcing mechanisms is the daily rise and fall of the tides, although much slower residual circulation patterns also influence the mixing and flushing processes of the South Bay.

The Alviso Complex ponds currently use water control structures to circulate water between the bay and ponds, and within the pond complex. Ongoing activity associated with the SBSP Restoration Project is modifying how flows are managed in some areas, but this activity does not affect the Shoreline Phase I Study Area.

The suspended solids concentration in the South Bay exhibits highly dynamic short-term variability, primarily in response to sediment input from tributaries and sloughs and tidally driven and wind-driven resuspension (Cloern et al. 1989; Powell et al. 1989; Schoellhamer 1996). Suspended solids concentration temporally vary on tidal and seasonal scales and exhibit strong diurnal and spring-neap (largest-smallest tidal range) variability, with the highest SSCs occurring on spring tides (tides that occur when the moon is either new or full, and the sun, moon, and Earth are aligned; the collective gravitational pull on the Earth's water is strengthened under this condition).

On a seasonal time scale, SSCs are higher in the summer months when average wind speeds and wind wave action are greatest. Greater wind wave action increases resuspension and reworking of the sediment deposited during the previous winter months. Wind is the most dynamic factor affecting temporal and spatial variability in SSCs (May et al. 2003). In general, increases in fetch (length of water over which a wind has blown) and wind speed will result in larger wind waves, and, in the South Bay's broad shoals, these wind waves resuspend sediments, creating more turbid conditions.

The sediment budget for the South Bay—an accounting of all sediment delivery, export, and storage—includes mostly waterborne sediments in tributary inflows; outflows to the Central Bay; and dredging and deposition within open water areas, existing marshes, and restored ponds.

4.1.3.3.2 NEPA and USACE Planning Guidance Baseline Condition

A notable difference between the 2014 physical setting (CEQA Baseline) and the 2017 condition (NEPA and USACE Planning Guidance Baseline) for the resource areas addressed in this Integrated Document is the inclusion of SBSP Restoration Project Phase I and Phase II actions. For most resource areas, however, the year 2017 condition is expected to be similar to the physical setting. The physical setting for each resource is described in detail in Section 4.2 *Geology, Soils, and Seismicity* through Section 4.16 *Public Utilities and Service Systems* of this chapter. Each resource section also includes a discussion regarding how the 2017 condition might differ from the physical setting described in each Affected Environment section.

This document assumes that the following completed SBSP Restoration Project Phase I[1] actions are part of the Shoreline Phase I Study NEPA Baseline year (2017):

- **Pond A8 Restoration:** Construction of an armored notch through the perimeter levee that separates Pond A8 and upper Alviso Slough, excavation of a pilot channel outboard from the armored notch, infrastructure modification and protection, and levee improvements. These changes will allow managed, muted tidal connections from bordering sloughs into Ponds A8, A8S, A5, and A7. Restoration resulted in connecting 1,400 acres of ponds to the bay and creating new marsh and shallow water habitats. Three Pond A8 tide gates have been opened since June 2012.
- **Pond A6 Restoration:** Restored to tidal habitat by breaching and lowering the outboard levee, excavating pilot channels through the fringe marsh outboard of the breaches, and constructing ditch blocks in the perimeter borrow ditch. Initially, this restoration is intended to generate large areas of emergent mudflat habitat. Tidal channel and vegetated salt marsh habitats are eventually expected to develop in Pond A6 because of reforming tidal channels and sediment accumulation, leading to vegetation establishment on the emerging mudflats.
- **Ponds A16 and A17 Restoration:** Altered to create new islands, berms, water-control structures, and operations to create nesting and shallow water foraging habitat for shorebirds; enhanced 240 acres of shallow ponds with 50 nesting islands for migrating shorebirds.
- **Bay Trail:** Opened 2.2 miles of new Bay Trail between Mountain View's Stevens Creek and Sunnyvale.

[1] The SBSP Restoration Project analyzed flood risk as part of the project and SBSP Restoration Project actions did not increase or substantively address flood risk. SBSP Restoration Project Phase I projects were considered as part of existing conditions in the USACE assessment of flood risk. For additional information on flood risk and the SBSP Restoration Project Phase I projects, see SBSP Restoration Project Programmatic and Phase I EIR/S at http://www.southbayrestoration.org/EIR.

This document also assumes that the following SBSP Restoration Project Phase II actions will begin implementation in 2017:

- **Mountain View area ponds (Ponds C1, A1, and A2W):** Breach levees for restoration of Ponds A1 and A2W to tidal marsh; construct habitat islands; raise and/or improve sections of existing levees; create habitat islands; create near shore upland transition zones (ecotones); and enhance recreational opportunities by adding viewing platforms, interpretive platforms, and hiking trails.
- **City of Mountain View Charleston Slough (near the Mountain View area ponds):** Collaboration with the City's project to restore 56-acre Charleston Slough.
- **Alviso-area island ponds (Ponds A19, A20, and A21):** Continue focus on tidal marsh restoration by retaining existing breaches, adding breaches, removing or lowering sections of existing levees, and adding or enhancing water-based recreation on adjacent Coyote Creek and Mud Slough.
- **Alviso-area Ponds A8 and A8S:** Add near-shore upland transition zones.

This chapter includes a description of the baseline condition of each resource in each resource section. For example, Section 4.5 *Surface Water and Sediment Quality* includes a description of the 2017 condition and specifies how it differs from the existing condition. The following paragraphs summarize the NEPA baseline (2017) conditions that could be different from the existing conditions.

4.1.3.3.2.1 Surface Water Hydrology and Sediment Budget

The 2017 sediment budget analysis assumptions are listed in Section 4.4 *Hydrology and Flood Risk Management*. The far South Bay currently receives surplus sediment, which is either stored as net deposition or exported from the far South Bay via ebb currents in the main tidal channel. The crucial threshold for disruption of the recent historical morphologic trend toward net deposition in the far South Bay is the threshold sediment demand, where the system switches from a sediment-rich system to a sediment-starved system.

The results of a numerical modeling analysis show that, for the limited increase in sediment demand caused by the proposed pond breaching projects associated with the 2018 condition, the sediment needed to supply these ponds will likely be derived from outside the far South Bay system.

4.1.3.3.2.2 Fluvial Flood Risk

Guadalupe River

The 0.2-percent annual chance of exceedance (ACE) flood will cause widespread overland inundation on both the left and right floodplains of lower Guadalupe River, which is upstream of the Shoreline Phase I Study Area. Overbank outflows from the river into the left (west) floodplain occur at two locations and into the right (east) floodplain at four locations. On the left floodplain, flows from the farthest downstream breakout location (i.e., the breakout location closest to the study area) travel in the northeastern direction through a network of streets and inundate large areas between Lick Mill Park and SR 237. Some waters flow through openings underneath SR 237 and accumulate in topographic depressions north of the highway and within the study area. No water spills into the baylands, and all overland floodwaters are contained within local storage areas.

On the right floodplain, overland waters from the 0.2-percent ACE flood are conveyed north and northwest through commercial and residential areas to a pond at SR 237, spill over the highway between First Street and Zanker Road, inundate a vast area north of SR 237, and pond behind high levees surrounding former salt ponds in the study area. No water spills into the baylands.

Coyote Creek

Flood flows from Coyote Creek spill into both the left (west) and right (east) floodplains. All the flow breakout locations are concentrated downstream from I-880 near the eastern boundary of the study area. On the left floodplain, the ground surface slopes away from Coyote Creek toward the Guadalupe River. As a result, overland flows travel westerly and then northwesterly away from the creek toward the Guadalupe River and then along the Guadalupe River. During the 0.2-percent ACE flood, left floodplain flows are conveyed as far as SR 237. Inundation depths do not exceed the elevations of the levee running along the Guadalupe River and are also below the elevation of SR 237. Therefore, floodwaters do not spill into the Guadalupe River or over SR 237 but are all contained within local topographic depressions.

On the right floodplain, overland flows travel north between the Coyote Creek channel and I-880. The flooded area extends up to SR 237 for both the 0.2- and 0.4-percent ACE floods. No water spills north over SR 237.

4.1.3.3.2.3 Tidal Flood Risk

The 2018 condition does not assume the construction of additional tidal flooding infrastructure and can be considered to be similar to the existing condition. There is currently a significant tidal flood risk in the study area. Table 4.1-2 *WSE Statistics for the Coyote Creek Gauge (9414575)* shows the water surface elevations for various return-period events. Crest elevations on the existing outboard dike range from as low as 9 feet NAVD 88 up to 13 feet NAVD 88. A 1-percent ACE tidal flood (elevation 10.76 feet NAVD 88) has a 26-percent chance of occurring over a 30-year home mortgage period. The existing tidal flood risk is expected to increase with time under the expected accelerated sea level change (SLC).

Table 4.1-2. WSE Statistics for the Coyote Creek Gauge (9414575)

Frequency (%)	Return Period (years)	1992 (feet NAVD 88)	2017 (feet NAVD 88)
99.99	1	8.25	8.42
50	2	9.08	9.25
20	5	9.54	9.71
10	10	9.82	9.99
4	25	10.15	10.32
2	50	10.38	10.55
1	100	10.59	10.76
0.4	250	10.85	11.02
0.2	500	11.04	11.21

4.1.3.3.3 Future (2067) Without-Project Condition

This description of the assumed future without-project condition serves as the baseline against which the effectiveness and potential effects of the project alternatives are evaluated in this Integrated Document.

The future without-project condition is based on planning-level forecasts. By their nature, forecasts are uncertain and largely founded on assumptions. The resulting most expected condition the region may experience without implementing a major project are a forecast of the future; they represent the collective best judgment of USACE; the U.S. Fish and Wildlife Service (USFWS); the SCVWD; and the State Coastal Conservancy collective team, which consists of scientists, planners, and engineers.

Assuming that construction and benefit accrual begins in 2021, projections for socioeconomic and environmental resource conditions are based on 2071. The future without-project condition for the study area with regard to many resources will remain relatively unchanged for the foreseeable future. Resources that would not change substantially are groundwater; geology, soils and seismicity; hazardous, toxicological, and radiological waste; socioeconomics; environmental justice; and cultural resources. The biggest changes that would occur between 2018 and 2071 would be related to the following resources:

- Sediment dynamics
- Tidal and fluvial flood hazards
- Air quality
- Habitats, vegetation, and wildlife resources
- Land use
- Recreational resources
- Visual resources
- Public health and vector management
- Transportation, public services, and utilities

Major assumptions regarding levee maintenance and SLC were incorporated into the future without-project condition. Specific assumptions include the following:

- **Levee Maintenance Assumption 1:** The USFWS will maintain the former salt pond dikes in the Alviso Pond Complex as the levees exist under the existing condition.
- **Levee Maintenance Assumption 2:** The USFWS will not be able to implement a large-scale multipurpose ecosystem restoration and flood risk management project in the Alviso Pond Complex ecosystem without assistance from USACE.
- **Levee Maintenance Assumption 3:** Levee failures are probable within the Alviso Pond Complex under the without-project condition.
- **Sea Level Change Assumptions:** Sea level change is considered based on three different levels: the USACE Low SLC scenario (0.51 foot), the USACE Intermediate SLC scenario (1.01 feet), and the USACE High SLC scenario (2.59 feet).

The following paragraphs summarize the expected 2071 resource condition.

4.1.3.3.3.1 Sediment Dynamics

Hydrology for the future condition was assumed not to change significantly. The maximum sediment demand for the 2071 condition is not expected to exceed the recent historical demand (including subsidence) associated with the historical rate of SLC. For the USACE High SLC scenario, however, the increased sediment demand resulting from the increased rate of SLC exceeds the critical threshold for the equilibrium platform (i.e., the increased sediment demand would exceed the threshold that is typical for balanced sediment loss and recruitment). This threshold is exceeded shortly after 2018. This results in a nonequilibrium planform, with an increased average depth in the far South Bay of about 9.5 inches by the end of the project life 2071. This increased average depth is spatially distributed according to erosion potential at each point in the bay, and the resulting changes are applied to the bathymetry (underwater depth of lake or ocean floors) to generate an expected nonequilibrium bathymetry for the USACE High SLC scenario condition at the end of the period of analysis.

4.1.3.3.3.2 Tidal and Fluvial Flood Hazards

Tidal flooding varies with location and SLC scenario, but increases with time for all of the study area. The results for the Shoreline Phase I Study show significant damages in the study area for all three SLC scenarios. A 1-percent ACE tidal flood in 2017[2] becomes a 16-percent ACE event in 2067 under the USACE Intermediate SLC scenario. The without-project expected annual flood damage between 2017 and 2067 is between $10 million and $28 million, depending on the year. The total equivalent annual damage over the 50-year period of analysis under the USACE Low, Intermediate, and High SLC scenarios is $18.2 million, $22.6 million, and $40.2 million, respectively.

Fluvial flood risk under the future without-project condition is assumed to be similar to conditions described under existing and without-project condition because of great uncertainty over how the frequency of extreme precipitation events may change. At this time there is no reliable basis for assigning a specific changed number to future fluvial flood risks; any such number will imply a degree of precision that the study does not have.

4.1.3.3.3.3 Air Quality

Air quality in the future is likely to improve based on local and statewide efforts. Recent legislation to reduce greenhouse gas emissions, including California Assembly Bill (AB) 32 and AB 1493, may also aid in improving air quality in the Shoreline Phase I Study Area. AB 32, signed into law in 2006, aims to reduce greenhouse gas emissions to 1990 levels by 2020. This would result in a 30-percent reduction in greenhouse gases in 2020. The bill includes additional goals to further reduce greenhouse gas levels to 80 percent of 1990 levels by 2050. AB 1493 focuses on requiring auto manufacturers to produce new vehicles that emit less heat-trapping exhaust, including a mandated decrease in new vehicle greenhouse gas emissions of up to 30 percent by 2016.

Governmental measures to improve air quality, along with increased public awareness, have and will continue to influence the ways in which companies and individuals function. A decrease in greenhouse gas emissions would be beneficial to air quality in the Shoreline Phase I Study Area.

[2] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021-2071 although the technical analysis reflects results over the period 2017 through 2067.

4.1.3.3.3.4 Habitats, Vegetation, and Wildlife Resources

Under the without-project condition, the SBSP Restoration Project actions would increase the availability of intertidal mudflat habitat at low tide in the short term. Most of the breached ponds are sufficiently subsided that they will provide intertidal mudflat habitat for several decades before accreting enough sediment to become vegetated. In the long term, however, sedimentation patterns of the South Bay are expected to result in a loss of intertidal mudflats, both because of conversion to emerging fringe marsh (through sedimentation) and conversion to subtidal habitat because of scour. In the far South Bay, south of the Dumbarton Bridge, slight mudflat gains are expected because of mudflat accretion in this area.

Through the SBSP Restoration Project, additional mudflat areas would be created along the numerous tidal channels that would be present within the restored marsh. Although these mudflats may be used differently by some wildlife species (e.g., shorebirds) than broad, open tidal flats, they do still provide foraging habitat for a number of wildlife species. Mudflat accretion in the far South Bay is anticipated only in the short term (for the duration of the project) because SLC associated with climate change may result in eventual mudflat loss beyond the life of the project. The majority of the mudflat loss is projected to occur north of the Dumbarton Bridge in response to continuing geomorphic trends and SLC.

Potential actions of the SBSP Restoration Project could result in a long-term loss of open water habitat that provides habitat for pond-dependent waterfowl. Under the without-project condition, however, the open water areas in the Shoreline Phase I Study Area would continue to provide this type of habitat (a total of about 2,900 acres). This would benefit species such as diving ducks and some fish-eating birds, but would prevent an increase in diversity of habitats (and therefore species) increases in the Shoreline Phase I Study Area.

On the other hand, as a result of actions that will be implemented as part of the 2014 San José–Santa Clara Regional Wastewater Facility Plant Master Plan (Plant Master Plan), areas of Pond A18, which is in the Shoreline Phase I Study Area, could still be converted to non-open-water use (tidal habitat, as identified in the Plant Master Plan land use plan). Expected changes related to how Wastewater Facility land is used and managed could also lead to a slight increase in riparian habitat along Coyote Creek and, according to the Plant Master Plan land-use plan, new recreation, light industrial, commercial, and office development on existing buffer land adjacent to the north side of SR 237. The Plant Master Plan land-use plan shows that some buffer land and burrowing owl habitat will be retained in the same area.

In addition, upland, seasonal wetland and marsh habitats may experience a modest degree of increased effective salinity (in areas that are tidally influenced) and reduced effective water availability from climate change. These types of changes could contribute to wildlife diversity in the study area.

The SBSP Restoration Project ponds do not currently support special-status plant species. Levees support some plant life, but none of the plants present on the levees are special-status species (most species present are weedy, non-native plants). In the long term, the SBSP Restoration Project is expected to improve conditions for plants that are present in upper tidal marsh habitat through the creation of suitable habitat, as described for the 2017 condition. Upland transition zone habitats would be created at the upper edge of some marshes by importing fill to produce broad, gently sloping areas adjacent to flood risk management levees or adjoining upland habitat.

These upland transition zones represent an important habitat type largely absent from the South Bay. These areas would likely be managed to keep out invasive species. In addition, SBSP Restoration Project tidal habitat restoration could eventually include the development of mature tidal marsh features (e.g., shell ridges, micro topographic differences [plant-scale topographic variability], salt panne [water-retaining depressions within salt and brackish marshes]) that could support special-status plant species.

Numerous species of invertebrates, birds, and fish use intertidal mudflats. As a result, a decline in mudflat availability is expected to result in declines in abundance of these species in the absence of any mitigating factors. Mudflat productivity, however, is expected to increase with tidal restoration because of detrital input from restored tidal marshes. As a result, marsh restoration is likely to result in increased productivity in the benthic (deep water) invertebrate food chain, potentially increasing the density of the invertebrate prey base available to the various bird and fish species that forage on intertidal mudflats (Harvey et al. 1977; Day et al. 1989). Many of the fish recorded in the South Bay use tidal channels and mudflats at high tide when they are inundated. These tidal habitats are particularly important as nursery habitat for juvenile fish. Thus, these tidal channels and mudflats are productive foraging habitats for estuarine (partly enclosed body of brackish water with one or more rivers or streams flowing into it) fish in this system (Harvey 1988), and conversion of managed ponds to tidal habitats is expected to result in substantial increases in estuarine fish populations in the South Bay. These predictions are supported by the historical abundance of fish and invertebrate populations in the Alviso area before the major diking of marshes for salt production.

Even in the absence of any SBSP Restoration Project actions, eventual declines in shorebird numbers throughout San Francisco Bay may be expected to occur not only because of changes in the management of ponds (or lack thereof) but also because of mudflat loss resulting from SLC. Because shorebirds use alternative habitats such as managed ponds primarily for roosting, and because roosting habitat on levees, islands, and artificial structures such as boardwalks is expected to be present in abundance even if ponds are restored, the SBSP Restoration Project is not expected to result in significant adverse effects on large shorebirds because of loss of pond habitat. The conversion of managed ponds to tidal habitats, however, would reduce the numbers of areas where shorebirds can congregate at high tide, potentially resulting in increased predation, possibly increased susceptibility to disease, and increased disturbance (and associated increases in energy expenditure) by predators and humans.

Restoration of managed ponds to tidal marsh would result in a loss of nesting habitat for several avian species because of inundation and loss of suitable nesting substrate. The SBSP Restoration Project has constructed numerous islands (e.g., at Ponds A16 and SF2) that would be specifically managed to provide island nesting habitat for western snowy plovers and other birds. Thus, with targeted management, it is expected that local species densities can be increased so that South Bay populations can be maintained or increased despite a reduction in the extent of managed ponds.

The conversion of high-salinity managed pond habitat to tidal habitats or to low-salinity managed pond habitat by the SBSP Restoration Project would result in a decline in the extent of pond foraging habitat for several avian species. Converting managed ponds that currently provide foraging habitat for diving ducks to tidal habitats could also lead to a decrease in diving duck numbers in the study area.

Conversion of some low-salinity ponds to tidal habitats would reduce foraging habitat in managed ponds by fish-eating avian species. Tidal restoration, however, is expected to result in a considerable increase in the abundance of native estuarine fish in the South Bay, and the tidal sloughs and channels that would develop in restored marshes are expected to be used heavily by foraging fish-eating species. It is expected that the SBSP Restoration Project will have a net benefit to most fish-eating species because the minor impacts from the loss of managed ponds would be far outweighed by the increase in fish abundance and tidal foraging habitat.

Tidal restoration under the SBSP Restoration Project would require direct alteration of habitats (e.g., levee breaching, levee lowering, and installation of pond water-control structures), which would affect levees and small areas of tidal marsh. Additionally, tidal marsh restoration would re-create larger tidal prisms within existing channels, which is expected to result in an increased level of erosion of existing tidal marshes along these channels. In the long term, there would be an overwhelmingly positive benefit to tidal marsh–associated species from tidal restoration because thousands of acres of new marsh would be created, albeit over an extended period. Project scientists expect tidal restoration to result in substantial increases in habitat connectivity via marsh establishment. Tidal restoration would also likely increase foraging and haul-out habitat for harbor seals.

In the context of future SLC, it is expected that tidal marshes will maintain their elevation because of sediment accretion, based on local tidal marshes having done this in the past in response to several feet of subsidence caused by groundwater withdrawals. Sea level change is not expected to cause significant loss of tidal marsh within the study area during the evaluation period. This is because the ability of tidal marshes to trap sediment and keep up with substantial relative SLC in the study area has been documented during past episodes of subsidence in the area. If SLC eventually accelerates to much higher rates in subsequent decades, however, the ability of these tidal marshes to keep up with SLC could be exceeded.

Project scientists do not expect SLC to directly degrade the quality of low- and mid-marsh habitats within the study area during the evaluation period, since these areas are expected to keep up with SLC and while doing so to maintain their morphology and vegetation. The limited existing areas of high marsh and marsh-to-upland transitional habitat, however, will not be able to increase their elevation through sediment accretion to the same extent and will be gradually overtaken by the aggrading mid-marsh plain. High marsh and transitional habitats will instead move up existing slopes as tidal elevations change over time. Given that these habitats within the study area are already generally located on levees and thus are of minimal width and poor quality, it is not expected for this to present a problem for marsh habitat quality until sea level rises enough for levees to be overtopped, and their refugial function during high tides is compromised as a result.

4.1.3.3.3.5 Land Use

Santa Clara County and Alameda County are expected to grow considerably by 2040 (to 1,987,950 and 2,423,470 people, respectively) (One Bay Area 2013). These two counties and the City-County of San Francisco are expected to experience the highest rate of growth in the Bay Area's nine-county region. Land-use patterns are anticipated to be similar to that described under without-project condition; however, the level of development is expected to be much greater to match the anticipated population growth in the region.

The Plan Bay Area document rates San José second in job growth and first in housing unit growth in the nine-county region by 2040 (One Bay Area 2013). Land uses in the Shoreline Phase I Study Area are anticipated to be consistent with the goals and policies in relevant local and regional plans that exist and that are updated between 2017 and 2050.

4.1.3.3.3.6 Recreational Resources

The Shoreline Phase I Study Area is within the city limits of San José and within Santa Clara County but is adjacent to other cities and to Alameda County. Recreational resources such as trails often cross from one jurisdiction to another. The local jurisdictions have identified recreation-related goals in their general plans, with a consistent goal being the intent to extend the existing San Francisco Bay Trail (Bay Trail). This long-term effort will require coordination among the jurisdictions to facilitate the connections of existing trails and extending areas that have not yet been developed. In total, the trail will be altered from its current 340-mile length to a 500-mile-long trail.

Overall, the City of San José, Santa Clara County, and Alameda County have broad goals with the consistent intent to preserve natural, scenic, and open space recreational resources. These actions will enhance recreational opportunities and provide alternative means of commuting and navigating to other natural areas as well as providing additional hiking, bicycling, and wildlife viewing recreational opportunities.

4.1.3.3.3.7 Aesthetics

The future without-project condition includes naturally occurring aesthetic alterations in the study area landscape. Visual changes to the Shoreline Phase I Study Area will occur gradually as a result of SBSP Restoration Project's restoration efforts and planned and ongoing Alviso Slough restoration. The SBSP Restoration Project's conversion of ponds to tidal habitat will change the industrial character of former polygonal-structured ponds to become more natural after levees are breached and many of the ponds are eventually filled in by sediments brought in by the tide and become covered with marsh vegetation. Channel restoration in the SBSP Restoration Project area will also provide enhanced visual aspects in the future.

4.1.3.3.3.8 Public Health and Vector Management

As other restoration projects are completed, vegetation in the study area will eventually become more plentiful and will consequently add suitable mosquito breeding habitat. Mosquito species use different areas of aquatic habitats: some lay eggs in stagnant water, some lay eggs near the water's edge, and other others attach their eggs to aquatic plants. Such differences are important because certain ecological preferences keep mosquitoes away from areas inhabited by humans. Mosquito larvae generally need protected areas such as emergent vegetative areas, which provide protection from predators such as fish. If the pond edges become more vegetated over time, then the amount of mosquito habitat could increase substantially depending on the location and type of mosquito.

When weighed against the potential ecological benefits of having more vegetation in the study area (such as increased oxygen production), the potential long-term effects of a potentially higher mosquito population might not be substantial, especially with continued management by area Vector Control Districts. Restoration activity associated with the SBSP Restoration Project will increase the tidal salt marsh area with frequent tidal exchanges, resulting in a decreased amount of potential mosquito breeding habitat and increase habitat diversity in the SBSP Restoration Project area.

4.1.3.3.3.9 Transportation

A travel forecast analysis of the Silicon Valley Rapid Transit Corridor anticipated 53-percent growth in work travel and 18-percent growth in non-work travel between Alameda and Santa Clara Counties from 2000 through 2030. Travel would largely occur on existing freeways, expressways, major arterials, and, to a lesser extent, by existing and planned transit services (USDOT and VTA 2009). The Metropolitan Transportation Commission (MTC) has projected that daily automobile trips in the San Francisco Bay Area will increase to 23.3 million by 2035, which represents a 32-percent increase over 2006 levels (MTC 2009). Highways in and around the study area are expected to experience increased congestion. Even with planned improvements to accommodate growth in longer-distance travel, the roadway network capacity is expected to be insufficient (USDOT and VTA 2009). The MTC has projected that daily transit trips in the Bay Area will increase to 1.9 million by 2035, which is a 75-percent increase over 2006 levels (MTC 2009).

Between 2000 and 2030, transit trips in the travel forecast area are projected to grow by roughly 70 percent, increasing from 1.25 million in 2000 to 2.12 million in 2030. Transit trips between Alameda and Santa Clara Counties are predicted to increase from about 7,000 to 23,000 per day. Bay Area Rapid Transit (BART) trips throughout the areas served are expected to increase 92 percent to more than 650,000 trips in 2030 (USDOT and VTA 2009).

Planned improvements to transit service in the Silicon Valley Rapid Transit Corridor, including the BART extension to Warm Springs, are not expected to keep up with the demand for quality transit service, given the expected increase in highway congestion without implementation of the Silicon Valley Rapid Transit Project. Passenger service for the Silicon Valley Rapid Transit Project Alternative would begin in 2018, provided that funding is available. Ridership is projected to be approximately 98,750 by 2030. If the Silicon Valley Rapid Transit Project is built, system-wide BART trips are projected to increase to more than 735,000 trips in 2030 (USDOT and VTA 2009).

Caltrain, a commuter railway, currently uses track for what will become the San Francisco–to–San José section of the California high-speed train line. This rail line runs west of the study area. The section is expected to become part of the high-speed electric train line system by 2020.

The MTC has projected that daily non-motorized trips in the Bay Area will increase to 3.9 million by 2035, which is a 51-percent increase over 2006 levels (MTC 2009).

4.1.4 Major Characteristics of the Study Area's Natural and Human Resources

This subsection introduces the study area's natural and human resources. In addition, topic sections also describe the resources relevant to the topic being evaluated (Section 4.2 *Geology, Soils, and Seismicity* through Section 4.16 *Public Utilities and Service Systems*). The study area is largely defined by its hydrologic features (Figure 1.5-4 *Alviso Pond Complex and Shoreline Phase I Study Area* in Chapter 1 *Study Information*), including the following:

- The large composite of ponds including Ponds A9 through A18 and the New Chicago Marsh, which collectively dominate over half of the study area
- The various drainage features and tributaries including Alviso Slough along the southern boundary of the study area, Coyote Creek along the northern boundary, and Artesian Slough near the center of the study area
- The South Bay of San Francisco Bay on the west side of the study area; however, the tidal influence of the bay extends farther west

Major developed features include:

- The community of Alviso, which has commercial, residential, and municipal land uses
- The Wastewater Facility, which comprises over 2,000 acres of buildings, plant features, ponds, and other land and dominates the southeast portion of the study area

Major community or recreation features include the Refuge trails and Environmental Education Center, the Alviso Marina, and the Bay Trail and the pond trail systems, which are used for hiking, running, and wildlife watching. Transportation features include SR 237, which defines the southeastern boundary of the study area; I-880, which defines the eastern boundary of the study area; arterial and local roads; and the Union Pacific Railroad line, which crosses north-south across the middle of the study area.

4.1.5 Resources Found to Be Potentially Significant in the Study Area

This document evaluates the potential impacts that the Proposed Project would have on significant, or important, resources. The specific topics evaluated are further described below.

4.1.5.1 Method Used to Identify Important Resources

Topics to be evaluated were identified through the following methods:

- Consideration of input obtained during the scoping process from consulting parties, partner agencies, and stakeholders
- Review of previous planning documents leading to the current project
- Review of the topics identified in Appendix G of the CEQA Guidelines
- Review of documentation for recently completed projects in the broader region
- For any given topic, if there was the potential for the project or the No Action Alternative to have an impact or environmental consequence, the topic was included for further evaluation.

4.1.5.2 Resources Identified

See Table 4.1-1 *Resources Evaluated in Detail* for a list of the resulting topics and corresponding section containing the evaluation.

4.1.5.3 Resources Rare or Unique to the Study Area and/or Region

North Pacific tidal marsh habitat has been greatly depleted, and the study area contains individual species or suitable habitat for specific Threatened and Endangered terrestrial, aquatic and avian species; see Section 4.6 *Aquatic Biological Resources* and Section 4.7 *Terrestrial Biological Resources* for further discussion.

4.1.6 Resources Considered but Not Found to Be Significant in the Study Area

The following resources were considered, but it was found that the Proposed Project or the No Action Alternative would have no effect or such a small effect so as not to warrant a detailed evaluation. Because these resources are not studied in this document, further thresholds of significance are not presented in this document. A brief explanation for each topic is provided in Section 4.1.6.1 *Water Supply* through Section 4.1.6.5 *Population and Housing*.

4.1.6.1 Water Supply

In the short term, water use would be limited to project construction for activity such as dust control; no long-term water use would be associated with the project, and the project would not affect the overall water supply. Water use during project construction would depend on weather conditions and would be primarily limited to earthwork operations. A project of this type and magnitude would typically use two water trucks per day during earthwork operations at 2,500 gallons per truck. Earthwork operations for this project are estimated at this feasibility level of development to be about 750 days, which equates to approximately 3.75 million gallons of construction water.

It should be noted that construction operations such as these often make use of recycled water. The Wastewater Facility is within the project boundary and produces high-quality, tertiary treated recycled water. The recycled water is distributed throughout the area for irrigation and other approved purposes as part of the discharge permit, and this would be a viable, available, conservation-minded source.

Because the project would not require any new, long-term sources of water, impacts on water supply would be less than significant.

4.1.6.2 Groundwater

As described in Section 4.1.6.1 *Water Supply*, the project water use would be limited to construction; therefore, no impacts on groundwater availability are anticipated. In addition, implementation of Clean Water Act (CWA) requirements (e.g., implementation of best management practices in a stormwater pollution prevention plan, which is required under CWA Section 402) would protect existing water resources during construction (also see Section 4.4 *Hydrology and Flood Risk Management*).

Forty years of groundwater studies have not given results that show a connection between groundwater and surface water in the Shoreline Phase I Study Area and surrounding areas. Sampling and analysis of information from hundreds of water production and groundwater monitoring wells have provided a clear understanding of changes in the groundwater regime, from both a hydrogeologic and a groundwater quality perspective. These data indicated that there are no apparent impacts on the shallow or deep aquifers as a result of restoring historical intertidal flows to the former salt pond areas. Based on this information, the Shoreline Phase I Project is not expected to affect the regional groundwater condition. Therefore, this Integrated Document does not include a detailed study of groundwater.

4.1.6.3 Mineral Resources

There are no known naturally occurring mineral resources in the study area. Human-made evaporative salt ponds are still operated in the South Bay of San Francisco Bay by private operators. Former salt ponds within the study area have been sold by private parties to local agencies and the USFWS to manage for wildlife purposes. Thus, these ponds have already been removed from production, and further pond modification with the Proposed Project would have no impact on salt production and mineral resources.

4.1.6.4 Indian Trust Assets

There are no Indian Trust assets within the study area; therefore, the project would have no impact on Indian Trust assets.

4.1.6.5 Population and Housing

The project would not create any housing and would not create any commercial development that would provide an employment center. Project construction would create only a temporary increase in employment in construction workers but would not result in long-term employment increases in the restored areas.

Residential and commercial development in the study area is established between the southern edge of the former salt pond complex and SR 237. This area is within the City of San José's Alviso Master Plan area and supports the residential community of Alviso (which is largely built out); the Wastewater Facility; and industrial, light industrial and commercial development. The Alviso Master Plan was adopted in 1998 but was amended with the City's new land-use plan adopted as part of the City's 2040 General Plan. The City still uses the principles of the 1998 plan to guide development in the Alviso area. As described in the 2040 General Plan, the expanded job growth capacity is in the area west of the Wastewater Facility along the SR 237 corridor. The 1998 plan shows the same general types of uses in the area, so the update did not change the focus from the 1998 plan. The Alviso area land-use principles remain unchanged; these principles focus on maintaining community character and making sure new uses are carefully integrated into the existing community. Like the 2040 general plan policies for environmental protection and resource management, the community plan policies recognize the importance of intact riparian areas and the effects of tidal flooding.

The Alviso plan objectives do not include establishing new flood risk management features but rather encourage uses that are compatible with the existing environment. The 1998 Master Plan specifically states an assumption that USACE will not provide flood risk management measures in the future. This assumption has influenced ongoing and future development plans, including those reflected in the 2040 General Plan. In spite of the FRM levee proposed as part of the Shoreline Phase I Project, the Alviso and San José plans continue to reflect development patterns that would be suitable without additional tidal flood risk management.

In summary, the planned development patterns reflect an assumption that new tidal flood risk management features will not be constructed and thus would not provide flood risk management that would induce growth beyond that currently planned. Because Alviso is largely built out and because the commercial, industrial, and light industrial uses would be established consistent with the current (2040) General Plan, the Shoreline Phase I Project is not expected to affect population and housing.

4.1.7 Social Environment of the Study Area

The historic community of Alviso is the only community within the study area. It was founded in 1845 and is San José's only waterfront community. The community was constructed on marsh land; because of subsidence, the community is below sea level and thus susceptible to flooding. Approximately 9 acres of the community have been recorded as part of the Alviso Historic District on the National Register of Historic Places (Section 4.15 *Cultural Resources*). Development within the community is guided by a Specific Plan (Section 4.3 *Land Use and*

Planning). See Table 4.1-3 *Demographic Summary of Alviso* for a summary of the demographic makeup of the community.

Table 4.1-3. Demographic Summary of Alviso

Demographic Category	Number	Percentage (%)
2010 Population	2,077 people	—
Median Age	35.4 years	—
Population over 21 Years	1,450 people	69.8
Population over 65 Years	193 people	9.5
Hispanic Population	1,270 people	61.1
Households	579 households	—
Household Size (average)	3.6 people	—
Family Size (average)	4 people	—
Home Ownership	342 households	59.1

Source: U.S. Census Bureau, 2010 Census, File DP-1 (ZCTA5 95002)

4.1.8 Cumulative Impacts Setting

Cumulative impacts include the direct and indirect impacts of a project together with the impacts of all other anticipated past, present, and reasonably foreseeable future actions in the area, including those proposed or implemented by others. The analysis of cumulative impacts concentrates on whether the project impacts would be cumulatively considerable.

4.1.8.1 Methodology

The cumulative impacts assessments review the effects of past, present, and reasonably foreseeable future actions along with the direct and indirect impacts of the Shoreline Phase I Project. The evaluations assume that the City of San José and Santa Clara County comprehensive and general plans direct the type of development within the study area and that One Bay Area's *Plan Bay Area* (which is also the most recent Regional Transportation Plan) will also be used as a guidebook for regional development through about 2040. Development detailed in these plans would likely occur eventually regardless of which alternative is implemented.

The geographic context for the evaluation of cumulative effects varies by topic. For most topics, evaluation on a study area basis is appropriate; however, for certain topics, the natural system provides a more appropriate context. For instance, hydrology and water quality are addressed on a watershed or receiving waters basis, while air quality is addressed on an air basin basis. This cumulative impacts setting focuses on the study area in detail and the San Francisco Bay Area (Bay Area) in general, where the Bay Area is the nine-county area that is part of the Association of Bay Area Governments (ABAG).

The timeframe considered for the cumulative impacts analyses is 2003 through 2040. The Federal government acquired the Alviso Pond Complex in 2003. Previous management of most of the Shoreline Phase I Study Area before 2003 as salt evaporation ponds is represented by the 2003 condition, which does not assume that the area was managed for restoration purposes. 2040 is the end of the period covered by the Envision San José 2040 General Plan and the period covered by the Plan Bay Area integrated transportation and land-use/housing strategy. This timeframe allows for analysis considering the best available information regarding reasonably foreseeable future development. To consider years after about 2040 would be speculative given the lack of planning documents that describe the region's planned development beyond 2040.

Cumulative impacts are discussed for those resources that could be affected by the project, even if such impacts are less than significant. The cumulative impacts analysis area for the resources studied is identified in each resource section.

4.1.8.2 Projects Addressed in the Cumulative Impact Analysis

4.1.8.2.1 Past Actions

Past actions include study area development between 2003 and 2017 (the NEPA baseline year).

Past actions focus on changes in the Alviso Pond Complex as a result of the property transitioning to Federal management, including the beginning stages of SBSP Restoration Project implementation, and land-use and transportation development that has influenced the present regional condition. Past land-use and transportation development have influenced the air quality, population and housing, recreational, and infrastructure conditions of urban areas that surround the Shoreline Phase I Study Area and, in some cases, resources that are part of the study area, such as air quality. This section includes background on management of South Bay salt ponds for context to understand the condition of the Alviso Salt Ponds in 2003.

4.1.8.2.1.1 Historic Management of South Bay Salt Ponds

Salt ponds have occupied parts of South San Francisco Bay's tidal margin for nearly 150 years. Salt mining was one of the first industries in California. During the gold rush, miners used salt and mercury to extract metal from ore, and by 1857 a permanent salt industry was established in the marshes near what is now the eastern end of the San Mateo Bridge. Salt miners first used berms to contain salt ponds in 1857, and using berms and levees became standard practice for the industry (Booker et al. 2010).

Most of the historic salt ponds are now part of the Refuge, which was established in 1972. The first salt ponds were acquired in 1979, and Federal acquisition continued even as commercial salt harvesting continued from neighboring ponds. This resulted in a pattern of public and private ownership in throughout the salt pond complexes. The 2003 acquisition of the Alviso Ponds included the ponds and the mineral rights associated with most of the remaining ponds in the South Bay. Cargill retains ownership of several thousands of acres of ponds (and associated refining and shipping facilities near Redwood City, which is west of the Shoreline Phase I Study Area), but most of the shallow waters of the bay's margin south of the San Mateo Bridge are now part of the Refuge. Cargill donated Pond SF-2 to the Refuge in 2007 (Booker et al. 2010).

4.1.8.2.1.2 SBSP Restoration Project

The SBSP Restoration Project was developed to implement restoration associated with salt ponds acquired in 2003. Phases I and II of the SBSP Restoration Project modified several ponds that are part of the Alviso Pond Complex and are adjacent to ponds that are part of the Shoreline Phase I Project and are considered in the existing conditions or cumulative impact analyses as appropriate. Phase I activities were completed between 2008 and 2013, and Phase II will begin implementation in 2017. See Section 4.1.3.3.2 *NEPA and USACE Planning Guidance Baseline Condition* for detailed information about the SBSP Restoration Project Phase I and Phase II activities.

SBSP Restoration Project activities include adaptive management, so some of the Phase I and Phase II elements could change over time if restored areas do not meet the SBSP Restoration Project performance standards and restored areas need additional, adaptive management.

4.1.8.2.1.3 Regional Restoration

In addition to the USFWS, several other entities participate in tidal habitat restoration in the nine-county area. Participants include Federal and State landowners, nonprofit organizations, and local governments. Examples of past projects include the Sonoma Baylands Wetland Restoration Project (Sonoma County), Napa Salt Ponds Complex (Napa County; first phase completed in 2009), and Bahia Marsh Tidal Marsh Restoration (Marin County). Although past restoration projects were distributed throughout the region, the San Pablo Bay and South Bay areas have historically been the focus of restoration efforts (SFEP 2012).

4.1.8.2.1.4 Wastewater Facility Plant Master Plan

The San José–Santa Clara Regional Wastewater Facility Plant Master Plan, which the City of San José adopted in 2014, includes a number of technical improvements to and land-use changes for the 2,600-acre Wastewater Facility property. The cumulative analyses in this document assume that the Plant Master Plan will be implemented. The 30-year plan includes technical improvements to modify existing facilities (which include upgrades and some demolition), build some new wastewater treatment facilities, and establish compatible land uses in areas around the active operations area.

Implementing the Plant Master Plan will result in an overall reduction of the operations footprint from 950 acres to 440 acres. This reduction will facilitate future non-operational use of most of the Wastewater Facility property. Non-operational uses of the property will include areas for economic development, habitat, and recreation. The property will also retain areas for flexible uses, such as easements and frontage.

The Plant Master Plan includes a land-use plan that provides a concept for future use of the entire site. The concept identifies operational areas, plant buffer land, burrowing owl habitat, a habitat easement along Coyote Creek, wetland areas, tidal habitat, a park along Artesian Slough and other recreation areas, landfill and waste-transfer facilities, new roads and trails, and development areas for light industrial, office/research and development, and commercial uses. The City intends to review and update the Plant Master Plan every 5 years.

4.1.8.2.1.5 Land Use

The Shoreline Phase I Study Area is situated in a large urban area. U.S. Census data for 2000 and 2010 show that the population of the nine-county ABAG region increased by 17 percent over the 10-year period, from 6,783,760 to 7,150,739. During this same period, the populations of Santa Clara County and San José grew by about 6 percent each. Table 4.1-4 *2000 to 2010 Population Changes for the Nine-County ABAG Region* summarizes the 2000–2010 population growth in the nine-county region.

Table 4.1-4. 2000 to 2010 Population Changes for the Nine-County ABAG Region

County	2000 Population	2010 Population	10-Year Change (%)
Alameda	1,443,741	1,510,271	+4.6
Contra Costa	948,816	1,049,025	+10.6
Marin	247,289	252,409	+2.1
Napa	124,279	136,484	+9.8
San Francisco	776,733	805,235	+3.7
San Mateo	707,161	718,451	+1.6
Santa Clara	1,682,585	1,781,642	+5.9
Solano	394,542	413,344	+4.8
Sonoma	458,614	483,878	+5.5

Source: MTC-ABAG Library, no date

Table 4.1-4 *2000 to 2010 Population Changes for the Nine-County ABAG Region* shows that, in 2010, Santa Clara County was the most populous county in the region, followed closely by Alameda County, which is adjacent to Santa Clara County and is the northern boundary of the Shoreline Phase I Study Area. Although these two counties did not have the highest population growth in the 10-year period, this very populous part of the region has been subjected to intense development pressures associated with job growth, residential development, and non-residential development.

Between 2003 and 2014, several of the Bay Area jurisdictions updated their general plans to address population growth. Updates addressed land use, transportation, housing, economic development, health and safety, and natural resources. Some of these plans were in effect for most of the past planning period (and remain in effect for the present and future). Some of the cities in Alameda and Santa Clara Counties that completed comprehensive plan updates include Fremont, which updated its plan through 2030; Hayward, which updated its plan through 2040; San José, which updated its plan through 2040; Sunnyvale; Santa Clara, which updated its plan through 2035; and Mountain View, which updated its plan through 2030. Other Cities, such as the City of Milpitas (which is adjacent to the east side of the Shoreline Phase I Study Area), have not completed comprehensive general plan updates since before 2003 and relied on periodic general plan updates and amendments.

Plan Bay Area, a regional transportation and housing strategy, was adopted in 2013. This plan, which is discussed in more detail in Section 4.1.8.2.3.2 *Transportation and Land Use*, provides a regional blueprint for population, housing, and transportation development in the nine-county region through 2040.

The City of San José's Wastewater Facility began implementing its Plant Master Plan in 2014. Elements of the plan scheduled for implementation before 2017 include improvements related to headworks odor control, primary treatment odor control, the primary treatment equalization facility, the biosolids facilities, planning for a solar power facility, and landscaping and road repairs.

The Santa Clara Valley Habitat Partners adopted the Santa Clara Valley Habitat Plan, a joint Habitat Conservation Plan–Natural Community Conservation Plan that can voluntarily be applied to development on non-Federal land in the region. This plan provides a way for developers and local municipalities to addresses listed species and continued regional development.

4.1.8.2.1.6 Transportation

Past transportation development focused on projects approved in regional transportation plans. The primary plan in effect was the Metropolitan Transportation Commission's *Transportation 2035 Plan for the San Francisco Bay Area* (MTC 2009). That plan outlined transit and highway projects that would cost a total of $218 billion. Major transit projects include a BART extension from Fremont to San José/Santa Clara; electrification of the Caltrain system; implementation of the Sonoma Marin Area Rail Transit rail system in Marin and Sonoma Counties; expanded ferry service around the region; enhanced service along the Amtrak Capitol Corridor; a rail extension from the Pittsburg/Bay Point BART station to eastern Contra Costa County; and improvement to local and express bus services (including bus rapid transit services on Oakland's Grand-MacArthur Corridor, San Francisco's Van Ness Avenue, and San José's Santa Clara Street/Alum Rock Corridor).

Eighty percent of the $218-billion cost was targeted for maintaining and operating the transportation network already in place at the time the plan was adopted in 2009. Local projects completed in the recent past included express lanes on SR 237 (opened in March 2012) and auxiliary lanes in each direction of a 3.2-mile segment of U.S. Highway 101 between State Route 85 in Mountain View and Embarcadero Road in Palo Alto (construction complete in 2014).

The Santa Clara Valley Transportation Authority's (VTA) mission is to build partnerships to deliver transportation solutions that meet the evolving mobility needs of Santa Clara County. Valley Transportation Plan 2040 provides a planning and policy framework for developing and delivering transportation projects through 2040. Location-specific improvements for all modes of travel are covered in three major program areas: Highways, Local System, and Transit. The Highways Program includes major freeway improvements, local freeway interchanges, and express lanes. The Local System includes local roadway improvements, expressway improvements, pedestrian and bicycle projects, and technology-related projects. The Transit Program includes projects related to transit efficiency and new transit improvements.

Finally, the State of California Transportation Commission prepares and identifies potential funding sources for projects every 2 years through its State Transportation Improvement Program (STIP). The California Department of Transportation (Caltrans) oversees STIP implementation, and STIP projects are identified by Caltrans region. STIPs that were in place since 2003 include those prepared in 2002, 2004, 2006, 2008, 2010, 2012, 2014, and 2016. The same nine counties considered to be part of the Bay Area by ABAG comprise Caltrans District 4. Current and historical STIP documents can be found online at www.catc.ca.gov/programs/stip.htm.

4.1.8.2.2 Ongoing and Present Actions

Ongoing and present actions that affect the nine-county region include the following:

- Active management of the Refuge consistent with its Comprehensive Conservation Plan
- Active restoration and adaptive management that are being implemented as part of the SBSP Restoration Project and other restoration projects in the region
- Active recreational use of the Refuge and recreational trails that connect to or travel within and adjacent to the Shoreline Phase I Study Area
- Continued implementation of existing general plans, zoning ordinances, transportation plans, and alternative transportation plans (bicycle and pedestrian plans)
- Continued implementation of the Santa Clara Valley Habitat Plan
- Implementation of the Caspian tern habitat restoration and enhancement project (improving existing islands for nesting and erosion control; will also improve western snowy plover habitat)
- Continued implementation of Plan Bay Area
- Active non-residential development in the area between the Wastewater Facility and SR 237
- Infill residential and non-residential development in the community of Alviso
- Continued implementation of the Wastewater Facility Plant Master Plan
- Continued infrastructure improvements such as pipeline upgrades and sewer force main improvements
- Continued implementation of Transportation 2035 Plan for the San Francisco Bay Area
- Continued implementation of the VTA 2040 transportation plan
- Continued implementation of the STIP

4.1.8.2.3 Reasonably Foreseeable Future Actions

4.1.8.2.3.1 Regional Restoration

The San Francisco Bay Restoration Authority (Authority) is a regional government agency charged with raising and allocating resources for the restoration, enhancement, protection, and enjoyment of wetlands and wildlife habitat in San Francisco Bay and along its shoreline. The Authority was created by the California legislature in 2008. Being in its beginning stages, the Authority is still in the process of securing funds to support restoration throughout the nine Bay Area counties. The Authority has identified the types of projects that it could support now and in the future.

The Authority's list of example projects includes baywide restoration projects (such eelgrass and oyster bed restoration) and projects specific to the Peninsula and South Bay areas, the East Bay, and the North Bay.

Because funding has yet to be secured, project selection and timeframes for implementation of each of the projects are unknown. However, for a list of the potential projects that could be funded through the Authority, view the draft expenditure plan project list at sfbayrestore.org/docs/Projects.pdf.

4.1.8.2.3.2 Transportation and Land Use

Current transportation and land-use plans outline expected growth and development into the future. In some cases, the plans do not address development through 2040, which is the end of the cumulative effects analysis study period. Plan Bay Area provides the best projection for regional growth through 2040 because it covers the entire nine-county region. Plan Bay Area does not include specific projects, but the population and housing projections included in that plan give the best estimate of the 2040 condition.

The most recent population projections for the nine-county region show a 2020 population of 7,786,800, with Santa Clara County accounting for 2,423,470 people, or about 31 percent of the total regional population (One Bay Area 2013). Table 4.1-5 *Population and Jobs Projections for the ABAG Region, 2015–2040* shows the ABAG population and job projections for the nine-county region in 10-year increments through 2040.

Table 4.1-5. Population and Jobs Projections for the ABAG Region, 2015–2040

Year	Population	Jobs
2020	7,786,800	3,987,150
2030	8,496,800	4,196,580
2040	9,299,100	4,505,230

Source: ABAG 2013 as cited in One Bay Area 2013

In a summary describing what the Bay Area will be like in 2040, Plan Bay Area notes the following:

- Between 2010 and 2040, the nine-county region is projected to add 1.1 million jobs, 2.1 million people, and 660,000 homes for a total of 4.5 million jobs, 9.3 million people, and 3.4 million homes.
- Substantial shifts in housing preferences are expected as the Bay Area population ages and becomes more diverse.
- As the Bay Area continues to recover from the lingering effects of the Great Recession (2007–2009), certain economic trends and indicators will likely rebound. For example, strong job growth is expected in the professional services, health and education, and leisure and hospitality sectors.

Table 4.1-6 *Population Growth by County, 2010–2040* summarizes the population growth by county between 2010 and 2040.

Table 4.1-6. Population Growth by County, 2010–2040

County	2040 Population	Percentage Change from 2010 (%)
Alameda	1,987,950	+32
Contra Costa	1,338,440	+28
Marin	285,400	+13
Napa	163,680	+20
San Francisco	1,085,730	+35
San Mateo	904,430	+26
Santa Clara	2,423,470	+36
Solano	511,600	+24
Sonoma	598,460	+24

Source: One Bay Area 2013

As shown in Table 4.1-6 *Population Growth by County, 2010–2040*, Santa Clara County is projected to have the highest growth rate of all counties in the region through 2040, accounting for 35 percent of the total growth.

The City of San José is projected to gain the second-highest number of new jobs between now and 2040 (behind San Francisco) and is expecting a 38 percent increase overall (One Bay Area 2013). The percentage increase in jobs in 2040 in San José, within which the Shoreline Phase I Study Area is located, is higher than in 2040 in most cities in the region (39 percent), but not all (Oakland and Concord, both in the East Bay, are projected to have increases of 45 percent and 46 percent, respectively).

The MTC and the VTA will continue to implement their transportation plans through 2035 and 2040, respectively. Because STIPs focus on immediate projects, there is no STIP information available for 2018 through 2040.

4.1.8.2.3.3 Other Reasonably Foreseeable Future Actions

Many of the present actions listed in Section 4.1.8.2.2 *Ongoing and Present Actions* will continue through 2040. These actions include:

- Active management of the Refuge consistent with its Comprehensive Conservation Plan
- Active adaptive management that is being implemented as part of the SBSP Restoration Project
- Active restoration in other parts of the Bay Area
- Active recreational use of the Refuge and recreational trails that connect to or travel within and adjacent to the Shoreline Phase I study area
- Continued implementation of existing general plans, zoning ordinances, transportation plans, alternative transportation plans (bicycle and pedestrian plans)
- Continued implementation of the Santa Clara Valley Habitat Plan
- Continued implementation of Plan Bay Area
- Continued implementation of the Wastewater Facility Plant Master Plan
- Continued infrastructure improvements such as pipeline upgrades and sewer force main improvements

4.1.8.2.4 How Cumulative Effects Are Addressed in This Document

Within each resource section, a discussion of the project's cumulative effects follows the discussion of the direct effects for a given topic (Section 4.2 *Geology, Soils, and Seismicity* through Section 4.16 *Public Utilities and Service Systems*). In addition, a summary of impacts is provided in Section 5.3 *Potential Cumulative Impacts of the Action Alternatives on Resources (NEPA and CEQA)* in Chapter 5 *National Environmental Policy Act/California Environmental Quality Act Considerations and Other Required Analyses*.

4.1.9 Climate Change

Understanding how the potential project-related impacts relate to the existing, ongoing environmental condition is critical to USACE. This document considers the environmental condition related to climate change and how such change could affect the USACE mission. Important influences of climate change are changes in temperature; changes in precipitation quantity, intensity, and form (snow versus rain); and changes in sea levels, wind, and wave patterns (USACE 2012b). All of these factors could affect the water resources projects operated by USACE and its non-Federal sponsors. The USACE must be able to perform its missions and operations under dynamic conditions, whether these result from climate change alone or in combination with other physical, social, or economic global changes (e.g., demographic shifts, land-use and land cover changes, aging infrastructure, etc.; USACE 2012b).

On March 4, 2011, the White House Council on Environmental Quality issued a set of *Implementing Instructions for Federal Agency Climate Change Adaptation* in response to the growing awareness that Federal agencies must begin to plan for and adapt to climate change. In response to the Implementing Instructions, USACE issued the report *USACE Climate Change Adaptation Plan and Report* (USACE 2011b). This report identifies progress and future priorities and includes an overarching agency policy statement about client change that calls for integrating climate change adaptation into all that the USACE does. This includes building adaptation into all USACE activities based on the best available and actionable science when undertaking long-term planning, setting priorities, and making decisions (USACE 2012b).

4.1.9.1 Description of Assumptions and Modeling for Alternatives Development

With respect to the objectives of the Shoreline Phase I Project and the potential need for adaptation resulting from climate change, the primary consideration is SLC. Hydrologic modeling was conducted based on USACE requirements to determine sea level characteristics over the following periods[3]:

- The year 2017, which represents essentially the same condition as the existing condition, provides useful context for the sea level condition that would be in place when construction starts, provides a useful comparison against the future condition, and provides for alternative comparison.
- A design year of 2067 reflects the flood risk management objective of addressing risk associated with a 2-percent ACE event at the minimum.

Collectively, this hydrologic modeling shows the projected rate of SLC over 50 years. The action alternatives being evaluated would provide flood risk management for potential effects of SLC through this horizon date.

[3] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021-2071 although the technical analysis reflects results over the period 2017 through 2067.

Climate change in relation to the Shoreline Phase I Project is primarily concerned with SLC and is considered substantially in Section 4.4 *Hydrology and Flood Risk Management*.

4.2 Geology, Soils, and Seismicity

This section reviews the environmental setting for and discusses the impacts of the Shoreline Phase I Project related to the topics of geology, soils, and seismicity.

4.2.1 Affected Environment

This section describes the physical setting of the Proposed Project related to geology, soils, and seismicity. Aspects of geology addressed in this section are largely described within the context of the entire San Francisco Bay region and are based on publicly-available information published over the last 35 years.

4.2.1.1 Regulatory Setting

Federal and State agencies enforce regulations regarding geology, soils, and seismicity. The agencies, their enabling legislation and their roles in establishing and implementing policies related to geology, soils, and seismicity in the study area are described below.

4.2.1.1.1 Federal

4.2.1.1.1.1 Clean Water Act – Section 402

Section 402 of the CWA includes discharge elimination regulations through National Pollutant Discharge Elimination System (NPDES) permitting. Activities that result in alteration of the geologic or soil setting, such as mining, dredging, or filling, would require application for, and acquirement of, an NPDES permit. Further description of this law is included in Chapter 8 *Compliance with Applicable Laws, Policies, and Plans* of this document.

4.2.1.1.2 State

4.2.1.1.2.1 Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act addresses seismic hazards such as strong ground shaking, soil liquefaction (sudden loss of soil strength), and earthquake-induced landslides. This act requires the State of California to identify and map areas that are at risk for these and other related hazards. Cities and counties are also required to incorporate the mapped seismic-hazard zones into their safety elements.

Permit review is the primary method of regulating local development under the Seismic Hazards Mapping Act. Cities and counties cannot issue development permits in these hazard zones until site-specific soils and/or geology investigations are carried out and measures to reduce potential damage are incorporated in the development plans.

4.2.1.1.2.2 California Building Standards Code

The proposed FRM levee would be designed to USACE standards and may consider other applicable building regulation, such as the California Building Standards Code (CBC, Title 24), a compilation of three types of building criteria from three different origins:

- Building standards that have been adopted by State agencies without change from building standards contained in national model codes;
- Building standards that have been adopted and adapted from the national model code standards to meet California conditions; and
- Building standards, authorized by the California legislature, that constitute extensive additions not covered by the model codes that have been adopted to address particular California concerns.

The design of all structures is required to comply with the CBC, with exceptions for Federal land. Construction activities are overseen by the immediate local jurisdiction and regulated through a multistage permitting process. Projects within city limits typically require permit review by the City, while projects in unincorporated areas require a county permit. Grading and building permits require a site-specific geotechnical evaluation. The geotechnical evaluation provides a basis from which to develop appropriate construction designs. A typical geotechnical evaluation usually includes an assessment of earth materials to a depth sufficient to determine all impacts on the design of intended improvements. The evaluation may also address the requirements of the Seismic Hazards Mapping Act, when applicable.

4.2.1.2 Physical Setting (CEQA Baseline)

The San Francisco Bay region is located along the boundary between the Pacific and North American plates, two large tectonic plates that are separated by the north-northwest-trending San Andreas Fault, within the California Coast Ranges Geomorphic Province. The region includes parts of three prominent, northwest-trending geologic/geomorphic features, namely, from west to east, the Santa Cruz Mountains, the Santa Clara Valley, and the Diablo Range. The Santa Clara Valley forms part of an elongated structural block (the San Francisco Bay block) within the central Coast Ranges Province that contains San Francisco Bay and its surrounding alluvial (deposited by flowing freshwater) margins (Page 1989). This structural block is bounded by the San Andreas Fault to the southwest and the Hayward-Calaveras fault zone to the northeast.

There are no buildings within the pond complex. There is usually a low density of people present within the pond areas, limited to recreationists, wildlife managers, or maintenance workers. The areas closest to the Alviso Marina and the Environmental Education Center (EEC) experience the greatest use, with the latter including visits from children’s classes. Landward are the buildings of the EEC and the community of Alviso.

4.2.1.2.1 Geology

The oldest rocks in the region belong to the Franciscan Complex of Jurassic to Cretaceous age (205 to 65 million years before present [Ma]). These rocks are intensely deformed (i.e., folded, faulted, and fractured) due to ancient tectonic processes and, to a lesser extent, from more recent tectonic processes associated with the San Andreas fault system. Franciscan rocks generally compose the “basement” of the Coast Ranges northeast of the San Andreas fault; Cretaceous granitic rocks, known as the Salinian block, compose the basement of the ranges located southwest of the study area. A sequence of Tertiary age (65 to 1.8 Ma) marine and nonmarine sedimentary rocks overlies the granitic and Franciscan basement rocks in the region with gaps in the depositional sequence caused by periods of erosion. In places, the contact between sediments and older basement rocks is locally faulted (in contrast to larger regional faults). Quaternary-age (1.6 Ma to present) surface deposits are concentrated in the Santa Clara Valley and locally overlie the basement and sedimentary rocks previously described. During the Pliocene and Pleistocene epochs (5 Ma to 11,000 years ago [ka]), sediments eroded from the nearby mountain ranges formed broad alluvial fan complexes along the margins of the Santa Clara Valley. The 5-Ma to 300,000-year-old (Plio-Pleistocene) Santa Clara Formation, which consists of a sequence of fluvial sediments (deposited in flowing water) and lacustrine sediments (deposited in standing water such as lakes) lies on the older Tertiary and Franciscan rocks along the margins of the Santa Clara Valley. The Santa Clara Formation has subsequently been folded, faulted, and eroded. The Santa Clara Formation is overlain by younger Quaternary and Holocene (11 ka to present) alluvial and fluvial deposits (deposited in stream channel, flood overbank, and flood basin environments), which intermingle to the north with the estuarine muds of San Francisco Bay (Helley et al. 1979).

A wide variety of igneous, metamorphic, and sedimentary rocks are present in the vicinity of the study area (EDAW et al. 2007). Minerals of economic significance present at some locations in the area include cinnabar and chrysotile. Cinnabar is a mercury sulfide (HgS) mineral and ore of mercury that occurs naturally in the South Bay area, and which has historically been mined for the production of mercury. The New Almaden Mining District in the Santa Cruz Mountains, southwest of San José, was historically a primary mining area (Stoffer 2002). Mercury mining in this area occurred from the late 1820s to 1976, although the majority of production occurred before 1900. This and other smaller mercury deposits are a potential source of natural and anthropogenic mercury in sediments (EDAW et al. 2007). Chrysotile, a common type of asbestos occurring as a fibrous mineral, is found within the metamorphic rock serpentinite frequently present in the Franciscan unit.

4.2.1.2.1.1 Subsidence

Local land elevations in the South Bay area have subsided from original elevations that existed before these areas were developed. This subsidence was generally a result of the over-extraction of groundwater in the South Bay area (Freeze and Cherry 1979) largely due to agricultural pumping in the early part of the 1900s. Beginning in 1971, surface water importation from the San Francisco Regional Water System and State Water Project virtually halted further subsidence in the region by offsetting the need for groundwater pumping. In addition, groundwater recharge efforts have also helped to reduce historical subsidence. As a result, groundwater levels in the region have since recovered, although land subsidence impacts are not reversible (Helley et al. 1979).

4.2.1.2.1.2 Landslides

The study area is located on generally level ground adjacent to San Francisco Bay. Landsliding (downslope movement of rock and soil) is not anticipated in the study area since it is not located within an area zoned by the State of California as having potential for seismically induced landslide hazards. However, some surficial displacement on the dike side slopes may occur as a result of seismic shaking during larger seismic events.

4.2.1.2.2 Soils

The South Bay area consists of a subsiding basin oriented north-northwest that is filled primarily with Quaternary alluvial (chiefly stream) deposits eroded from the surrounding margins and from estuary (bay mud) deposits. Alluvium consists of sediments eroded from the surrounding Santa Cruz Mountains and Diablo Range uplands. These alluvial sediments include a mixture of sands, gravels, silts, and clays with highly variable permeability. In contrast, the fine-grained bay muds have a more uniform very low permeability. The youngest Holocene bay muds underlie almost all of the original San Francisco Bay (Helley et al. 1979), including portions of the levees in the study area.

Soils along the reaches of the pond dikes generally are described as fill (less than 100 years), over young bay mud (11 ka to present), over alluvial soils that include fluvial sediments and old bay mud (5 ka to 11 ka). Exterior berm fill primarily consists of locally excavated bay mud that is generally about 5 to 15 feet thick. Young bay mud is generally classified as fat clay or plastic silt that has been deposited in a marine environment during the current high seawater level. This layer is generally weak and highly compressible and has very high moisture content and liquid limits, although the upper portion of the young bay mud (about 2 to 10 feet) has been subjected to some loss of pore water during tidal cycles, resulting in moderately weaker overall strength. The total depth of the young bay mud ranges from less than 10 feet to approximately 45 feet thick in explorations conducted along the exterior berms. Beneath the young bay mud, older alluvial deposits consisting of fluvial sediments eroded from the surrounding mountain ranges and deposited by streams, and old bay muds (deposited during a previous high sea-level period) are encountered. These deposits are generally mixed in grain size and consist of a variety of sands, silts, clays, and gravels. Coarse-grained deposits are generally medium dense to very dense, and fine-grained soils are generally stiff. Predominantly fine-grained alluvium was encountered below the bay mud in the study area, making these areas less subject to liquefaction than areas with relatively loose coarse-grained alluvial deposits.

Soil conditions near the interior berms follow the same general layering as the exterior berms (fill over bay mud over alluvium). Interior berm fill is described as a combination of coarse- and fine-grained alluvium placed as levee fill and is more variable compared to the outboard levees. Excluding pavement surfacing layers, interior berm fill descriptions range in classification from silty sand to fat clay. Interior berms are located along the fringes of the bay mud, and, in some places, berms are supported on only a few feet of desiccated young bay mud crust or directly on alluvial soils. A maximum bay mud thickness of about 20 feet was encountered along the interior berms.

In general, soils in the study area are deep and poorly drained. The soils in this area are influenced by the adjacent bay and experience regular tidal inundation by seawater, which provides nutrients and sediment to the soil surface, especially in the soils closest to the bay. Through construction of the former salt pond complex berms, this natural inundation has been prevented in the pond areas. Subsidence from a lack of regular alluvial deposition by both the bay and nearby rivers as well as subsidence from water table drawdown for agricultural uses has resulted in many of the former salt ponds having lost elevation relative to sea level.

As defined by the Natural Resources Conservation Service (NRCS) soil survey, the soil units within the study area can be broadly split into three categories: alluvial soils formed from deposits from flowing freshwater (streams); bay soils, formed from the deposition of small particles within the tidal and recently tidal areas; and urban soils, those that have been significantly disturbed (and often deposited) by humans (NRCS 2012a, 2012b). Urban soils and land complexes are strongly human-influenced areas, typically covered by impermeable surfaces (e.g., pavement and buildings), or are soils developed from artificial fill material either placed in development for housing and businesses or placed for industrial uses such as landfills or sewage treatment facilities or as a consequence of local resource extraction. These soils and land complexes represent an area of about 387 acres and are found in the area bounded by North First Street and Nortech Parkway, in the community of Alviso, and in the area around the Zanker Road Landfill.

Bay soils occupy the overwhelming majority of the bayward portion of the study area. These soils are formed from finely textured clay and silt particles and are typically saturated for a portion of the year under the normal condition. Ponds associated with salt production have been removed from the normal deposition regime of silt-laden ocean water. These soil surfaces have experienced high levels of salinity and evaporative deposition of secondary minerals such as gypsum. However, the soils on the bayward side of the berms and along the streams within the study area still are hydrologically connected to the historical water and deposition regimes.

Alluvial soils fill most of the landward portion of the study area. These soils are formed from alluvial material, mainly derived from erosion of sandstone, shale, and other material from nearby mountain ranges, and are deposited when the water energy in streams decreases as they reach the flatter surface gradients near San Francisco Bay. These soils are typically deep to very deep and range from moderately well to very poorly drained depending on the composition and texture of the parent material and its position on the landscape.

4.2.1.2.3 Seismicity and Seismic Hazards

The greater San Francisco Bay Area is one of the most seismically active regions in the United States. Significant earthquakes that occur in the San Francisco Bay Area are generally associated with tectonic movement along the well-defined, active fault zones of the San Andreas Fault system; these fault zones regionally trend in a northwesterly direction. The San

Andreas Fault, which generated the great San Francisco earthquake of 1906, is located approximately 7 miles west of the study area. The Hayward fault, another major active fault, is located about 2 miles east of the study area.

The U.S. Geological Survey (USGS) 2007 Working Group on California Earthquake Probabilities has reported that it is a near certainty (93-percent chance) that at least one magnitude-6.7 earthquake or greater will occur in northern California within the next 30 years, with a 63-percent chance of occurrence in the San Francisco Bay Area (USGS 2008). Among the faults in the region, the Hayward fault is the most likely source, with a 31-percent chance of producing a magnitude-6.7 or greater seismic event within the next 30 years. The Hayward fault produces a large earthquake approximately once every 140 years; the last major earthquake on the Hayward fault occurred in 1868 (known as the great San Francisco earthquake until the 1906 San Andreas event), approximately 143 years ago.

Seismic hazards in the Shoreline Phase I Study Area will continue to be a concern. Strong ground shaking and liquefaction of saturated loose granular soils during an earthquake may cause damaging lateral spreading or ground settlement within the Shoreline Phase I Study Area.

4.2.1.2.3.1 Ground Shaking

A potential earthquake hazard that exists throughout the San Francisco Bay region is strong ground shaking (EDAW et al. 2007). Ground shaking is a complex vibratory motion in both the horizontal and vertical directions. The amplitude, duration, and frequency of ground shaking experienced during an earthquake event at any given location is dependent on several factors, including the magnitude of the earthquake, fault rupture characteristics, distance of the fault rupture from the site, and types and distributions of soils beneath the site.

The seismic hazards for the Shoreline Phase I Study Area are generally related to strong ground shaking and seismically induced liquefaction. The California Geological Survey (CGS) has published maps indicating that peak ground accelerations of approximately 0.5 to 0.6 times the acceleration of gravity (g) have a 10-percent chance of exceedance in 50 years at the location that includes the Shoreline Phase I Study Area. Strong ground shaking has the potential to cause downslope movement of surficial materials on the slopes of existing non-engineered dikes, especially when combined with a liquefiable soil condition.

Some of the loose to medium-dense coarse-grained soils identified in subsurface explorations may liquefy or undergo lateral spreading (finite lateral displacement of gently sloping ground as a result of pre-pressure build-up or liquefaction in a shallow, underlying deposit during an earthquake) because of strong seismic shaking. These effects are likely to include local ground settlement but are considered unlikely to cause slope movement or failure due to the nearly flat topography present in the area. Site soils have the capability to amplify ground motion in certain frequency ranges and to dampen ground motion in other frequency ranges.

4.2.1.2.3.2 Liquefaction and Related Ground Failure Phenomena

Soil liquefaction results from loss of strength during cyclic loading, such as loading imposed by earthquake shaking. Soils most susceptible to liquefaction are clean, loose, saturated, fine-grained sands and silts. The CGS has mapped the study area as having a high potential for seismically induced liquefaction hazards. Project soils that are most susceptible to liquefaction are portions of the younger bay mud sediments (shells and sands within the larger bay mud unit) and some of the loose and medium-dense coarse-grained fill and alluvial soils. It is anticipated that, during a large seismic event, liquefaction may occur at some project locations and that the effects would likely include ground settlement. Liquefaction-induced lateral spreading is defined as the lateral displacement of gently sloping ground as a result of pore-pressure build-up or liquefaction in a shallow underlying deposit during an earthquake.

4.2.1.2.3.3 Tsunamis

Shoreline areas in the study area are subject to inundation as a result of a tsunami (CEMA et al. 2009). Tsunamis or seismically induced water waves may result from local or distant earthquakes (e.g., originating in Japan and Alaska). *Tsunami Inundation Maps for Emergency Planning* (CEMA et al. 2009) identify areas along Coyote Creek, portions of its tributaries, Alviso Slough, and the Guadalupe River as potential tsunami inundation areas.

4.2.1.2.4 National Environmental Policy Act and Engineer Regulation 1105-2-100: Planning Guidance Notebook Baseline Condition

For soils, geology, and seismicity, the NEPA and the Planning Guidance Notebook baseline condition is determined by projecting how the resource condition might change between current condition discussed in Section 4.2.1 *Affected Environment* and the start of construction. Soil and geologic conditions do not change quickly and thus are not expected to be different for the condition described above. Other FRM and wetland restoration projects in the vicinity of the Shoreline Phase I Study Area are expected to have minor effects on geologic resources, particularly related to ground subsidence and liquefaction. However, because these effects could take years to develop and the certainty of whether they would develop is unknown, this analysis assumes that the future risks associated with subsidence and liquefaction would be similar to the present risks. The analysis in Section 4.2.2 *Environmental Consequences* assumes that the NEPA and the Planning Guidance Notebook baseline condition is the same as the physical setting described in Section 4.2.1 *Affected Environment*.

4.2.2 Environmental Consequences

4.2.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

Avoidance and minimization measures (AMM) are those parameters that have been built into the design of the Proposed Project and are committed to as part of project implementation. These measures are generally included in the alternatives description of this report (Section 3.8 *Action Alternatives Component Details*), but, where appropriate, the specific measures related to the impact evaluations are also summarized in the resource chapters.

The following AMMs will be implemented as part of the project design and will avoid or minimize adverse effects:

- **AMM-GEO-1 – Public Warning Signs:** Public warning signs and sirens would improve public awareness and response to inundation emergencies (floods, tsunamis). This action will enhance safety for people using and working in the area.
- **AMM-GEO-2 – Reuse of Soils:** Reuse of earth materials (existing dikes, etc.) will reduce the amount of import material, stockpile, and landfill material, which will minimize offsite soils effects.
- **AMM-GEO-3 – Levee Design:** New or reinforced levees or berms will be designed and constructed to avoid, reduce, or otherwise account for future settlement from liquefaction and potential for lateral spreading. This action will enhance safety for people using and working in the area.
- **AMM-GEO-4 – Stop Work after Seismic Activity:** In the event of an earthquake or tsunami warning, the contractor will stop all work until it is determined that conditions are safe to commence work. This action will enhance safety for people working in the area.
- **AMM-GEO-5 – Channel Tidal Flow:** Ditches will be dug to channel tidal flow into preferred locations to concentrate the erosional potential to small areas. This will minimize erosion and sedimentation effects in large areas.
- **AMM-GEO-6 – Prepare Stormwater Pollution Prevention Plan (SWPPP):** Erosion will be controlled based on the SWPPP to be prepared for the project. Implementing the SWPPP measures will minimize soil erosion and related sedimentation.

4.2.2.2 Methodology for Impact Analysis and Significance Thresholds

An alternative would be considered to have a significant effect if it would:

- **Impact GEO-1:** Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving:
  - Rupture of the San Andreas or Hayward faults
  - Strong seismic ground shaking
  - Liquefaction, lateral spreading, and/or ground settlement in areas where people live and work
  - Slumping of levee slopes as a result of seismic ground shaking
- **Impact GEO-2:** Expose people or structures to tsunami
- **Impact GEO-3:** Result in substantial soil erosion or the loss of topsoil in or adjacent to the study area

The project footprint does not include any faults, so the exposure to rupture of the San Andreas, Hayward or other faults is not an impact and is not discussed further.

4.2.2.3 Alternatives Evaluation

This section evaluates the impacts on geology, soils, and seismicity risk resulting from the alternatives, as further described below.

4.2.2.3.1 No Action Alternative

With the No Action Alternative, none of the proposed management measures, such as the FRM levee, pond marsh restoration, or recreation improvements would be implemented. Existing pond dikes would continue to be maintained.

The No Action Alternative would avoid construction impacts associated with the action alternatives, including temporary impacts on soil features, construction of new levees, and decommissioning of former salt pond dike features.

Regular maintenance of the pond dikes would continue; however, since there would be no tidal influence within the ponds, there would also be no deposition of tidal sediments. Sea level change would continue, so ponds would grow deeper over time relative to sea level.

Because of the study area's proximity to the San Andreas and Hayward faults, the area could experience strong seismic ground shaking and slumping of the existing dike side slopes under the No Action Alternative. In general, slumping of the dikes would increase risks to life and property because the dikes served as incidental FRM areas where homes and businesses are established. Proximity to the faults and the soil condition could result in liquefaction at some project locations during seismic events.

Based on the above discussion, strong ground shaking, liquefaction, ground settlement, subsidence, and lateral spreading could occur as part of the No Action Alternative. Refuge users and refuge infrastructure would continue to be subject to these risks.

4.2.2.3.2 Action Alternatives

This section describes the effects on geology, soils, and seismic risk resulting from the action alternatives. Impacts related to geology, soils, and seismicity would be similar for all action alternatives as the size and alignment of the levees presented in each alternative would all be equally subject to ground shaking and associated risks. The underlying soils for all alignments are similar.

Impact GEO-1: Expose People or Structures to Potential Substantial Adverse Effects During Seismic Events

As explained above, the Shoreline Phase I Study Area is within an area subject to strong seismic-related ground shaking, and much of the region is underlain by bay muds and other unconsolidated near-surface materials with the potential for liquefaction. Strong ground shaking and liquefaction of saturated loose granular soils during an earthquake may cause damaging lateral spreading or ground settlement within the Shoreline Phase I Study Area. As a result, the action alternatives may expose people (workers) and equipment to these conditions if a moderate to strong earthquake were to occur during construction. The primary hazards typically associated with ground shaking and liquefaction are falling objects, collapsing structures, or obstacles created as a result of ground shaking. The planned construction areas mostly lack features that could fall or collapse, thereby limiting exposure to these types of hazards.

However, liquefaction of underlying bay muds and other unconsolidated near-surface materials or movement of levee materials (slumping) could result in levee failure or equipment sinking and may pose a hazard to workers. Seismic-related ground-shaking cannot be prevented or predicted, but the likelihood of potential adverse effects related to liquefaction during construction is fairly low since strong seismic events are rare.

New or reinforced levees would be designed and constructed to avoid, reduce, or otherwise account for future settlement or from lateral spreading (AMM-GEO-3: Levee Design). New structures would be limited to the FRM levee, recreation features, and related structures. No buildings or occupied structures would be introduced by the action alternatives.

Long-term impacts from lateral spreading related to presence and maintenance of the FRM levee would be less than significant.

Based on geotechnical data that the USACE has evaluated, some subsurface layers in the vicinity of the new levee alignments would be subject to liquefaction during very large seismic events (Appendix G *Geotechnical Investigation and Analysis, South San Francisco Bay Shoreline Study, F3 Milestone, without Project*). No expansive soils have been identified along the FRM alignments. The engineered levee would be designed to USACE standards with consideration of the specific geotechnical condition along the levee alignment (AMM-GEO-3).

Potential hazards to maintenance workers and recreation users would be the same as those described for construction effects. Areas of public access are subject to seismicity, strong ground shaking, and liquefaction. However, the area mostly lacks structures, obstacles, or objects that would create a related injury or hazard. People recreating in the area would generally use areas that have been stabilized as part of the project (such as trails on levee tops) and thus would not normally use areas that would be more susceptible to liquefaction. In addition, the project includes public warning signs that will make the public more aware of risks associated with seismic activity (AMM-GEO-1: Public Warning Signs).

New levees would likely experience settlement on the order of inches after a large seismic event and minor surficial slumping may occur. This degree of settlement would not pose an immediate hazard to people or nearby structures.

Seismic ground shaking that could cause liquefaction or slumping after construction would be a less-than-significant impact to the public.

Seismically induced liquefaction would not pose an immediate flood hazard risk, although some repairs may be necessary post-earthquake to restore levels of flood risk protection to the design. Existing levees in the area have already shown some resistance to moderate seismic shaking (0.2 to 0.3 g) experienced during the 1989 Loma Prieta earthquake.

The flood hazard risk impact would be less than significant.

Impact GEO-2: Expose People or Structures to Tsunami

Coyote Creek and the low-lying former salt pond areas may be subject to inundation by tsunamis depending on location. As a result, the action alternatives may expose workers and equipment during construction, and visitors post-construction, to rapidly rising, turbulent and debris-strewn water. However, tsunamis are aftereffects of an earthquake, and because the inundation area is relatively small, tsunami hazards could be avoided by leaving the area immediately following an earthquake or tsunami warning. The contractor will stop all work after an earthquake until it is determined that conditions are safe to commence work (AMM-GEO-4: Stop Work after Seismic Activity). Warnings are generally provided hours in advance of a potential tsunami depending on the location of the earthquake that spawns the event. Earthquakes in the Bay Area are unlikely to trigger tsunamis since fault lines are not under the bay. The project includes installing signage to warn users of the dangers associated with tsunamis and other events that could cause flooding (AMM-GEO-1).

Tsunami risk would be less than significant to workers during construction and visitors after construction.

Impact GEO-3: Result in substantial soil erosion or the loss of topsoil in or adjacent to the study area

Disturbances to soil features would arise from ecosystem restoration construction activities, including pond breaching and construction, installation of ditch blocks, removal of salt production hardware such as culverts and valves, inundation of areas to be permanently ponded, and construction of initial tidal flow channels. Soil disturbance would expose soils to temporary erosion until tidal flow equilibrium and marsh vegetation are naturally re-established. Construction activity would be conducted consistent with waste discharge requirements (WDRs) prescribed for compliance with the State’s Porter-Cologne Water Quality Control Act and Best Management Practices (BMPs) outlined in the SWPPP for the Shoreline Phase I Project (AMM-GEO-6: Prepare SWPPP) (see Section 4.5 *Surface Water and Sediment Quality* for further discussion on SWPPPs and related requirements under Section 402 of the CWA and the State’s Porter-Cologne Water Quality Control Act). Applying these measures would reduce any potential impacts to a less-than-significant level.

Construction of the FRM levee would involve soil disturbance along the levee alignment, adjacent areas, and staging areas, thereby temporarily exposing the soil in these areas to erosion. The project’s WDRs and SWPPP would include measures to control erosion during construction (AMM-GEO-6: Prepare SWPPP). In addition, as work in areas is completed, disturbed areas would be stabilized consistent with the SWPPP. Soil would be re-used onsite to greatest degree feasible to reduce the amount of import material (AMM-GEO-2: Reuse of Soils).

Levee construction–related impacts from soil erosion would be less than significant.

The breaching of levees to reintroduce regular tidal inundation to former salt production areas would change the character of the soils found in the area. In the short term, there is a high probability of fluvial suspension of unconsolidated surface soil and along the margins of the ditches to funnel tidal flow. This would be counteracted by the deposition of suspended fluvial materials on the soil surface, particularly in areas that are vegetated. Ditches will be dug to channel tidal flow into preferred locations to concentrate the erosional potential to small areas. This will minimize erosion and sedimentation effects in large areas (AMM-GEO-5: Channel Tidal Flow). See Section 4.5 *Surface Water and Sediment Quality* for a detailed evaluation of potential long-term effects related to sediment balance in the study area.

Based on the above analysis, the Shoreline Phase I Project would not expose people or structures to substantial adverse effects and would also not cause a substantial loss of topsoil or result in substantial erosion. Impacts from soil erosion would be less than significant.

4.2.2.3.2.1 Comparison of Action Alternatives

Impacts related to geology, soils, and seismicity would be similar for all action alternatives as discussed above.

4.2.3 Mitigation Measures

No mitigation measures are measures that would be required to be implemented to avoid or minimize significant adverse effects of the Proposed Project. Mitigation measures are requirements that have not been specifically included as part of the overall project (or alternative) description.

4.2.3.1 Residual Impacts and Additional Measures Necessary to Mitigate Significant Impacts

Implementing the project as designed and incorporating measures listed above would ensure that the project avoids and minimizes most impacts related to geology, soils, and seismicity. All impacts associated with geology, soils and seismicity are less than significant.

There is no residual impact that would require additional mitigation.

4.2.4 Cumulative Effects

An introduction to cumulative effects is included in Section 4.1.8 *Cumulative Impacts Setting*, including a list of projects considered in this analysis.

Development in the Bay Area has resulted in the loss and unavailability of topsoil resources, representing a cumulatively significant impact. Also, the Bay Area, as in many other parts of California, development in a seismically active region has put people and structures at risk from seismic effects. This represents a cumulatively significant impact. However, as summarized below, none of the action alternatives' incremental effects related to geology, soils, or seismicity would be cumulatively considerable.

Past, present, and reasonably foreseeable future actions that could cause effects on geology, soils, and seismicity include ground-disturbing activity associated with regional land and transportation development, restoration activity associated with projects like the SBSP Restoration Project, ongoing implementation of the Wastewater Facility Plant Master Plan, and infrastructure improvements such as pipeline and sanitary sewer line installation and upgrades.

Ground-disturbing activity in areas that are proximate to the Shoreline Phase I Study Area could combine with the effects to cause cumulative effects. To be consistent with local and State requirements, the project would implement erosion-control measures to prevent soil loss and sedimentation of local waterways. Because of this, the project's incremental effects would not be cumulatively considerable.

In the long term, there are no other projects that propose installing levees or other structures that could cause lateral spreading, slumping, or settlement in the project vicinity. These project-related effects would be limited to the immediate project area and are not expected to combine with other effects to cause a cumulatively significant effect in the study area.

Many parts of the Bay Area are at risk of personal or property damage related to seismic shaking, seiche or tsunami, or liquefaction. People working on the project would be subject to these risks, but this risk is not isolated to the study area. The Shoreline Phase I Study (as with all development projects in the region) must comply with design standards developed to minimize risk from damage from seismic events. With these standards in place (AMM-GEO-3) the project's incremental effect would not be cumulatively considerable. The project would not worsen any conditions that could magnify adverse effects associated with seismic danger, nor would it increase worker risk.

4.2.5 Summary

Table 4.2-1 *Soils, Geology, and Seismicity NEPA Impact Conclusions* summarizes the project effects under the NEPA.

Table 4.2-1. Soils, Geology, and Seismicity NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
GEO-1: Expose People or Structures to Potential Substantial Adverse Effects During Seismic Events	Negative	Major	Short term	Unlikely	Limited
GEO-2: Expose people or structures to tsunami	Negative	Minor	Short term	Unlikely	Limited
GEO-3: Result in substantial soil erosion or the loss of topsoil in or adjacent to the study area	Negative	Minor	Short term	Possible	Local

Table 4.2-2 *Soils, Geology, and Seismicity CEQA Impact Conclusions* summarizes the project effects under the CEQA.

Table 4.2-2. Soils, Geology, and Seismicity CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
GEO-1: Expose People or Structures to Potential Substantial Adverse Effects During Seismic Events	AMM-GEO -1: Public warning signs AMM-GEO-3: Levee Design	LTS	None	LTS
GEO-2: Expose people or structures to tsunami	AMM-GEO -1: Public warning signs AMM-GEO-4: Stop Work After Seismic Activity	LTS	None	LTS
GEO-3: Result in substantial soil erosion or the loss of topsoil in or adjacent to the study area	AMM-GEO-2: Reuse soils AMM-GEO-5: Channel Tidal Flow AMM-GEO-6: Prepare SWPPP	LTS	None	LTS

LTS = less than significant
S = significant
NA = not applicable

During construction, strong ground shaking could result in liquefaction of underlying material or tsunami which could result in hazards to workers. Construction may also result soil erosion. Immediately after construction is complete, the new structures could increase lateral spreading from increased weight and be at risk from strong ground shaking which could result in liquefaction, slumping, and increased flood risk. The operation of the new structures could result in soil erosion. As described above, these impacts are less than significant. This impact is reduced to less than significant by the implementation of mitigation measure M-GEO-1.

4.3 Land Use and Planning

4.3.1 Affected Environment

This section characterizes land use in and near the Shoreline Phase I Study Area. The area considered for land use and planning focuses on the Shoreline Phase I Study Area (see Figure 1.5-4 *Alviso Pond Complex and Shoreline Phase I Study Area* in Chapter 1 *Study Information*) but also considers regional plans and policies that apply to the South Bay region. The physical setting described in this section focuses on the present condition and plans in effect as of 2014.

The following discussion describes the physical setting and regulatory setting for the Shoreline Phase I Project. This section focuses on the land-use policies and plans adopted and implemented by Santa Clara County, the City of San José, (which includes the community of Alviso), and Federal and local facilities or uses within or adjacent to the study area. There are no State-owned or -managed facilities or land in the study area. All of the study area is within the boundaries of incorporated areas, but this section briefly discusses the plans and policies of Santa Clara County because the county has specific policies for the former salt pond area (since the former salt pond area is outside of San José's urban services area).

Figure 4.3-1 *General Overview of Land Uses in the Study Region* shows major landmarks and the location of cities in and around the study area.

4.3.1.1 Regulatory Setting

This section describes the Federal, State, regional and local plans and regulations that apply to land use in the study area.

4.3.1.1.1 Don Edwards San Francisco Bay National Wildlife Refuge Comprehensive Conservation Plan, New Chicago Marsh Water Management Plan, and SBSP Restoration Project Pond Management

Other than Pond A18, which is owned and managed by the City of San José, the Federal government owns and the USFWS manages all of the ponds within the Shoreline Phase I Study Area (Ponds A9 through A15) as part of the Refuge. With the exception of the SBSP Restoration Project ponds, USFWS manages the Refuge consistent with its Comprehensive Conservation Plan (CCP) (USFWS 2012; the SBSP Restoration Project ponds are managed consistent with its program). The CCP describes and evaluates how the USFWS manages each of the Refuge's four units: Alviso, Mowry, Newark, and West Bay. The CCP recognizes that the Shoreline Phase I Study is in progress and that it is within the Alviso Unit of the Refuge.

Currently, the majority of the managed ponds in the Alviso Unit are being operated and maintained as part of the SBSP Restoration Project. The Shoreline Phase I Study Area surrounds two other restored ponds—A16 and A17—that are being actively managed as part of the Refuge. Because the USFWS considers the Shoreline Phase I Study to be integrally related to the SBSP Restoration Project, managers at the Refuge are actively engaged in the Shoreline Phase I process and understand the importance of ensuring that the Shoreline Phase I plan is compatible with the SBSP Restoration Project and Refuge CCP.

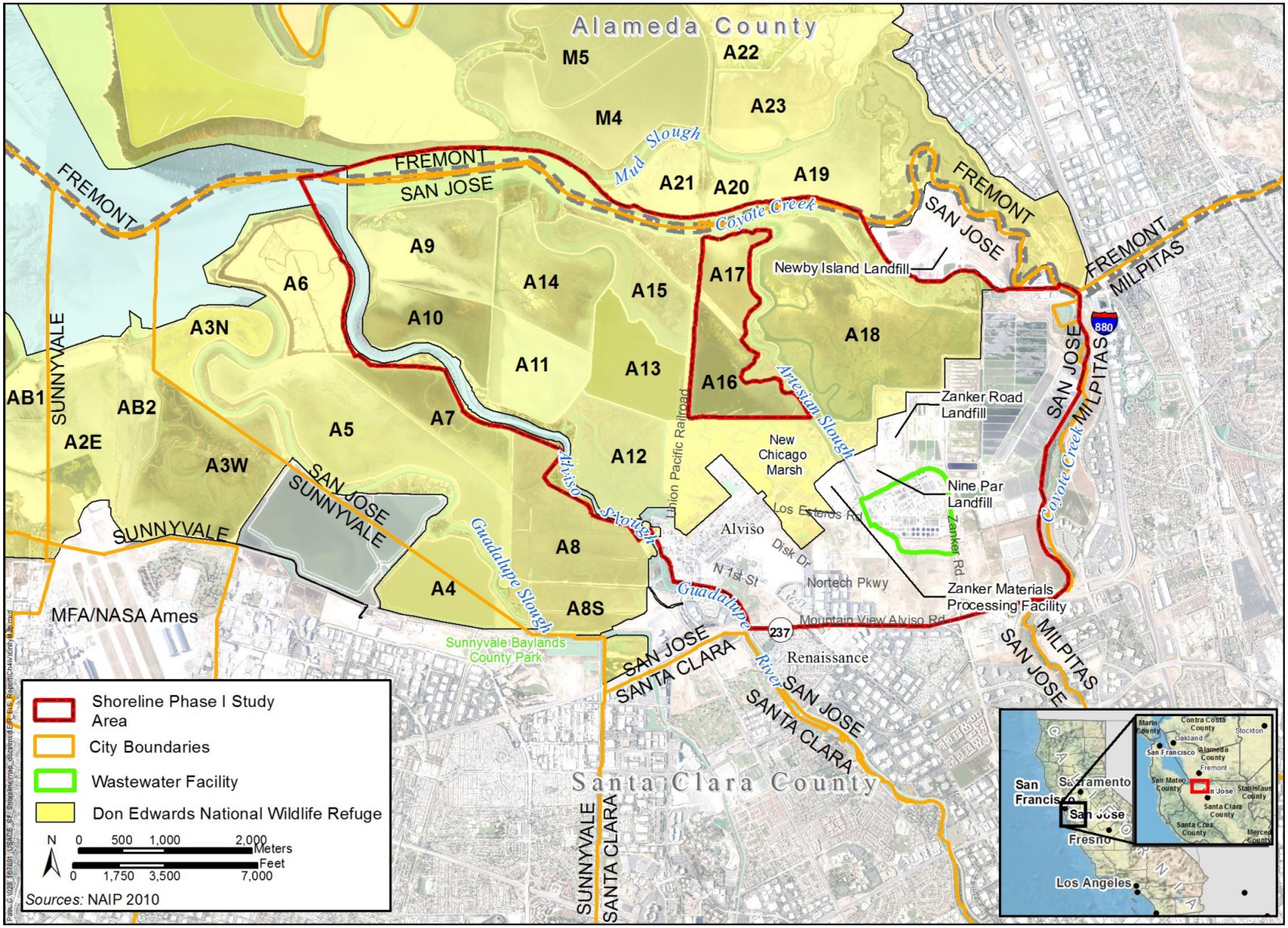

Figure 4.3-1. General Overview of Land Uses in the Study Region

The CCP addresses hunting, recreation, education, and a volunteer program as well as habitat enhancement and species protection. The CCP includes the following five overarching Refuge goals:

- **Goal 1:** Protect and contribute to the recovery of Endangered, Threatened, and other special-status species on the Refuge by conservation and management of the habitats on which these species depend.
- **Goal 2:** Conserve, restore, enhance, create, and acquire habitats to support the diversity and abundance of migratory birds and other native flora and fauna that depend on Refuge land.
- **Goal 3:** Provide the local community and other visitors with compatible wildlife-oriented outdoor recreation opportunities to enjoy, understand, and appreciate the resources of the Refuge.
- **Goal 4:** Through diverse environmental education, interpretation, and outreach opportunities, increase public awareness of the Refuge's purpose and the ecosystem of the San Francisco Bay estuary and promote environmental stewardship and conservation.
- **Goal 5:** Instill community stewardship through volunteerism to support the Refuge's diverse purposes.

The CCP includes detailed objectives and strategies to achieve these goals. The Shoreline Phase I Project would need to be compatible not only with the five Refuge goals but also with implementing the objectives and strategies for adjacent areas or for areas shared by the Refuge, SBSP Restoration Project, and Shoreline Phase I Project plan.

The New Chicago Marsh Water Management Plan (NCM Management Plan), originally adopted in the early 1990s and updated in 2008, guides how the USFWS manages the area that is included in the New Chicago Marsh (NCM) footprint. The USFWS has made changes to the way it manages water in the marsh since the most recent plan update (2008), but the plan itself has not been updated. This analysis assumes that the primary long-term resource management goal stated in the plan remains to enhance local habitat for the endangered salt marsh harvest mouse.

The 390-acre marsh was restored to muted tidal marsh in 1994. The USFWS currently manages water levels under the New Chicago Marsh Water Management Plan consistent with two goals: (1) to enhance marsh habitat for salt marsh harvest mouse (*Reithrodontomys raviventris*) and (2) to increase wildlife diversity in the marsh, achieve nuisance mosquito reduction, and maintain water quality (USFWS 2008a). USFWS recently completed work to improve water control between the marsh and Pond A16.

4.3.1.1.2 Federal Coastal Zone Management Act and State McAteer-Petris Act

The Federal Coastal Zone Management Act of 1972 (CZMA) encourages states and tribes to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs and the fish and wildlife using those habitats. Any Federal agency activity within or outside a coastal zone that affects any land or water use or natural resource of the coastal zone must be carried out in a manner that is consistent to the maximum extent practicable with enforceable policies of approved state management programs.

Section 304(1) of the CZMA requires exclusion from the coastal zone of "lands the use of which is by law subject solely to the discretion of or which is held in trust by the Federal Government, its officers or agents." The Attorney General of the United States and the Office of Coastal Zone Management have interpreted this clause to require exclusion of "those lands owned, leased, held in trust or whose use is otherwise by law subject solely to the discretion of the Federal Government, its officers or agents."

Much of the study area is within an area that would be part of the coastal zone but is federally owned land administered by the USFWS. Any activities or projects conducted within excluded land that may have an effect on land use, water use, or the natural resources of the coastal zone are subject to the consistency provisions of the CZMA [Section 307(c)(1)(A)]. The Shoreline Phase I Study Area is subject to these consistency provisions. See Section 8.2 *Planning Guidance Notebook and Principles and Guidelines Requirements* in Chapter 8 *Compliance with Applicable Laws, Policies, and Plans* for more information about Federal consistency determinations.

In the study area, the San Francisco Bay Conservation and Development Commission (BCDC) implements the provisions of the CZMA. The McAteer-Petris Act (California Government Code Sections 66600–66694) is the California State law that establishes the BCDC as a State agency; prescribes the BCDC's powers, responsibilities, and structure; and describes the broad policies that the BCDC must use to determine whether permits can be issued for activities in and along the shoreline of San Francisco Bay.

The BCDC first adopted the San Francisco Bay Plan in 1969. The plan includes general goals for management of the Bay Area, permitting guidance, and policies against which BCDC weighs a proposed action during the permit process. Non-Federal land in the study area and non-Federal actions that are part of the project are subject to CZMA permitting through the BCDC's process. The Shoreline Phase I Project is within the area covered by Map 7 of the San Francisco Bay Plan.

4.3.1.1.3 California Government Code Section 65300

California Government Code Section 65300 et seq. establishes the obligation of Cities and Counties to adopt and implement general plans. A general plan is a comprehensive, long-term strategy document that sets forth the expected location and general type of physical development expected in the city or county developing the document. This section considers the project's compatibility with the adopted general plans of Santa Clara County and the City of San José.

4.3.1.1.4 City and County Plans and Policies

The following paragraphs summarize the land-use plans of Santa Clara County and the City of San José and touches on land use in Santa Clara and Milpitas. In addition to land-use goals and policies, most general plans include goals and policies related to flooding, floodplain development, FRM, biological resources, and recreation. In some cases, these resource-specific goals or policies are included here because they have a direct tie to land uses associated with the Shoreline Phase I Project. Refer to Section 4.4 *Hydrology and Flood Risk Management*, Section 4.7 *Terrestrial Biological Resources*, and Section 4.11 *Recreation* for discussions of the consistency of the Shoreline Phase I Project with the City and County goals and policies for these topics.

4.3.1.1.4.1 Santa Clara County General Plan

As noted above, none of the Shoreline Phase I Study Area is in unincorporated areas. However, the Santa Clara County General Plan 1995–2010 (adopted on December 20, 1994) designates land uses for the former salt pond area, which is outside of the City of San José's Urban Services Area. The most recent Land Use Map (May 2008) designates most of the study area as Other Public Open Lands (National Wildlife Refuge) and Baylands. Developed areas within the study area are identified as Urban Service Area (County of Santa Clara 2008). These designations are consistent with the City of San José's land-use designations.

Goals, objectives, and policies pertinent to land use in those parts of the study area that are designated as Other Public Open Lands and Baylands are contained in the Resource Conservation Element and its Mineral Resources subsection and in the Land Use Element (County of Santa Clara 1994). These policies are listed below.

- **Policy C-RC 3:** Multiple uses of lands intended for open space and conservation shall be encouraged so long as the uses are consistent with the objectives of resource management, conservation, and preservation, particularly habitat areas.
- **Policy R-RC 30:** Land uses in areas adjacent to the Baylands should have no adverse impact upon wetlands habitats or scenic qualities of the Baylands. Uses adjacent to the Don Edwards National Wildlife Refuge should be compatible with the Refuge.
- **Policy R-LU 5:** The edges of San Francisco Bay shall be preserved and restored as open space. Allowable uses shall include:

  a. Bay waters and sloughs;
  b. Marshes, wetlands, and wetlands restoration;
  c. Salt extraction;
  d. Wildlife habitat;
  e. Open space preserves;
  f. Small piers and walkways;
  g. Wildlife observation; and
  h. Recreational uses, such as walking, horseback riding, bicycling, fishing, boating, education, swimming, limited hunting, aquaculture, and marinas.

Policies that apply to Urban Service Areas focus on managing growth and development. The Shoreline Phase I Project would not include any restoration activity on areas designated as Urban Service Area, but FRM is of concern in adjacent Urban Service Areas. The following policy applies to flood-related hazards and restoration activities.

- **Policy C-RC 34:** Restoration of habitats should be encouraged and utilized where feasible, especially in cases where habitat preservation and flood control, water quality, or other objectives can be successfully combined.

See Section 4.4 *Hydrology and Flood Risk Management* for more detailed discussion on how the project would affect flooding and floodplains.

4.3.1.1.4.2 City of San José General Plan

Most of the study area is within San José, and the only residential area in the study area is in the community of Alviso.

On November 1, 2011, the San José City Council adopted a comprehensive General Plan update to its previous 2020 General Plan. This new plan, called the Envision San José 2040 General Plan, became effective on December 1, 2011 (City of San José 2011). The General Plan identifies several planning areas, including one for the Alviso area. The Shoreline Phase I Study Area is entirely within the Alviso planning area.

As shown in Table 4.3-1 *Land Uses in the Study Area as Identified in the City of San José 2040 General Plan*, designated land uses for this planning area are dominated by Parks and Open Space (most of the former salt pond area and Refuge properties).

Table 4.3-1. Land Uses in the Study Area as Identified in the City of San José 2040 General Plan

Land-Use Type[a]	Acres	Percentage of Study Area
Light Industrial/Commercial	270.3	3.6
Industrial	291.9	3.9
Residential	83.0	1.1
Commercial	4.8	<0.1
Parks and Open Space	5,099.5	68.2
Public/Quasi-Public	1,567.2	21.0

Source: City of San José 2011

Note: With the adoption of the San José–Santa Clara Regional Wastewater Facility Plant Master Plan, General Plan designations for some parts of the Wastewater Facility property that are adjacent to SR 237 between about Artesian Slough and Coyote Creek have been changed from public/quasi-public to industrial park, light industrial, industrial/commercial, neighborhood/ community commercial, and parks and open space.

[a] Totals do not include the 156.2 acres (6,802,816 square feet) of streets.

Other uses include Public/Quasi-Public (most of the Wastewater Facility property); Industrial and Commercial (around the Nortech Parkway and Gold Street, north of SR 237, and on that part of the Wastewater Facility property along SR 237 between Artesian Slough and Coyote

Creek); Residential (in the Alviso village area); Light Industrial (solid waste sites, power facility, and an area that abuts the NCM, shown as Industrial on Figure 4.3-2 *City of San José 2040 General Plan Alviso Planning Area Land Use Plan*); and a very small area of Community Commercial near the I-880/SR 237 interchange. As shown on Figure 4.3-2 *City of San José 2040 General Plan Alviso Planning Area Land Use Plan*, the City's Urban Growth Boundary and Urban Service Area boundary bisect the study area.

Table 4.3-1 *Land Uses in the Study Area as Identified in the City of San José 2040 General Plan* summarizes the acreage of each type of designated land use in the study area. The table does not include farmland because the study area does not include any important farmland (prime farmland, unique farmland, farmland of statewide importance, or farmland of local importance) as identified by the California Department of Conservation's Farmland Mapping and Monitoring Program.

Most of the City of San José's General Plan policies are resource-specific and are discussed elsewhere in this document. The primary land-use goal contained in the City's General Plan is related to identifying growth areas, with a policy specific to the Alviso area (which is a specific plan area; specific plan areas are one type of growth area):

- **Goal LU-2 – Growth Areas:** Focus new growth into identified Growth Areas to protect the quality of existing neighborhoods, while establishing new mixed-use neighborhoods with a compact and dense form that is attractive to the city's projected demographics (i.e., a young and senior population), and that supports walking, provides opportunities to incorporate retail and other services in a mixed-use format, and facilitates transit use.
  - **Policy LU-2.2 – Specific Plan Areas:** The City's Specific Plans provide significant residential growth capacity and opportunities for mixed-use development. Alviso Master Plan and Rincon South Specific Plan Areas also include significant amounts of planned job growth. The Wastewater Facility lands, currently undergoing a separate master planning process, have been identified as a significant opportunity within the city to add new employment land areas, and in particular to provide an opportunity for new light industry or manufacturing activity jobs. Note that the City completed the master planning process in 2014 with adoption of the Plant Master Plan. The Plant Master Plan land-use plan includes areas for economic development, consistent with this policy.

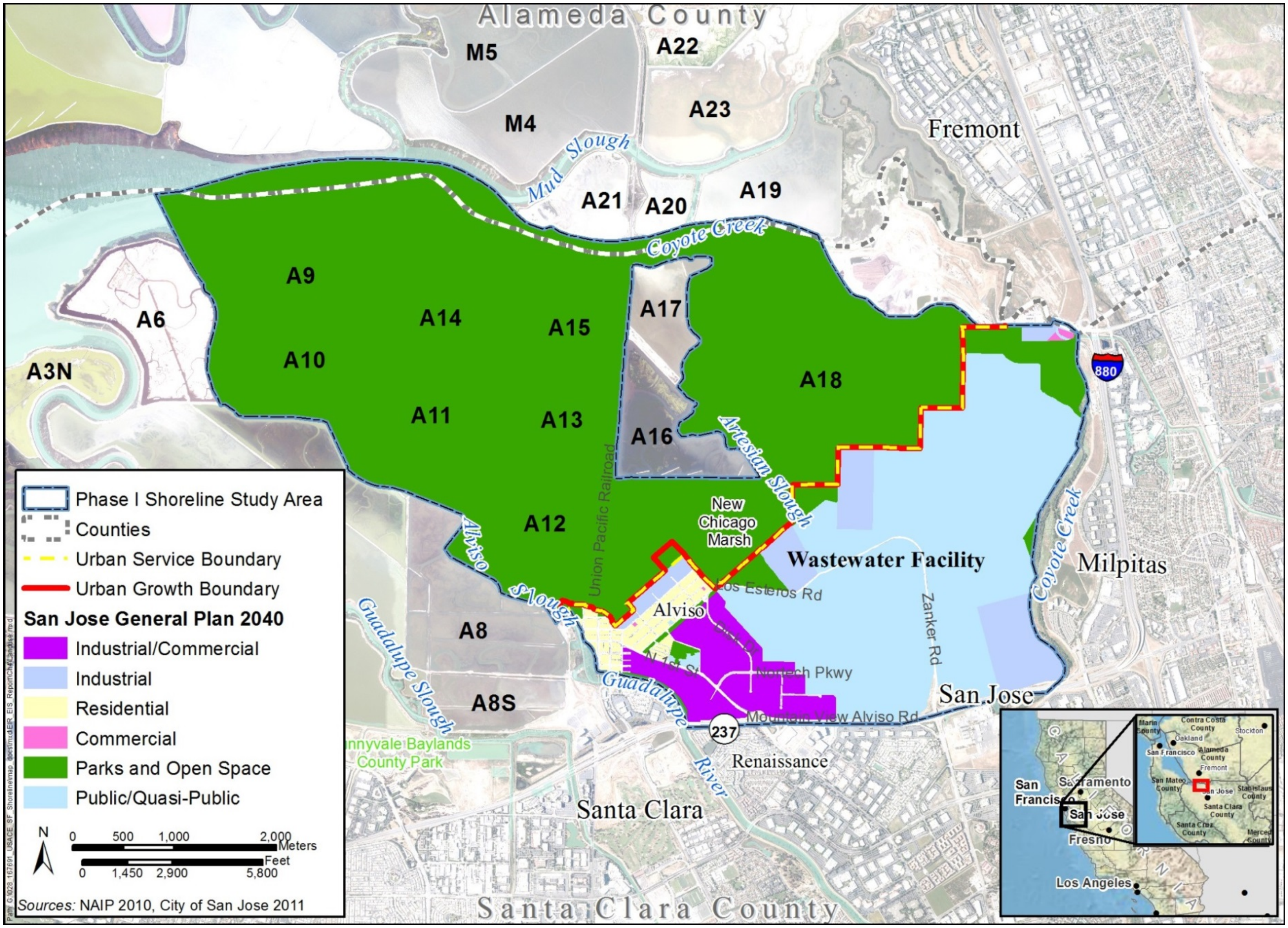

Figure 4.3-2. City of San José 2040 General Plan Alviso Planning Area Land Use Plan

Alviso Master Plan. The Envision San José 2040 General Plan update incorporates the 1998 Alviso Master Plan but makes an adjustment by emphasizing an employment focus and expanded job growth capacity to the Alviso Planning Area.

In general, the Alviso Master Plan established a long-term development plan for the sensitive Alviso planning area by guiding appropriate new development, community facilities, infrastructure, and beautification (City of San José 1998). The land-use map presented in the 1998 Master Plan has been updated with a new land-use map (Figure 4.3-1 *General Overview of Land Uses in the Study Region*). As described in the 2040 General Plan, the expanded job growth capacity is in the area west of the Wastewater Facility along the SR 237 corridor, although the 1998 plan shows the same general types of uses in the area, so the update is not really a change in focus from the 1998 plan. The Alviso area land-use principles remain unchanged; these principles focus on maintaining community character and making sure new uses are carefully integrated into the existing community. Like the 2040 General Plan policies for environmental protection and resource management, the community plan policies recognize the importance of intact riparian areas and the effects of tidal flooding.

San José–Santa Clara Regional Wastewater Facility Plant Master Plan. This master plan, described in Section 4.1.8.2.1.4 *Wastewater Facility Plant Master Plan*, includes a future land-use plan for the 2,684-acre property. The land-use plan identifies expected future uses for different areas of the property. In some areas, such as the main Wastewater Facility buildings, future use will not change from existing use. In other areas, land use is expected to change over time. Land uses shown on the Plant Master Plan land-use map include Wastewater Facility and recycled water operations (629 acres), new roads and economic development areas (387 acres), flood control protection and environmental habitat restoration benefiting endangered and threatened species (1,190 acres), recreational facilities such as parks (42 acres) and trails (16 miles), and other uses (436 acres). The City intends to review and update the Plant Master Plan every 5 years.

Norman Y. Mineta San José International Airport Master Plan and Comprehensive Land Use Plan. The City of San José, the airport operator, adopted an airport Master Plan in June 1997; this plan was approved by the Federal Aviation Administration in December 1999. The plan has been subsequently updated through a series of City-approved amendments and currently extends to the year 2027. The Airport Land Use Commission adopted the current Comprehensive Land Use Plan (CLUP) in May 2011 (Windus 2011a).

The northern boundary of the airport influence area is SR 237 west of the Guadalupe River. The Shoreline Phase I Study Area does not extend beyond the point where Alviso Slough crosses the highway (about 0.75 mile to the east). This indicates that aircraft noise is not expected to affect resources in the study area. The noise contours included in the 2010 plan amendment show that, in 2027, the 60 community noise equivalent level (CNEL; average sound over a 24-hour period) contour also occurs south of the southern boundary of the Shoreline Phase I Study Area near the point where the Guadalupe River crosses SR 237. The 2020 65 CNEL noise contour included in the CLUP does not extend even as far north (and therefore does not affect the Shoreline Phase I Study Area). The CLUP shows that several of the airport's flight paths are directly over the study area. The study area is not within any of the airport safety zones but is within the 512-foot-to-612-foot height limitation area.

The study area is beyond the 10,000-foot buffer zone of Norman Y. Mineta San José International Airport (4.5 miles). However, the proximity of proposed ecosystem restoration efforts raised concerns for the potential to attract wildlife in the 5-mile zone serving as the immediate path for take-offs and landings. An evaluation of the current managed pond functionality, and future tidal habitat, determined that the numbers of shorebirds and waterfowl would very likely decrease from existing conditions over the long term. This determination confirmed that the project is unlikely to encourage hazardous wildlife movements into or across the path of take-offs and landings.

4.3.1.1.5 Collaborative Regional Plans and Policies

4.3.1.1.5.1 South Bay Salt Pond Restoration Project

As described in Section 1.5 *Project Background and General Study Area Setting* in Chapter 1 *Study Information*, the Shoreline Phase I Project is closely coordinated with ongoing implementation of the SBSP Restoration Project. Most of the Shoreline Phase I Study Area is within the SBSP Restoration Project's Alviso area, so integrating the Shoreline Phase I Study objectives and actions with what is planned through the SBSP Restoration Project is integral to the success of both projects (Pond A18 is not included in the SBSP Restoration Project and is managed independently by the City of San José). The overall ecosystem restoration goals of the two projects are similar (though not the same), and the Shoreline Phase I Project is working closely with the agencies that are implementing the SBSP Restoration Project to ensure consistency. A Final EIS/EIR for the SBSP Restoration Project was completed in 2007. Phase I SBSP Restoration Project construction started in 2009 with restoration activities in Ponds A19–A21 and continued with work in Ponds A16 and A17, which are not included in the Shoreline Phase I Project (but are surrounded by other ponds that are included in the Shoreline Phase I Project). Proposed Shoreline Phase I activity will need to be consistent with ongoing management of this area that formerly supported Ponds A16 and A17 in addition to being compatible with planned future SBSP Restoration Project activities.

As of early-2015, the SBSP Restoration Project partners were analyzing Phase II activities. As proposed, Phase II implementation would begin in about 2017. Phase II would affect Ponds A1 and A2W west of the Shoreline Phase I Study Area; Ponds A8 and A8S, which are adjacent to the south side of the study area (on the south side of Alviso Slough, across from Pond A12); and Ponds A19, A20, and A21, which are north of the study area (on the north side of Coyote Creek). Detailed information about the activities that will be implemented in Phase II is provided in Section 1.5.5 *South Bay Salt Pond Restoration Project – Phase I and II* in Chapter 1 *Study Information*.

4.3.1.1.5.2 Comprehensive Conservation and Management Plan – The San Francisco Estuary Project

The Comprehensive Conservation and Management Plan (CCMP) was prepared by the San Francisco Estuary Project, a Federal-State-local partnership. Land-use goals of the CCMP include the following:

- Establish and implement land-use and transportation patterns and practices that protect, enhance, and restore the estuary's open waters, adjacent wetlands, adjacent essential uplands habitat, and tributary waterways;
- Coordinate and improve planning, regulatory, and development programs of local, regional, State, and Federal agencies to improve the health of the estuary; and
- Adopt and utilize land-use policies that provide incentives for more active participation by the private sector in cooperative efforts that protect and improve the estuary.

The goals, policies, and recommendations of the CCMP that are relevant to land use and development in the Shoreline Phase I Study Area include the following:

- **Action LU – 3.1:** Prepare and implement Watershed Management Plans that include the following complementary elements: (1) wetlands protection, (2) stream environment protection, and (3) reduction of pollutants in runoff.
- **Action LU – 3.2:** Develop and implement guidelines for site planning and best management practices.

4.3.1.1.5.3 San Francisco Bay Restoration Authority

The San Francisco Estuary Project is also represented on the advisory committee for the San Francisco Bay Restoration Authority. The San Francisco Bay Restoration Authority, created by the California legislature with the enactment of AB 2954, is a regional government agency charged with raising and allocating resources for the restoration, enhancement, protection, and enjoyment of wetlands and wildlife habitat in San Francisco Bay and along its shoreline. As of October 2012, the San Francisco Bay Restoration Authority had not developed any long-term management plans, so the Shoreline Phase I Project cannot be evaluated for consistency with the San Francisco Bay Restoration Authority policies.

4.3.1.1.5.4 One Bay Area's Plan Bay Area

A consortium of regional agencies called One Bay Area has cooperatively developed a regional plan called Plan Bay Area. Regional agencies that are part of One Bay Area include the Association of Bay Area Governments, the Metropolitan Transportation Commission, the Bay Area Air Quality Management District, and the BCDC. The plan, which was adopted in July 2013, was developed to coordinate efforts among the region's nine Counties and 101 Towns and Cities to create a more sustainable future. Plan Bay Area is the region's long-range plan for sustainable land use, transportation, and housing.

One of the Plan Bay Area includes a performance target for open space land like much of the land that is in the study area. Plan Bay Area aims to protect open space and agricultural land by directing 100 percent of the region's growth inside the year 2010 urban footprint, which means that all growth occurs as infill development or within established urban growth boundaries or urban limit lines. Because the plan assumes that all urban growth boundaries and limit lines are fixed through 2040, plan participants do not expect sprawl-style development to occur on the region's open space areas. Plan Bay Area identifies numerous highway and transit system projects that would be implemented between now and 2040, but none of those projects would occur in or affect the study area (One Bay Area 2013).

4.3.1.1.5.5 Santa Clara Valley Habitat Plan

The Santa Clara Valley Habitat Plan (habitat plan), which is a joint habitat conservation plan and natural community conservation plan (HCP/NCCP) was adopted in 2013. The habitat plan is administered by the Santa Clara Valley Habitat Agency. The habitat plan is a 50-year regional plan to protect endangered species and natural resources while allowing for future development in Santa Clara County. Six local agencies known as the Local Partners (the Santa Clara County, the Santa Clara Valley Transportation Authority, the Santa Clara Valley Water District, and the Cities of Gilroy, Morgan Hill, and San José) worked cooperatively with the USFWS and the California Department of Fish and Wildlife (CDFW; formerly CDFG) to prepare the plan. The USFWS and the CDFW have issued permits for the HCP/NCCP. The habitat plan permit area includes privately owned and managed land south of the Wastewater Facility (SCVHA 2014). The plan does not address most of the land in the study area.

The plan is intended to accomplish the following:

- Help private and public entities plan and conduct projects and activities in ways that lessen impacts on natural resources, including specific threatened and endangered species.
- Identify regional lands—called reserves—to be preserved or restored to benefit those species.
- Describe how reserves will be managed and monitored to ensure that they benefit those species.

The habitat plan clearly states that covered activities do not include the SCVWD stream maintenance program and projects led by the USACE, such as activity associated with the Shoreline Phase I Project. The Shoreline Phase I Project requires a separate Endangered Species Act Section 7 consultation (County of Santa Clara et al. 2012).

4.3.1.2 Physical Setting (CEQA Baseline)

The Shoreline Phase I Study Area contains a matrix of waterways, open space, and urbanized areas (residential, light industrial/commercial, and industrial uses). The study area includes eight ponds of the Alviso pond complex on the shores of the South Bay (Ponds A9 through A15 and Pond A18; Ponds A16 and A17 are not included in the Shoreline Phase I footprint because they are currently being restored under SBSP Restoration Project). Ponds A9 through A15 are part of the Refuge, and Pond A18 is owned and managed by the City of San José.

In general, the Shoreline Phase I Study Area is surrounded on the south and east sides by developed areas. The western and northern areas of the Shoreline Phase I Study Area abut former salt ponds that are being managed as part of the SBSP Restoration Project and Coyote Creek. Other nearby land uses include residential and commercial properties; open space and recreational facilities; the Moffett Federal Airfield (MFA)/National Aeronautics and Space Administration Ames Research Center west of the study area; the Wastewater Facility and Sunnyvale Treatment Ponds east of the study area; and waste recovery facilities (Bay Counties Waste Services facility, Zanker Road Resource Recovery Operation and Landfill, Zanker Material Processing Facility, and Newby Island Landfill) both in and near the study area. The MFA is about 3.5 miles away and includes an active airstrip. The Norman Y. Mineta San José International Airport is about 3.9 miles south of the southern boundary of the study area.

Phase I actions could directly affect land subject to San José General Plan policies. The community of Alviso, within the city of San José, is the closest residential area to the Shoreline Phase I Study Area, although Alviso also supports commercial and light industrial uses.

Table 4.3-1 *Land Uses in the Study Area as Identified in the City of San José 2040 General Plan* summarizes land uses in the 7,473-acre Shoreline Phase I Study Area. Alviso is included as part of San José, so it is not called out separately.

4.3.1.2.1 Don Edwards San Francisco National Wildlife Refuge

Most of the Shoreline Phase I Study Area is part of the Don Edwards San Francisco National Wildlife Refuge. The Refuge is part of the SBSP Restoration Project. The SBSP Restoration Project partners (including the Refuge) are in the process of implementing the plan; completed actions include restoring Ponds A16 and A17, which are adjacent to the Shoreline Phase I Study Area, and Ponds A19–A21, which are just north of the study area. Other Refuge units managed through the CCP— Ravenswood and Eden Landing—are to the northwest and north of the Shoreline Phase I Study Area and SBSP Restoration Project area, respectively.

4.3.1.2.2 San José

San José is the largest city in Santa Clara County in terms of both population and area. According to the most recent population estimate by the U.S. Census Bureau, the 2011 population of this 177-square-mile city was just under a million people (967,487 people; U.S. Census Bureau 2012a). Because the City is largely built out within its limits and the City's 2040 General Plan does not support the conversion of industrial areas to residential use or the urbanization of the Mid-Coyote Valley or South Almaden Valley Urban Reserves or land outside of San José's Urban Growth Boundary, most new housing development will be achieved through higher-density redevelopment within defined urbanized areas (City of San José 2011). As noted above, the Urban Services Area boundary and related Urban Growth Boundary bisect the Shoreline Phase I Study Area. None of the Alviso pond complex is within the Urban Services Area, but all of the community of Alviso is, as is the Wastewater Facility.

While a substantial amount of undeveloped land suitable for urban uses is still available on the valley floor, the hillsides surrounding the City are an extensive land resource devoted to nonurban uses such as range land and wildlife habitat. These areas are outside of the Urban Growth Boundary, which generally follows a 15-percent slope line (that is, the point where the hillside topography exceeds a 15-percent incline based on 1 foot slope contour data).

Alviso. Originally called the *Embarcadero de Santa Clara de Assis*, the waterfront area of Alviso was developed along Alviso Slough at the mouth of the Guadalupe River on San Francisco Bay. Annexed by the City of San José in 1968, Alviso is now a planning area in the northern end of the City. The Alviso planning area includes all properties within the City of San José north of SR 237 between Coyote Creek and the Guadalupe River. The entire planning area is roughly 10,730 acres (City of San José 1998). Although Alviso is not an individual city, it is called out specifically in this Integrated Document because of the potential for the Shoreline Phase I Study actions to have an effect on this community.

The Alviso community is made up of a wide variety of land uses, including residential, commercial, and industrial. The structures in Alviso are generally not more than two stories tall, and expanses of agricultural land are also common within this planning area (City of San José 1998). One of the considerations that constrain residential construction in Alviso is the requirement to meet the City's Flood Hazard Area Ordinance. Alviso has a relatively flat topography and is located in the natural floodplains of two major freshwater watercourses. In addition, much of Alviso is located within the tidal land of San Francisco Bay, making it vulnerable to tidal flooding. Land subsidence resulting from extensive historical groundwater withdrawals has contributed to a change in the bed slope of sloughs in the Alviso pond complex. As a result of land subsidence, flood hazards in the Alviso area are the highest of any area in San José.

Public Facilities and Utilities. The study area supports facilities owned and operated by public entities, facilities including the Wastewater Facility and a bomb-disposal site. Both facilities are owned and operated by the City of San José.

Historically, existing Wastewater Facility operations have been consistent with city plans and policies and applicable State and Federal regulations. With recent adoption of a Plant Master Plan, operations are transitioning to be in step with master plan direction. Future operation will also continue to comply with State and Federal regulations that apply to operating wastewater treatment facilities.

The City of San José Police Department maintains a bomb-disposal site on the Wastewater Facility property. This site is used to destroy or otherwise disable destructive devices and energetic materials, with an average use frequency of two to three times a month. The site is used for detonations and for exploratory activity that does not result in explosions, such as using a remotely controlled saw to cut something open.

The disposal site is in a remote part of the Wastewater Facility property in an area that supports out-of-service legacy sewage ponds. Devices to be detonated are usually buried at the site before they are destroyed, and the City's bomb technicians follow a strict disposal protocol to ensure the safety of the bomb technicians and of people who are in the vicinity of the site (such as people working at the Wastewater Facility). The protocol outlines how and when the bomb technicians provide notification and gives guidance on limits for the appropriate types of charges (which affect the size of an explosion) and appropriate safe perimeters.

Pacific Gas & Electric Company (PG&E) overhead power transmission lines and towers are located throughout the study area. The USFWS and PG&E have an operations and maintenance agreement, but that agreement does not apply to Pond A18, which is part of the Wastewater Facility property. PG&E currently uses boardwalks and small boats for maintenance access in Pond A18.

4.3.1.2.3 Bordering Cities: Santa Clara and Milpitas

Santa Clara. The City of Santa Clara encompasses an area of 18.4 square miles and is home to over 118,000 people (U.S. Census Bureau 2012b). The study area abuts the City of Santa Clara. Land uses in the area nearest the Shoreline Phase I Study Area (along the SR 237 corridor southwest of where SR 237 crosses the Guadalupe River) are dominated by open space uses associated with the P.A.L. BMX track and Santa Clara Golf and Tennis Club. These facilities are likely to remain and be in place at baseline conditions.

Milpitas. About 68,000 people live in the 13.6-square-mile City of Milpitas (U.S. Census Bureau 2012c). The City's developed areas line the I-880 corridor. As noted above, the area of Milpitas that immediately abuts the Shoreline Phase I Study Area is designated for Parks and Open Space along Coyote Creek. The area between the creek and I-880 is an important industrial/light industrial center for the City, and the creek corridor provides separation between this area and the Wastewater Facility in neighboring San José. A large area of the land designated for industrial uses between the highway and Coyote Creek is currently undeveloped but will probably begin to build out by the baseline condition.

4.3.1.2.4 Regional Plans: Plan Bay Area

Plan Bay Area includes a jobs-housing connection strategy that proposes a long-term approach to growth focused on locally designated Priority Development Areas (PDAs) and articulates how the region can capture its economic potential by providing more housing and transportation choices to Bay Area residents and workers (One Bay Area 2013). Plan Bay Area does not mandate any changes to local zoning, general plans or project review. The region's cities, towns, and counties maintain control of all decisions to adopt plans and permit or deny development projects. Similarly, Plan Bay Area's forecasted job and housing numbers do not act as a direct or indirect cap on development locations in the region. The strategy recognizes that different parts of the Bay Area will develop differently and outlines specific development expectations for each. The strategy uses place types to describe intensities of development throughout the Plan Bay Area region.

Plan Bay Area predicts that the City of San José as a whole will experience about 39-percent job growth between 2010 and 2040, which is the second-highest rate for all cities in the Plan Bay Area study area. The plan identifies small, focused employment center PDAs along the part of the SR 237 corridor that runs along the south side of the study area, although the changes in jobs per acre between 2010 and 2040 in these areas is projected to be low (1 to 50 jobs/acre) to low (50 to 1000 jobs/acre). The plan identifies the area as having medium to high strength for knowledge sector job growth (professional and business services), meaning that local job growth is expected to focus on jobs with relatively high educational requirements.

Plan Bay Area does not project much growth in the number of households along most of the part of the SR 237 corridor that parallels the southern study area boundary. However, it does predict concentrated household growth in a regional center PDA south of SR 237 and roughly bound by Interstate 280 (I-280) on the east and U.S. Highway 101 (US 101) on the west.

In addition to PDAs, Plan Bay Area identifies Priority Conservation Areas (PCAs). PCAs are regionally significant open spaces for which there exists broad consensus for long-term protection but nearer-term development pressure. The study area includes the Santa Clara County Baylands PCA, which is described as follows (FOCUS, no date):

> The Baylands include the City of San José's northern shoreline along San Francisco Bay. The area has been identified since the mid-1980s as a recommended priority area for open space preservation and park acquisition. These portions of South San Francisco Bay consist mainly of the salt ponds, submerged lands, and wetlands behind levees, with lands mainly in parks and Federal wildlife refuge. This area possesses unique and valuable natural and recreational resources and experiences development pressures. The landscape of the area provides significant water protection and enhancement opportunities for the San Francisco Bay shoreline and wetlands within Santa Clara County. The Baylands promote regionally significant conservation and public access values by providing opportunities for a continuous shoreline trail connection for people and the bay environment (Juan Bautista de Anza National Historic Trail and San Francisco Bay Trail).

Plan Bay Area's objective for areas like PCAs is to "protect the region's unique natural environment — The Bay Area's greenbelt of agricultural, natural resource and open space lands is a treasured asset that contributes to residents' quality of life and supports regional economic development."

4.3.1.3 National environmental Policy Act and Engineer Regulation 1105-2-100: Planning Guidance Notebook Baseline Condition

For land use, the NEPA and Planning Guidance Notebook baseline condition is determined by projecting how the condition might change between current condition discussed in Section 4.3.1 *Affected Environment* and the start of construction. Most of the plans discussed in Section 4.3.1 *Affected Environment* address development beyond 2018, so the NEPA and Planning Guidance Notebook baseline for land-use plans would not be different from what is described in Physical Setting above.

Residential and non-residential development will continue consistent with established land-use and zoning designations. New residential and non-residential developments will be built between 2014 and 2018, but the amount of development in this time period would not have a significant effect on the local condition. Similarly, the SBSP Restoration Project is in the process of detailed analysis of the Phase II activities. Based on what is currently being studied as part of Phase II (which is restoration on Federally managed land, similar to that already completed during SBSP Restoration Project Phase I), Phase II actions are not expected to result in a change of land use. The analysis in Section 4.3.2 *Environmental Consequences* assumes that the NEPA and Planning Guidance Notebook baseline condition is characterized by the plans and policies described in Section 4.3.1 *Affected Environment* and that the physical condition will be similar.

4.3.2 Environmental Consequences

4.3.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

As part of the project, the lead agencies agreed to a number of measures intended to avoid or minimize potential effects. Some of these measures apply to multiple topic areas or resources. The following list includes some of the measures that generally apply to land use, particularly nuisance effects related to construction. These measures would be adopted as part of the project:

- **AMM-LND-1: Minimize Disturbance** – Areas of possible disturbance will be avoided or will be minimized to the smallest footprint necessary. In all cases, the footprint of disturbance will remain within the impact boundaries defined for each resource (in most cases, the footprint of the Shoreline Phase I Study Area as shown in Figure 1.5-4 *Alviso Pond Complex and Shoreline Phase I Study Area* in Chapter 1 *Study Information*) and evaluated in the impact analyses provided in Section 4.2 *Geology, Soils, and Seismicity* through Section 4.16 *Public Utilities and Service Systems*; however, additional effort will be made to further reduce impacts within these parameters. This measure will minimize the project footprint and impacts to adjacent uses.
- **AMM-LND-2: Remove Materials** – All leftover construction material will be removed from the site after construction is complete. This will reduce land use incompatibilities associated with construction.

4.3.2.2 Methodology for Impact Analysis and Significance Thresholds

Land-use impacts were determined using the following tools and methods:

- Using geographic information systems (GIS) software to evaluate the types of uses in the study area and to determine potential impacts on specific areas
- Reviewing existing, publicly available literature about historical development patterns and expected future patterns
- Comparing the Proposed Project land uses for each alternative to the applicable city and county policies

Effects on land use are also evaluated using a descriptive, qualitative approach to compare the effects of the No Action and action alternatives.

An alternative would be considered to have a significant effect on land use if it would:

- **Impact LND-1:** Physically divide the community of Alviso
- **Impact LND-2:** Conflict with policies or plans of the Santa Clara County General Plan; City of San José General Plan; Wastewater Facility Plant Master Plan; the Don Edwards San Francisco Bay National Wildlife Refuge Comprehensive Conservation Plan; the NCM Management Plan; the Comprehensive Conservation and Management Plan for the San Francisco Estuary Project; the Plan Bay Area regional strategy; or CLUPs for the MFA and the Norman Y. Mineta San José International Airport
- **Impact LND-3:** Conflict with the adopted Santa Clara Valley Habitat Plan, which is a habitat conservation plan and natural community conservation plan

The analysis below discusses the Project's potential to physically divide the community of Alviso (Impact LND-1) or conflict with the Santa Clara Valley Habitat Plan (Impact LND-3). Particular plans and policies the Project could conflict with include: access to the Alviso Marina, loss of baylands habitat, access to the EEC, and the NCM Management Plan (Impact LND-2).

4.3.2.3 Alternatives Evaluation

4.3.2.3.1 No Action Alternative

Because it would not include any construction, the No Action Alternative would not physically divide the community of Alviso. The following sections focus on the project's consistency with local plan policies.

4.3.2.3.1.1 Santa Clara County General Plan, City of San José General Plan, Plan Bay Area, and Regional Development

Although most of the cities in the South Bay area are essentially built out, there is potential for infill development and redevelopment. San José's 2040 General Plan clearly states the City's goal of maintaining the existing Urban Growth Boundary and Urban Services Area boundary. Because most of the Shoreline Phase I Study Area is in the City but outside of these urban areas and because most of the land is part of a Federal wildlife refuge, it is not likely to develop with residential uses under a no action scenario. Development within most of the City of San José would continue to focus on infill and redevelopment that is far removed from the Shoreline Phase I Study Area. The City would continue to use the bomb-detonation facility on the Wastewater Facility property.

The City is in the beginning stages of implementing the Wastewater Facility Plant Master Plan, which would include modifying existing wastewater treatment facilities (which include upgrades and some demolition), building some new wastewater treatment facilities, and developing compatible land uses in areas around the active operations area consistent with the Plant Master Plan land-use plan. The Plant Master Plan land-use plan is consistent with the City of San José's land-use policies and General Plan land-use designations for the Wastewater Facility property.

Some cities adjacent to but outside the Shoreline Phase I Study Area are adjacent to large areas of undeveloped open land that is not currently protected. For example, Milpitas has identified a large area that is within its Urban Growth Boundary but is currently outside of its Urban Services Area boundary. Areas like this might expand development (and urban services) as long-term development pressure increases with population growth.

Regional growth projections are not available for the end of the period of analysis. Projections for 2010–2050 show that the 10-year rates of growth between 2010 and 2030 are expected to be about 7 percent but that growth is expected to slow considerably after that. The projections show that the 2030–2040 10-year growth is expected to be about 6 percent, and the 2040–2050 growth is expected to be only about 2 percent (ABAG Website 2009). Given this expected pattern, population growth between 2050 and project the end of the period of analysis is also expected to be much lower than the earlier rates. Growth is projected to top off and slow down as the area builds out and as developable land becomes scarce. Regardless of the rate, growth in and around the study area will continue to add pressure for new housing and commercial development; this would occur with or without the Shoreline Phase I Project.

Without the Shoreline Phase I Project, the Alviso community and nearby employment center PDAs would continue to be vulnerable to tidal flooding. Because the community of Alviso is built out, new development that could be affected by such flooding is limited to infill development projects, which would not be great in number. The No Action Alternative could have a greater effect on long-term industrial and commercial growth in floodplain areas south of the community and along SR 237, including areas identified as employment center PDAs in Plan Bay Area.

While some of this targeted growth area is within the 100-year floodplain, it is likely that the economic condition would have a greater influence on development than flood hazards. See Section 4.4 *Hydrology and Flood Risk Management* for more discussion about flood hazard effects. The 1998 Alviso Master Plan recognizes a future development pattern that does not rely on improved FRM; the No Action Alternative would continue this current land-use planning direction. The No Action Alternative, then, is not inconsistent with the City’s plan and is not expected to change the baseline development plans for the Alviso community and surrounding areas.

Implementing the No Action Alternative would not affect long-term land management of areas outside of designated for urban grown areas, such as the Baylands PCA.

4.3.2.3.1.2 Other Local Plans

Don Edwards San Francisco Bay National Wildlife Refuge Comprehensive Conservation Plan and New Chicago Marsh Water Management Plan. Without the Shoreline Phase I Project, the USFWS would continue to manage much of the land in the study area as part of the Refuge and as part of the SBSP Restoration Project. In some areas, such as the NCM, current management plans and strategies would continue. The final SBSP Restoration Project and CCP assume several supplemental or new actions that involve habitats and species in the Shoreline Phase I Study Area, but these actions could be implemented without the Shoreline Phase I Study. While the

Shoreline Phase I ecosystem restoration actions would be intended to enhance existing habitat and would complement the USFWS's management of the area, not implementing the Shoreline Phase I Project would not prevent the USFWS from implementing its current and future management plans for the Refuge and would not prevent future phases of the SBSP Restoration Project. With the No Action Alternative, Refuge managers might need to change some short-term ecosystem restoration goals that are dependent on earlier implementation of FRM in support of ongoing SBSP Restoration Project actions and plan for and implement FRM measures unrelated to the Shoreline Phase I Project.

Comprehensive Conservation and Management Plan for the San Francisco Estuary Project. The No Action Alternative would not prevent the San Francisco Bay Restoration Authority from preparing and implementing goals associated with the San Francisco Estuary Project CCMP. The Shoreline Phase I Study ecosystem restoration actions could complement the San Francisco Estuary Project CCMP and contribute to cooperative efforts for restoration. However, the San Francisco Estuary Project could continue to move forward without the Shoreline Phase I Project.

Moffett Federal Airfield and the Norman Y. Mineta San José International Airport CLUPs. Not building the FRM levee and not implementing ecosystem restoration activities would not conflict with any height restrictions associated with the CLUPs for the MFA and the Norman Y. Mineta San José International Airport.

4.3.2.3.1.3 Santa Clara Valley Habitat Plan

As described in Section 4.3.1.1.5.5 *Santa Clara Valley Habitat Plan*, the Santa Clara Valley Habitat Plan does not apply to most land in the study area. No-action scenario development on non-Federal land in and near the study area that supports the covered species could consider participation in the plan; this would happen regardless of whether the Shoreline Phase I Project is implemented. The No Action Alternative would not conflict with the Santa Clara Valley Habitat Plan.

4.3.2.3.2 Action Alternatives

Impact LND-1: Physically divide the community of Alviso

All proposed project elements are located to the north of the community of Alviso. None of the project alternatives or project elements would divide the community.

Impact LND-2: Conflict with Land-Use Policies

Recreation and Ecosystem Restoration Elements

Construction of the recreation and access features and ecosystem restoration elements would not affect land use. The ecosystem restoration elements associated with all of the alternatives are consistent with and complementary to the City and County land-use plans, the Refuge management plans, the SBSP Restoration Project, the San Francisco Estuary Project, and Plan Bay Area. None of the recreation or ecosystem elements include structures that would exceed the height limitations associated with the Norman Y. Mineta San José International Airport CLUP (Windus 2011b).

Levee construction could affect land use depending on location, as described below. Impacts on baylands habitats, which are identified as important resources in the City's General Plan and are highlighted as part of the Baylands PCA, are discussed in Section 4.6 *Aquatic Biological Resources* and Section 4.7 *Terrestrial Biological Resources*. Land use conflicts with construction would be lessened by the implementation of AMMs (AMM-LND-1: Minimize Disturbance, AMM-LND-2: Removal Materials).

WPCP South Levee

As shown on Figure 3.5-3 *Potential Wastewater Facility Segment Levee Alignments* in Section 3.5.3.3 *Wastewater Facility (WPCP) Segment Levee Alignment*, the WPCP (Water Pollution Control Plant, which is an acronym used to describe the Wastewater Facility; see explanation of name change in Section 3.5.3 *Structural FRM Plan Formulation Strategy*) section of the levee (east of Artesian Slough) would be constructed between Pond A18 and adjacent southern upland areas (currently occupied by the Wastewater Facility and former solid waste facilities). Starting on the west side, this section of the levee generally follows the southern edge of Pond A18 from Artesian Slough to the northeastern edge of the pond.

The footprint of and construction buffer area for this section of the levee would include about 46 acres with Alternative 2 (12.5-foot NAVD 88 levee) or about 102 acres with Alternative 3 (15.2-foot NAVD 88 levee); both options would include about 0.5 acre of a biosolids disposal area and former sewage treatment ponds associated with the Wastewater Facility (the biosolids disposal area is also scheduled for closure as part of the Plant Master Plan). Most of this area is on the edge of the biosolids and former sewage treatment pond areas (i.e., the options would not bisect the disposal areas but would follow an existing edge). The Plant Master Plan land-use plan identifies the affected areas as edges of flexible space and wetland areas in the future. Converting the edges of the former biosolids disposal and sewage treatment areas to levee use would not affect future Wastewater Facility operations and would not prevent the future development of the former treatment areas for other uses that are consistent with the Plant Master Plan.

The WPCP South Levee is about 1,200 feet away from the City's bomb-disposal site. Given this large buffer, construction and operation of the levee would not affect continued use of the bomb-disposal site.

Providing improved FRM would be beneficial to the Wastewater Facility property by providing an added level of security for the operations area of the Wastewater Facility. Building a levee that addresses risk associated with a flooding event having a 1-percent ACE is consistent with the part of San José General Plan Policy EC-5.9 that directs the City to work with local, regional, State, and Federal agencies to ensure that new and existing levees provide FRM. The WPCP South levee would result in a beneficial effect.

The Wastewater Facility section of the levee generally follows the San José Urban Growth Boundary and Urban Services Area boundary except for short sections at its western and eastern extents (Figure 3.5-3 *Potential Wastewater Facility Segment Levee Alignments* in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*). The area north of this boundary is designated as open space and the area adjacent to and south of this boundary (the Wastewater Facility property and existing landfill sites) is designated public/quasi-public and industrial. Building a levee in this area would not conflict with the overall uses of these areas for public/quasi-public and industrial uses.

In summary, the WPCP South levee would have a less-than-significant impact on the Wastewater Facility property.

Alviso Levee Section Options

There are three alignment options for the FRM levee section in the Alviso area near the NCM: (1) a north levee option, (2) a railroad spur levee option, and (3) a south levee option. All three options are intended to provide better FRM for the community of Alviso.

All three options would approach the right-of-way of an active Union Pacific Railroad rail line but would tie into adjacent high ground and would not be built into the Union Pacific Railroad right-of-way. In addition, the project design for all alternatives includes construction of a flood gate to protect the existing rail line right-of-way, along with a pedestrian bridge to straddle the rail crossing.

The following paragraphs describe the construction effects of each option starting from the west and moving east.

Construction

Alviso North Levee Section Option (Part of Alternatives 2 and 3)

The Alviso North levee section option (Figure 3.5-1 *Potential Alviso Segment Levee Alignments* in Section 3.5.3.1 *Alviso Segment*) would be constructed to either a 12.5-foot NAVD 88 height with Alternative 2 or a 15.2-foot NAVD 88 height with Alternative 3. Either case is consistent with San José General Plan Policy EC-5.9. This levee section footprint and the construction buffer area would include about 38 acres of land with Alternative 2 (12.5-foot NAVD 88 levee) or about 63 acres of land with Alternative 3 (15.2-foot NAVD 88 levee). Land that would be converted to FRM levee is primarily managed pond and former salt pond dikes and berms that were not originally constructed for FRM. Changing the land from these uses to FRM levee would not affect how the adjacent land is used.

The Alviso North levee section would be constructed from the Alviso Marina along the west side of the NCM and the Union Pacific Railroad line before turning east at the existing berm following the southern border of Pond A16 (i.e., along the northern extent of the NCM). With the exception of the beginning of the levee section at the eastern side of the marina, which would border land identified for mixed residential uses, most of this section of the Alviso North levee section option would travel through land identified by the City as Open Space, Parklands, and Habitat. Building a levee at this location would not conflict with the open space uses of the area.

In general, this section of the Alviso North levee section option would be adjacent to the marsh and railroad tracks. The beginning of this section of the Alviso North levee section would be located on the easternmost side of the Alviso Marina property, near where the property abuts the Union Pacific Railroad corridor and the NCM. The levee would not be constructed in a location that would affect how the marina property is used or accessed. This option would not affect current land uses in the marina area. While this levee section would not result in long-term or permanent access impacts at the marina, construction activity associated with the Alviso North levee option could temporarily disrupt access to the Alviso Marina property. Disruptions might require alternative access to the marina or limit access to some of the property but would not prevent use of the marina.

The remainder of the Alviso North levee section option would be constructed along the north side of NCM (between the marsh and Pond A16), along an existing berm, and would continue east to Artesian Slough. Most of this section of the Alviso North levee section would be adjacent to existing marsh habitats north of the existing railroad tracks and therefore would not affect any land uses in the community of Alviso.

The Refuge EEC is located just south of the Alviso North levee section alignment. Active levee construction could cause some temporary access impacts for people using the center. The presence of the levee could affect how the land is used for environmental education and could affect visitors' experience at the EEC. In the long term, the Alviso North levee section option for a 12.5-foot NAVD 88 levee or a 15.2-foot NAVD 88 levee would provide better FRM for the EEC over the current condition. This is a beneficial land-use effect.

At Artesian Slough, the Alviso North levee section would connect into the WPCP South levee section option described above via a tide gate closure system crossing the slough.

In summary, this option would not be in conflict with adopted plans. Providing improved FRM would be beneficial to urban uses associated with the EEC, the Alviso Marina, and the community of Alviso and would improve FRM for adjacent areas. Construction activity could temporarily affect access to the EEC and Marina but would not preclude people from using these facilities. In the long term, the presence of the levee so close to the EEC might affect the experience of people using the EEC, but the levee's presence would not affect the USFWS's ability to provide an environmental education experience. The beneficial effects associated with a 15.2-foot NAVD 88 levee (Alternative 3) would be greater than those associated with a 12.5-foot NAVD 88 levee (Alternative 2).

Construction of the Alviso North levee would have a less-than-significant impact on land-use policies.

Alviso Railroad Spur Levee Section Option (Alternative 4)

The Alviso Railroad Spur levee section option (Figure 3.5-1 *Potential Alviso Segment Levee Alignments* in Section 3.5.3.1 *Alviso Segment*) would construct a 15.2-foot NAVD 88 levee, which is consistent with San José General Plan Policy EC-5.9. This levee section footprint and the construction buffer area would include about 46 acres of land. Land that would be converted to FRM levee, currently an unused railroad spur, is primarily managed as part of the Refuge.

The western part of the Alviso Railroad Spur levee section option would be similar to the western portion of the Alviso North levee section option (although the Alviso Railroad Spur section option turns eastward earlier [farther south] than the Alviso North option). Like the Alviso North levee section option, the eastern end of the Alviso Railroad Spur levee section option ties into the Alviso Marina property on the property's easternmost side. The Alviso Railroad Spur levee's placement is not expected to affect use of or access to the marina property and, like the Alviso North levee section option, is not expected to conflict with the open space uses of the area north of the marina. As described for the Alviso North levee section option, construction activity associated with the Alviso Railroad Spur levee option could temporarily disrupt access to the Alviso Marina property. Disruptions might require alternative access to the marina or limit access to some of the property. Because impacts on users of the marina would be limited in duration and area, they would not be significant.

The Alviso Railroad Spur levee section option would be constructed through the middle of the NCM along an existing railroad spur but would still be physically separated from (north of) the community of Alviso. Residents of the northeastern part of this community might be able to see and hear construction activity, but these temporary impacts would not divide the community.

The existing rail spur that is located in the NCM has historically been managed through a long-term lease by the City of San José. The spur has been used by the Wastewater Facility for transporting chemicals used in processing waste. The Wastewater Facility stopped using the spur because it no longer uses the chemicals that were being transported by rail due to upgrades in processing and it is not expected that the Wastewater Facility will resume the use of the spur. Thus, this impact would be less than significant. See Section 4.16 *Public Utilities and Service Systems* for more information about the rail spur in the NCM.

The NCM is outside of the City's urban growth boundary and is in an area that is considered part of the Baylands PCA. The City identifies the NCM as Open Space, Parklands, and Habitat. The San José General Plan contains the following policy regarding the Refuge, of which the NCM is a part:

- **Policy ER-3.4:** Avoid new development which creates substantial adverse impacts on the Don Edwards San Francisco Bay National Wildlife Refuge or results in a net loss of baylands habitat value.

Building a new FRM levee through the middle of the marsh would affect the Refuge property and would result in a minor loss of baylands habitat associated with the marsh. While this net loss is minor, building a FRM levee through the NCM is not consistent with General Plan Policy ER-3.4.

Furthermore, the San José General Plan also includes a policy that focuses on preservation of habit for special-status species:

- **ER-4.1:** Preserve and restore, to the greatest extent feasible, habitat areas that support special-status species. Avoid development in such habitats unless no feasible alternatives exist and mitigation is provided of equivalent value.

The NCM provides valuable muted tidal and diked marsh habitat. This area, which has undergone substantial restoration over the last 15 years, is managed for the salt marsh harvest mouse, a Federally Endangered species. Building a levee through this area is not consistent with General Plan Policy ER-4.1.

The NCM Management Plan describes the current water management system in the marsh. The railroad spur has several culverts underneath it, allowing conveyance of water between the north and south sides of the marsh. If the levee were constructed such that water could not be conveyed between the two sides of the marsh, its presence could significantly affect the USFWS's ability to manage water in the marsh. Building a FRM levee through the middle of the NCM could interfere with water management in the marsh, which would not be consistent with the Refuge's NCM Management Plan. The USFWS originally restored the marsh to muted tidal marsh in 1994 and recently completed some water-control improvements between the marsh and Pond A16 as part of the SBSP Restoration Project. Without installing additional water-management controls and/or measures, building a section of the Alviso Railroad Spur levee in the marsh could conflict with the USFWS's management plan for the marsh, which would be a significant impact.

The Alviso Railroad Spur levee section option would also abut the EEC of the Refuge, and active levee construction could cause some temporary access impacts for people using the center. These temporary impacts would not prevent people from reaching the center or prevent its intended use. The presence of the levee could affect how the land is used for environmental education and could affect visitors' experience at the EEC. The Alviso Railroad Spur levee placement would not affect any of the facilities associated with the EEC, such as boardwalks and parking areas, but might require minor changes such as relocating fences. In the long term, the Alviso Railroad Spur alignment would improve the FRM condition (for 1-percent ACE events) for the EEC, further protecting uses associated with the EEC. This is a beneficial land-use effect.

The Alviso Railroad Spur levee section would end at Artesian Slough. The Alviso Railroad Spur option would connect to the WPCP South levee option described above via a tide gate closure system crossing the slough.

In summary, this option would result in a beneficial impact to urban uses associated with the EEC, the marina, and the community of Alviso by providing better risk management (by constructing a 15.2-foot NAVD 88 levee) than the current condition. This option would also improve FRM for adjacent areas. These are beneficial effects. Construction activity could temporarily affect access to the EEC and Marina but would not preclude people from using these facilities. In the long term, the presence of the levee so close to the EEC might affect the experience of people using the EEC, but the levee's presence would not affect the USFWS's ability to provide an environmental education experience. This levee option is not consistent with San José General Plan policies ER-3.4 and ER-4.1 and is not consistent with the NCM Management Plan. The incompatibility with the City's General Plan policies would be less than significant because the minor amount of baylands habitat lost would be mitigated by the restoration of baylands habitat (tidal marsh) and because the project would also benefit salt marsh harvest mouse by restoring habitat that can be used by this species.

Construction of the Alviso Railroad Spur levee would have a significant impact on the NCM Management Plan by dividing the marsh in two with the levee. Mitigation would be required to address this impact (see Section 4.3.3 Mitigation Measures*). The project would be consistent with other land-use policies.*

Alviso South Levee Section Option (Alternative 5)

The Alviso South levee section option (Figure 3.5-1 *Potential Alviso Segment Levee Alignments* in Section 3.5.3.1 *Alviso Segment*) would construct a 15.2-foot NAVD 88 levee as part of Alternative 5. The 15.2-foot NAVD 88 levee is consistent with San José General Plan Policy EC-5.9. The Alviso South levee footprint and the construction buffer area would affect about 48 acres of land. In both cases, most of the land that would be converted to FRM levee is primarily managed muted tidal/diked marsh managed by the USFWS and existing levees and berms not originally constructed for FRM. The area of the Refuge that would be affected is an edge that abuts a developed area. Building the Alviso South levee section option could result in additional, unplanned tidal inundation or flooding (during periods of high water and with SLC) of the NCM, which could have an adverse effect on how the USFWS manages the NCM. See Section 4.4 *Hydrology and Flood Risk Management* for a detailed analysis of how the levee could affect hydrology and Section 4.7 *Terrestrial Biological Resources* for more detailed analysis of how the levee could affect wildlife use of this part of the Refuge.

The Alviso South levee section option begins at the easternmost area of the Alviso Marina property, but, instead of running north along the western boundary of the NCM, this levee section alignment would generally run along the edge of the marsh, which is also the Urban Growth Boundary and Urban Services Area boundary line between the community of Alviso and the NCM.

The Alviso South levee section option placement on the marina property would not affect access to or use of the marina property. The railroad crossing for this option would be near a developed area of Alviso, and construction could cause temporary nuisance impacts but would not physically divide the community. As described for the Alviso North levee section option, construction activity associated with the Alviso Railroad Spur levee option could temporarily disrupt access to the Alviso Marina property. Disruptions might require alternative access to the marina or limit access to some of the property but would prevent use of the marina.

Like the other levee section options, the Alviso South option is not expected to conflict with the open space uses of the area north of the Urban Growth Boundary and Urban Services Area boundary line.

After crossing the railroad, the Alviso South levee section option would follow the marsh boundary (and Urban Growth and Urban Service Area boundaries, as described above) until just west of Artesian Slough, where the Alviso South levee would turn north. This boundary abuts the community of Alviso and avoids bisecting the NCM. However, this alignment would not provide flood protection to the NCM, leaving it vulnerable to future tidal flooding. People living in Alviso would be subject to temporary construction-related effects, but the levee would not divide the community. Residents living close to the Alviso South levee section option (especially where it would parallel Spreckles Avenue) might feel that the levee obstructs their views and changes the character of their neighborhoods. See Section 4.12 *Aesthetics* for a more detailed discussion regarding the visual effects of this levee section option. In general, this section of the Alviso South levee section option would not require changes in land uses for the residential areas adjacent to the levee and would improve FRM, a beneficial impact (see Section 4.4 *Hydrology and Flood Risk Management* for more information about FRM for the community of Alviso). Building the Alviso South levee option would not directly conflict with the open space uses of the marsh area to the north but would leave the NCM vulnerable to flooding, which could result in the loss of marshland in the future since this area is below sea level and could remain permanently ponded if flooded.

Like the Alviso Railroad Spur section option, the Alviso South levee section option would abut the EEC of the Refuge, and active levee construction could cause some temporary access impacts for people using the EEC. These temporary impacts would not prevent people from reaching the center or prevent its intended use. The presence of the levee could affect how the land is used for environmental education and could affect visitors' experience at the EEC. The Alviso South levee option placement would not affect any of the facilities associated with the EEC, such as boardwalks and parking areas, but might require minor changes such as relocating fences. In the long term, the Alviso South levee option would improve FRM over current levels. This would be a beneficial land-use effect.

Like the other Alviso levee section options, the Alviso South levee section option would end at Artesian Slough. The Alviso South levee section option would connect to the WPCP South levee option described above via a tide gate closure system crossing the slough.

In summary, this option is consistent with adopted plans. Providing improved FRM would be beneficial to urban uses associated with the EEC, the Alviso Marina, and the community of Alviso and would also improve FRM for adjacent areas; however, the FRM would not protect the NCM leaving it vulnerable to flooding, which is not consistent with the NCM Management Plan. Construction activity could temporarily affect access to the EEC and Marina but would not preclude people from using these facilities. In the long term, the presence of the levee so close to the EEC might affect the experience of people using the EEC, but the levee's presence would not affect the USFWS's ability to provide an environmental education experience.

Construction of the Alviso South levee would have a significant impact on the NCM Management Plan.

Operation and Maintenance

In general, future use of most of the study area would be similar to current uses. These uses are dominated by open space associated with the Refuge but also include developed uses that would require long-term maintenance, uses such as infrastructure associated with the Wastewater Facility (e.g., the outfall weir to Artesian Slough), the bomb-disposal facility, and PG&E power transmission infrastructure. Operating and maintaining the FRM levee, implementing ecosystem restoration elements, and making recreational improvements are consistent with and complementary to the City's and County's land-use plans for the area, Plan Bay Area's designation of the area as a PCA, the Refuge management plans, the SBSP Restoration Project, and the San Francisco Estuary Project. Operation and maintenance would not affect other ongoing uses in the study area and would be beneficial because a maintained FRM levee would be beneficial for the Wastewater Facility and the community of Alviso.

Long-term operation and maintenance of the project would not adversely affect future land uses in the area. Development of the Alviso area is expected to continue as described by the City of San José in its most recent General Plan and in Plan Bay Area, with an emphasis on job growth. Residential areas of Alviso are largely built out, but there continue to be opportunities for infill residential development. Because flood risks currently prevent some infill residential development in Alviso, better FRM might facilitate more infill residential development in areas identified for residential uses. This type of infill development would be consistent with the City's General Plan.

The Alviso Railroad Spur and Alviso South levee options would be constructed adjacent to the EEC, which could limit some permanent uses of the facility (such as restricting wildlife viewing from existing platforms). However, none of the Alviso levee options would prevent long-term access to the center or change the overall use of the center, so these minor effects would be less than significant. See Section 4.11 *Recreation* for a discussion regarding how the alternative levee locations might affect long-term recreational use of and recreational experiences in this area.

Operation and maintenance would have a less-than-significant impact on land-use policies.

Impact LND-3: Conflict with the Adopted Santa Clara Valley Habitat Plan

Most of the ecosystem restoration activities would not occur in the Santa Clara Valley Habitat Plan covered area, and therefore do not conflict with it. Restoration activity that would occur on land owned and managed by the City of San José would be consistent with the protection focus of the Habitat Plan. The only species covered by the Santa Clara Valley Habitat Plan with potential to be present around the project site is burrowing owl. The project will implement measures to protect burrowing owl consistent with the habitat plan as discussed in Section 4.7 *Terrestrial Biological Resources*.

The project would be consistent with the Santa Clara Valley Habitat Plan; this impact would be less than significant.

4.3.2.3.2.2 Comparison of Action Alternatives

Table 4.3-2 *Summary of Land-Use Impacts from the Action Alternatives* summarizes the land-use impacts of each alternative. Recreational use of the study area and ecosystem restoration would not result in any land-use impacts and are thus not included in the table.

Table 4.3-2. Summary of Land-Use Impacts from the Action Alternatives

Alternative	Impact Summary
2 - Alviso North with 12.5-foot Levee and Bench	• Levee footprint and construction area would affect about 83 acres of land; conversion of this land would not significantly change land uses in the area. • Temporary construction access impacts on use of the Alviso Marina. • Beneficial impacts on adjacent land use by providing improved FRM over the baseline condition but at a lower level than other alternatives (due to lower levee height).
3 - Alviso North with 15.2-foot Levee and 30:1 Ecotone	• Levee footprint and construction area would convert about 165 acres of land; conversion of this land would not significantly change land uses in the area. • Potential temporary construction nuisance impacts—such as noise, dust, and visual impacts—on use of the Alviso Marina. • Beneficial impacts on adjacent land use by providing high level of FRM.
4 - Alviso Railroad with 15.2-foot Levee and Bench	• Levee footprint and construction area would affect about 148 acres of land; conversion of Refuge land in the NCM is potentially incompatible with the NCM Management Plan. • Potential temporary construction access impacts on use of the Alviso Marina. • Potential temporary construction-related access impacts for people using the Don Edwards EEC. • Beneficial impacts on adjacent land use by providing high level of FRM.
5 - Alviso South with 15.2-foot Levee and Bench	• Levee footprint and construction area would affect about 150 acres of land; conversion of this land would not significantly change land uses in the area. • The NCM would be vulnerable to flooding, which is not consistent with the NCM Management Plan. • Temporary construction access impacts on use of the Alviso Marin. • Potential temporary construction-related access impacts for people using the Don Edwards EEC. • Beneficial impacts on adjacent land use by providing high level of FRM.

4.3.3 Mitigation Measures

Impact LND-2 is significant before mitigation for Alternatives 4 and 5. To ensure that NCM management objectives can continue to be met as part of Alternative 4, application of the following mitigation measure would provide additional insurance that the NCM could continue to be managed by the USFWS consistent with the NCM Management Plan. See Section 4.7 *Terrestrial Biological Resources* for more discussion regarding baylands habitat and special-status species impacts and mitigation.

- **M-LND-2: New Chicago Marsh Protection**

  In order to avoid impacts to water management in the NCM, the Alviso Railroad Spur FRM levee segment shall be constructed to accommodate moving water between the north and south sides of the FRM levee. This could be accomplished by either installing a new pumping system, which is costly to install and maintain, or installing culverts through the levee with flap gates that would close (either manually or automatically) during a flood.

Implementation of mitigation measure M-LND-2, requiring the design to accommodate water movement between the two sides would reduce this impact for Alternative 4 to less than significant. There is no mitigation available for the impact associated with Alternative 5.

4.3.3.1 Residual Impacts and Additional Measures Necessary to Mitigate Significant Impacts

Mitigating for Alternative 4 incompatibility with the NCM Management Plan would require either installing a new pumping system or installing culverts in the FRM levee. Either option would minimize the land use incompatibility impact. The levee alignment of Alternative 5 would leave the NCM unprotected from future flooding, as the levee alignment would be landward of the NCM. As the NCM has subsided and is below sea level the existing marsh would likely be transformed to open water with future floods and rising sea level. As Alternative 5 would likely result in the conversion of the NCM, it is incompatible with the NCM Management Plan. As the alignment of the levee for this alternative does not allow protection for the NCM, there is no mitigation available that could avoid or minimize the impact. There are no other residual land use impacts.

4.3.4 Cumulative Effects

The area considered for cumulative land-use effects is the nine-county area. This area represents an accepted, logical planning area for the San Francisco Bay Area. Past, present, and reasonably foreseeable future actions are done in accordance with local general plans approved by each local land use agency. As development is consistent with general plans the combined effects on land use would not be cumulatively significant and no further analysis is necessary.

4.3.5 Summary

None of the project alternatives would physically divide the community of Alviso. Ecosystem restoration activity would not affect land use under Alternatives 2 and 3. Alternative 4 would be inconsistent with San José General Plan policies ER-3.4 and ER-4.1 and the NCM Management Plan, a significant impact. However, this impact can be minimized to a less than significant level with mitigation measure M-LND-2. Alternative 5 would be inconsistent with the NCM Management Plan as the plan leaves the marsh vulnerable to flooding, which is a significant unavoidable impact. All alternatives would have a beneficial impact from protecting land uses from flooding.

Table 4.3-3 *Land Use NEPA Impact Conclusions* summarizes the project effects under the NEPA.

Table 4.3-3. Land Use NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
LND-1: Physically divide the community of Alviso	Neutral	None	None	None	Local
LND-2: Conflict with land-use policies	Negative (Beneficial on flood risk)	Minor (Major for flood risk)	Long tern	Probable	Local
LND-2: Conflict with land-use policies: Incompatibility with the New Chicago Marsh Water Management Plan *(Alternative 4 and 5)*	Negative	Moderate	Long term	Probable	Limited
LND-3: Conflict with the adopted Santa Clara Valley Habitat Plan	Neutral	None	None	None	Local

Table 4.3-4 *Land Use CEQA Impact Conclusions* summarizes the project effects under the CEQA. As described earlier in this section, these effects would all be less than significant.

Table 4.3-4. Land Use CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
LND-1: Physically divide the community of Alviso		NI	None	NI
LND-2: Conflict with land-use policies	AMM-LND-1: Minimize Disturbance AMM-LND-2: Removal Materials	LTS (Alt 2,3) S (Alt 4, 5)	None (Alt 2,3) M-LND-2: New Chicago Marsh Protection (Alt 4) None Available (Alt 5)	LTS (Alt 2,3,4) S (Alt 5)
LND-3: Conflict with the adopted Santa Clara Valley Habitat Plan	AMM-LND-1: Minimize Disturbance AMM-LND-2: Removal Materials	LTS	None	LTS

NI=No Impact
LTS = less than significant
S = significant
(B) = beneficial effect
NA = not applicable

4.4 Hydrology and Flood Risk Management

This section describes current hydrology and FRM within the study area, the potential impacts on hydrology and FRM resulting from the Proposed Project alternatives, and relevant regulations.

Information in this section was derived from the SBSP Restoration Project Final Environmental Impact Statement/Environmental Impact Report (EIS/EIR; December 2007) and the project's water resources engineering appendix (Appendix D1 *Coastal Engineering and Riverine Hydraulics Summary*).

4.4.1 Affected Environment

This section describes the regulatory setting and physical setting for hydrology and FRM within the study area. The aspects of hydrology and FRM addressed in this section focus on the Shoreline Phase I Study Area, which is influenced by the hydrology of the Coyote Creek and Guadalupe River watersheds and San Francisco Bay. Because of this relationship, the discussion in Section 4.4.1.2 *Physical Setting (CEQA Baseline)* includes some information about San Francisco Bay, with particular emphasis on the South Bay (that is, that part of the bay that is south of the Dumbarton Bridge).

4.4.1.1 Regulatory Setting

Flood risk assessments and some FRM projects are conducted by Federal agencies, including the FEMA and the USACE. Local FRM agencies and Cities implement the National Flood Insurance Program (NFIP) under the jurisdiction of FEMA and its Flood Insurance Administration.

The FEMA is responsible for responding to emergencies and natural disasters, including flooding. The FEMA has delineated Special Flood Hazard Areas to assign risk to the potentially flooded areas along the South Bay. The flood risk assigned to geographic areas is illustrated on Flood Insurance Rate Maps (FIRMs). FEMA FIRMs show base flood elevations (predicted water surface elevations landward of shoreline and river barrier crests) and separate flood hazard zones. This risk assessment is also used to set actuarial insurance premium rate tables.

The USACE has a regulatory role on local civil works projects under Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403), Section 404 of the Clean Water Act (33 USC 1344), or Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended (33 USC 1413). Also, the USACE conducts its own studies on flood hazards and participates in FRM projects as part of its Civil Works mission. This project is part of USACE's Civil Works mission. The USACE has developed their own principles and guidelines for designing and constructing FRM and ecosystem restoration measures for coastal, estuarine, and river environments, based on the Federal Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (U.S. Water Resources Council 1983).

The USACE conducts multi-purpose projects that combine FRM, ecosystem restoration, recreation, and other purposes under its overarching strategy of Integrated Water Resources Management, which maximizes economic services and environmental quality and ensures public safety while providing for the sustainability of vital ecosystems (USACE 2011c). All USACE construction projects are subject to authorization by Congress pursuant to the Water Resources Development Act of 2005. The USACE also has previously conducted studies on flood hazards and risks as part of the original San Francisco Bay Shoreline Study (USACE 1988b; USACE 1989; USACE 1992).

Although documents from both the FEMA and the USACE are valuable resources in evaluating flood hazards, the FIRMs for the South Bay area and flooding analyses from the original Shoreline Study may not be current in all areas.

The agencies, their enabling legislation, and their roles in establishing and implementing policies specifically related to hydrology and FRM in the study area are described in the following sections.

4.4.1.1.1 Executive Order 11988 – Floodplain Management

Executive Order 11988 requires Federal agencies to recognize the values of floodplains and to consider the benefits to the public from restoring and preserving floodplains. Under this order, the USACE is required to take action and provide leadership to:

- Avoid development in the base floodplain;
- Reduce the risk and hazard associated with floods;
- Minimize the impact of floods on human health, welfare, and safety; and
- Restore and preserve the beneficial and natural values of the base floodplain.

4.4.1.1.2 National Flood Insurance Act and National Flood Insurance Program

The National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 were enacted to reduce the need for FRM structures, create the NFIP, and limit disaster relief costs by restricting development on floodplains. The FEMA was created in 1979 to administer the NFIP and to develop standards for fluvial and tidal floodplain delineation. Section 1315 of the 1968 act is a key provision that prohibits the FEMA from providing flood insurance unless the communities adopt and enforce floodplain management regulations that meet or exceed the floodplain management criteria established in accordance with Section 1361(c) of the act.

The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. Participation in the NFIP is voluntary and is based on an agreement between communities and the Federal government. If a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new construction in floodplains, the Federal government will make flood insurance available within the community as a financial protection against flood losses. This insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods.

4.4.1.1.3 Clean Safe Creeks and Natural Flood Protection Program

In addition to protecting water supplies, the SCVWD is also charged with FRM and stream stewardship. The SCVWD stream stewardship mission is carried out through all of its operations, including the Clean Safe Creeks and Natural Flood Protection Program, which was established in November of 2000. This program is funded through a 15-year voter-approved benefits assessment until 2016. The program is designed to protect property from flooding, keep streams and creeks clean, protect and enhance the ecosystem function of streams, and provide open spaces, parks, and trails along streams and creeks in the Santa Clara Valley. In November of 2012, a new 15-year voter-approved assessment was established in the Safe, Clean Water and Natural Flood Protection Program, which will continue on with many of the Clean Safe Creeks initiatives.

4.4.1.2 Physical Setting (CEQA Baseline)

This section describes hydrologic setting, the hydrologic condition, hydraulics, hydrodynamics, sediment dynamics, FRM, and the geotechnical condition of FRM facilities for the study area.

4.4.1.2.1 Hydrologic Setting

This section provides an overview of the hydrologic setting in the study area.

4.4.1.2.1.1 Climate and Precipitation

The South Bay area has a mild Mediterranean climate. San Francisco Bay strongly influences the temperatures of the areas closest to the shoreline because of the influence of the marine environment and onshore winds. Summers are mild, with average temperatures in the 70s (Fahrenheit), and winters tend to be cool, with average temperatures in the 50s.

Locations farther from San Francisco Bay have a somewhat less moderate climate. Below-freezing temperatures are a minor component of the climate except in the higher elevations of the Santa Cruz Mountains.

Typically, most rainfall occurs during the cooler months, with approximately 80 percent of the area’s rainfall occurring from November to March. The valley floor has an average annual rainfall of approximately 15 inches, while the Santa Cruz Mountains to the west and the Diablo Range to the east average approximately 50 and 24 inches of rainfall per year, respectively. Snow is rare at low elevations and is a minor component of precipitation even at higher elevations.

4.4.1.2.1.2 Topography

San Francisco Bay is located in a trough between distinct parallel ranges of the Coast Ranges Geologic Province; this trough continues southward beyond the end of the bay to form the Santa Clara Valley. The Shoreline Phase I Study Area is located where the southern end of San Francisco Bay meets the northern end of the Santa Clara Valley and includes both water areas and flat land close to sea level. The Shoreline Phase I Study Area is within the Coyote Watershed bordered by Coyote Creek and Alviso Slough (Guadalupe River), the crest of the Santa Cruz Mountains to the west, and the Diablo Range to the east. Elevations within contributing watersheds range from sea level at San Francisco Bay to 3,791 feet above mean sea level (msl) at Loma Prieta, and 3,000 feet above msl within the Diablo Range. Small areas near the bay are below sea level because of past subsidence but do not drain directly into these watersheds because they are isolated behind levees.

The South San Francisco Bay adjacent to the Shoreline Phase I Study Area receives water from two watersheds within Santa Clara County (Guadalupe Watershed and Coyote Watershed) for a total contributing watershed area of 492 square miles. Pump systems drain the subsided watersheds to creeks. The largest contributing watershed, Coyote Creek in Santa Clara County, encompasses approximately 65 percent of the total contributing area.

Most of the floor of the Santa Clara Valley consists of broad alluvial fans that were formed as streamflows emerged from the foothills, flattened, slowed, and spread out, depositing unconsolidated material. The lowest portions of the valley are flat and are covered with fine alluvium. Areas currently or formerly exposed to regular tidal influence were generally flat or sculpted to some degree by tidal currents, but in many areas are now leveed or otherwise modified by human activities.

4.4.1.2.1.3 Surface Hydrology

The surface water hydrology of the South Bay area has been greatly altered by human activity. Flat valley areas adjacent to San Francisco Bay have undergone rapid and extensive urbanization over the last 70 years. The surrounding foothills have undergone some low-density urbanization, while the steep mountainous regions have remained mostly rural open space. In keeping with urbanization of the valley floor, the creek channels have also been modified over the years, first as the valley was developed for agricultural purposes in the late 1800s and later because of urbanization. As urban development occurred over the years, many of the creek channels were moved, realigned, and straightened. Today, most of the creek channels are a combination of earthen trapezoid and concrete channels, box culverts, bypasses, floodwalls, and levee systems.

Most freshwater inflows entering the South Bay occur during winter and spring (Life Science 2003; Life Science 2004). A major source of freshwater inflow during summer months and dry years is the effluent from municipal wastewater treatment plants in the region (Cheng and Gartner 1985). Peak flows for stream reaches in and near the Shoreline Phase I Study Area are shown in Table 4.4-1 *Guadalupe River, Coyote Creek, and Lower Penitencia Creek Peak Discharges*.

Table 4.4-1. Guadalupe River, Coyote Creek, and Lower Penitencia Creek Peak Discharges

Location	Drainage Area (square miles)	Percent Chance Exceedance/Peak Discharge (cfs)							
		50%	20%	10%	4%	2%	1%	0.4%	0.2%
Guadalupe River at San José	144	2,700	4,500	6,700	9,700	13,500	17,000	21,000	32,000
Guadalupe River at San José	146	3,317	6,059	7,712	10,463	14,251	17,967	22,431	27,942
Coyote Creek at SR 237	321	3,300	6,200	8,400	10,500	13,000	14,500	16,000	18,000
Lower Penitencia Creek at Coyote Creek	29	2,480	3,640	4,310	5,900	6,980	8,720	10,790	12,080

Sources: USACE 2014; USACE 1977 and 2009 as cited in USACE 2014; NHC 2006 as cited in USACE 2014
Key:
cfs = cubic feet per second
SR = State Route

The hydrology presented in Table 4.4-1 *Guadalupe River, Coyote Creek, and Lower Penitencia Creek Peak Discharges* assumes that all of the flow is contained within the channel. This statement assumes that each creek contains the 50-percent through the 0.2-percent floods to the study limits. However, this does not represent the condition in the field. Where existing information was available, the upstream channel capacities were taken into account and used in the hydraulic analysis (with a baseline of 2017)[1]. The creeks where upstream capacity restrictions affect the baseline hydrology are presented in Table 4.4-2 *Guadalupe River and Coyote Creek Hydrology Based on Capacity Limitations*.

Table 4.4-2. Guadalupe River and Coyote Creek Hydrology Based on Capacity Limitations

Location	Drainage Area	Percent Chance Exceedance/Peak Discharge (cfs)							
		50%	20%	10%	4%	2%	1%	0.4%	0.2%
Guadalupe River at San José	144	2,700	4,500	6,700	7,009	13,500	17,000	21,000	24,050
Coyote Creek at SR 237	321	3,300	6,200	8,400	10,500	13,000	14,500	16,000	17,000

Source: USACE 2014
Key:
cfs = cubic feet per second
SR = State Route

[1] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

4.4.1.2.1.4 Hydraulics, Hydrodynamics, and Sediment Dynamics

The South Bay is a complex system, both geographically and hydrodynamically, with freshwater tributary inflows, tidal currents, wind and small wind generated waves interacting to create complex circulation patterns that vary over time. The most obvious hydrodynamic response is the daily rise and fall of the tides, although much slower residual circulation patterns also influence mixing and flushing processes of the South Bay. The following sections describe the existing condition considered for South Bay bathymetry, tides and wind waves, SLC, circulation and residence time, and sediment transport and budget.

Bathymetry

The South Bay is a large, shallow basin containing a now-inundated deep relict river channel surrounded by broad shallow areas, mudflats, and fringing tidal marsh. The width of the South Bay ranges from less than 1.2 miles near the Dumbarton Bridge (the Dumbarton Narrows) to more than 12 miles north of the San Mateo Bridge. The mean (average) depth of the South Bay is less than 13 feet, with a channel depth of 33 to 50 feet. The areas between mean high and low tide contain a network of small, branching channels that effectively drain the South Bay at low water, leaving an expanse of exposed mudflats in the lower intertidal areas.

The channel down the length of the South Bay is natural except for a portion by San Bruno Shoal (near the San Francisco International Airport) where the bay widens out more and the channel gets shallower. The USACE dredges this portion of the channel. The deepest parts of the channel are natural and only the shallowest part (longitudinally) needs to be dredged to meet the –30 mean lower low water depth requirement for access to the Port of Redwood City.

Tides

Tides move through the narrow opening at the Golden Gate Bridge but are modified by bottom bathymetry, the shoreline, and the Earth’s rotation as they move through the San Francisco Bay estuary.

The enclosed nature of the South Bay creates a mix of progressive and standing-wave behavior for tides, meaning these waves are reflected back on themselves (Walters et al. 1985), causing an amplification of the tides and an increase in tidal range with distance from the Golden Gate Bridge, the area from which the bay opens to the open ocean. Tides in San Francisco Bay are mixed semidiurnal, with two high and two low tides of unequal heights each day. The tides exhibit strong spring-neap variability, with the spring tides (larger tidal range) occurring approximately every 2 weeks during the full and new moons. Neap tides (smaller tidal range) occur approximately every 2 weeks during the moon’s quarter phases. The tides also vary on an annual cycle in which the strongest spring tides occur in late spring and early summer and then late fall and early winter, and the weakest neap tides occur in spring and fall.

Wind Waves

The majority of waves within the South Bay are generated locally by wind (called seas), as opposed to waves generated by weather systems far offshore that spread into the San Francisco

Bay estuary (called swell). As stated above, the wind direction over the South Bay is typically from the west and northwest in late spring through early fall, with a more variable condition in winter (Cheng and Gartner 1985). Average wind speeds analyzed between 1992 and 1998 were 12.5 feet per second (f/s) in the winter, 17 f/s in the spring, 19.6 f/s in the summer, and 13.8 f/s in the fall, with peak winds occurring in the afternoon (URS 2002).

The wind-wave climate of the South Bay has not been extensively studied, although wind waves in the broad South Bay shoals are recognized as a mechanism for sediment re-suspension. The USGS collected wave data between the Dumbarton and San Mateo bridges in 1993 and 1994 during the winter, spring, and fall. The winter condition produced significant wave heights between 1.8 and 3.2 feet, with wave periods ranging from 2 to 5 seconds. The spring condition produced slightly lower waves ranging from 0.7 to 2.6 feet, with wave periods between 1 and 2.5 seconds. The fall wave condition was similar to that in spring. No measurements were taken during summer in the South Bay (south of Coyote Point on the western shore). Wind waves measured near the San Francisco International Airport (just north of the area considered the South Bay) during the summer of 2000 had wind-wave heights of 0.6 to 2.3 feet, with wave periods between 2 and 7 seconds (URS 2003). Due to the sheltering effect provided by the neighboring salt ponds and levees, seas within the study area are minimal and limited in wave height to 1.5 feet, with maximum periods of 2.2 seconds.

Three water pressure gauges were deployed in the South Bay from December 2006 through January 2007 (J. Smith 2009, in publication). The gauges were located along the longitudinal axis of the far South Bay from near Dumbarton Bridge at a depth of 19 feet, at mid-bay at a depth of 10 feet, and near Channel Marker 8 at a depth of 6 feet. Wave heights of 1.6 to 3 feet were recorded, with peak spectral periods of 2 to 6 seconds.

Winds recorded at the San Francisco International Airport exceeded 30 knots for 9 hours (directions of 270 to 300 degrees), and peak winds were 34 knots. The MFA in the South Bay recorded winds of up to 24 knots during this time.

Circulation

Currents in the South Bay are driven predominantly by tidal- and wind-driven flows and their interaction with the South Bay's bathymetry. These interactions create a series of four circular water movement patterns in the South Bay, located (1) north of the San Bruno shoal (i.e., the shallow region in the South Bay northwest of the San Mateo Bridge), (2) between the San Bruno shoal and San Mateo Bridge, (3) between the San Mateo Bridge and Dumbarton Bridge, and (4) south of Dumbarton Bridge (Cheng and Gartner 1985; Powell et al. 1986).

These currents affect the tidal excursion—the horizontal distance a water particle travels during a single flood or ebb tide—which differs between the channel and the shoals in the South Bay (Walters et al. 1985). In the channel, the tidal excursion varies between 6.2 and 12.4 miles, and in the subtidal shoals it ranges between 1.9 and 4.8 miles, with much smaller excursions occurring on the intertidal mudflats (Cheng et al. 1993; Fischer and Lawrence 1983; Walters et al. 1985). Tidal excursions exhibit strong spring-neap variability, especially in the channel where tidal excursions on the spring tides can be double those on neap tides.

Residual currents in the South Bay are primarily a product of meteorological events, wind-driven and density-driven circulation patterns. Winds alter water circulation when able to blow over a long, unobstructed distance, or "fetch" (Krone 1979). Typically, winds drive a surface flow, which then induces a return flow in deeper channels (Walters et al. 1985). In terms of circulation, the most significant winds are onshore breezes that create a horizontal clockwise circulation pattern during spring and summer. Density-driven currents occur when adjacent water bodies have differing densities, such as differences in temperature and/or salinity. Although density-driven currents are generally uncommon in the South Bay, in years of heavy rainfall, freshwater can flow from the Sacramento–San Joaquin Delta through the Central San Francisco Bay (Central Bay) and into the South Bay (Walters et al. 1985). In such events, freshwater flows southward along the surface, while the more saline South Bay water flows northward along the bottom.

4.4.1.2.1.5 Pond Operation

The ponds were originally constructed for solar evaporation of South Bay water to produce salt. South Bay water was brought into Pond A1 and then conveyed from pond to pond as it became more saline, eventually reaching ponds used for salt harvesting in Newark, California, north of the study area. The result was that nearly all of the ponds in the study area were saltier than South Bay water.

Per the *South Bay Salt Ponds Initial Stewardship Plan* (ISP) dated June 2003, within the *Alviso System A14*, inclusive of Ponds A9 through A15, Pond A9 acts as an intake for the circulation ponds (Ponds A9, A10, A11, and A14), while Pond A14 is the outlet. These four ponds are in salinity group 2 ponds with a maximum initial salinity of 100 parts per thousand (ppt). Ponds A12, A13, and A15 are managed separately as batch ponds and are in salinity group 3 ponds with a maximum initial salinity of 135 ppt (ISP 2003).

A 1999–2001 study of waterbird use of salt ponds in the bay found that, for all waterbird species and under a condition controlled for various effects, the highest number of birds is present in salt ponds having salinities around 140 ppt, and the highest species diversity is present in ponds having salinities around 126 ppt (Warnock et al. 2002). The USFWS currently manages the ponds seasonally to maintain optimal salinities for resources using the ponds throughout the year. Uncontrolled changes in salinity could affect reproduction and mortality of the waterbirds' food sources, which could in turn affect how and when waterbirds use the Alviso ponds.

Ponds A9, A10, A11, and A14 require limited active management. During the winter season, the Pond A9 intake is closed to prevent entrainment of migrating salmonids. The water levels in the ponds are set by a weir at the outfall or adjustment of the control gates to avoid flooding of the existing internal levees or wave damage to the levees. For winter operation, the gates from Ponds A9, A10, and A11 are open to allow rainfall to drain to Pond A14. This minimizes the need for water level management during the winter.

Ponds A12, A13 and A15 are operated as batch ponds to maintain summer salinity levels in the range of 120 to 150 ppt to provide habitat for brine shrimp and wildlife, which feed on the brine shrimp. Ponds A12, A13, and A15 are called a batch system because the ponds are operated in a series of batch operations to control the individual pond volumes and salinities. Lower salinity water is diverted from Ponds A11 and A14 into Ponds A12 and A13, and evaporation increases the salinity over time. Higher salinity water can be pumped up to Pond A15 as needed to maintain the pond volume.

4.4.1.2.1.6 Sediment Transport

Suspended solids concentration (SSC) in the South Bay exhibits highly dynamic short-term variability, primarily in response to sediment input from tributaries and sloughs and to tidally driven and wind-driven resuspension (Cloern et al. 1989; Powell et al. 1989; Schoellhamer 1996). Suspended solids concentrations are temporally variable on tidal and seasonal scales and exhibit strong diurnal and spring-neap variability, with the highest SSCs occurring on spring tides. On a seasonal time scale, SSCs are higher in the summer months when average wind speeds and wind-wave action are greatest. Greater wind-wave action increases re-suspension and reworking of the sediment deposited during the previous winter months. Wind is the most dynamic factor affecting temporal and spatial variability in SSCs (May et al. 2003). In general, increases in fetch and wind speed will result in larger wind waves, and, in the South Bay's broad shoals, these wind waves re-suspend sediments, creating more turbid conditions.

Lateral exchange is also an important mechanism for sediment transport (Jassby et al. 1996; Schoellhamer 1996). Lateral surface flows (between the channel and shoal) result from differing velocities in the channel relative to the shoals and the interaction of tidal flow with channel-shoal bathymetry. These lateral flows can transport a significant amount of sediment to the channel (Jassby et al. 1996), which can in turn lead to an export of sediment to the Central Bay.

Suspended solids are typically higher near the bed than at mid-depth and decrease with northward distance from the far South Bay (PWA et al. 2005). Measurements in the Guadalupe River near San José between 1979 and 1992 (PWA et al. 2005) and near U.S. Highway 101 in 2002 (Schoellhamer pers. comm. 2005) indicate that suspended solids are strongly correlated with discharge, with higher suspended solids found during times of higher discharge.

The sediment historically deposited within the Alviso pond complex is a mix of sand, silt, and clay. The USGS collected sediment data between April and June 2003 indicating that the sediments on the pond bottoms within the Alviso pond complex are composed of 38 percent sand, 36 percent silt, and 26 percent clay (USGS 2005a). Grain size distributions show a marked difference from those of area sloughs, where channels are composed of 13 percent sand, 54 percent silt, and 33 percent clay (USGS 2005a).

The rate of sedimentation in natural and restored marshes depends on sediment supply in the water column, settling velocities, and the period of marsh inundation. Rates of sedimentation decrease over time as mudflats and marsh plains accrete and the period of tidal inundation decreases. Sedimentation rates near the Alviso pond complex are generally higher at present than those near the Eden Landing and Ravenswood pond complexes because of higher suspended sediment concentrations (sediment availability) and higher average sedimentation rates; historically, this was due to subsidence. Subsidence of land relative to water levels in the South Bay moderates sedimentation deceleration by maintaining low land elevations (relative to tidal water levels). This subsequently results in higher average sedimentation rates over specific periods of time.

The sedimentation within the former salt ponds has not kept pace with past subsidence due to the reduced sediment supply to the ponds by the management operations. Consequently, the average elevation within the former salt ponds is several feet lower than the elevations of the adjacent wetlands just outside of the outboard levees.

The other primary sediment source to the far South Bay is sediment inflow from the Central Bay. Sediment can be exchanged with the Central Bay via any of four primary transport pathways:

- Advective transport associated with tidal residual currents
- Advective transport associated with wind-driven circulation
- Advective transport associated with baroclinic residual circulation
- Dispersive transport associated with tidal movement coupled with horizontal gradients in sediment concentration

Sediment exchange between the South and Central Bays is governed by the relative strength of each of these pathways together with the available suspended sediment supply associated with each of the bays. This complicated exchange is difficult to quantify. Reliable long-term measurements of these exchanges do not exist, and estimating the quantity of sediment passing under the Golden Gate Bridge (and hence bypassing this exchange pathway) is problematic.

4.4.1.2.1.7 Sediment Budget

A sediment budget is essentially an accounting of all sediment delivery, export, and storage. For the South Bay, this includes mostly waterborne sediments in tributary inflows, outflows to the Central Bay, dredging and deposition within open water areas, existing marshes, and restored ponds. The most recent published sediment budgets for San Francisco Bay cover the period of 1955 through 1990 (Krone 1979; Krone 1996; Ogden Beeman & Associates and Ray B. Krone & Associates 1992; Schoellhamer 2011). These budgets include estimates of fluvial sediment inputs from the Sacramento–San Joaquin Delta and local watersheds, bathymetric change, upland disposal of dredge material, and loss of sediment under the Golden Gate Bridge. Recent research by Foxgrover and others (2004) proposes significant revisions to earlier sediment budgets with important implications for the SBSP Restoration Project. For the most recent studies on the sediment transport and sediment budget of San Francisco Bay, see the Marine Geology Special Issue (Barnard et al. 2013).

Foxgrover and others (2004) suggest that the South Bay has undergone net erosion from 1956 through 1983, rather than deposition as presented in Krone (1996), although both studies agree that the far South Bay south of Dumbarton Bridge has remained a net depositional environment. The historical erosion and deposition patterns within the South Bay are currently a topic of scientific research and debate. Estimates of total fluvial sediment inputs to the South Bay (Krone 1996; McKee et al. 2002; Ogden Beeman & Associates and Ray B. Krone & Associates 1992) have decreased over time because of reservoir construction and watershed recovery from 19th-century land-use changes in the Central Valley (McKee et al. 2002; Wright and Schoellhamer 2004). A far greater volume of sediment is continually re-suspended into the water column and subsequently reworked and redistributed internally (Krone 1996).

Several researchers have provided estimates of sediment yield associated with local tributary inflows in the South Bay (north of Dumbarton Bridge) and the far South Bay (south of Dumbarton Bridge) (Porterfield 1980; PWA 2006). These analyses rely on observed USGS stream gauge data as well as sediment yield estimates associated with watershed parameters. As part of this study, Scott (2009) developed a new analysis of these local tributary inflows using the same data source, as well as one-dimensional Hydrologic Engineering Center 6 (HEC-6) numerical modeling results. The analysis indicates a significantly lower sediment yield to the South Bay than is predicted by the previous methods, especially with respect to tributary inflows to the far South Bay. This is likely because the previous analyses assume that a large fraction of sediment load in the river reaches the South Bay. Scott's analysis accounts for the fact that most coarse-grained sediments are not transported to the South Bay because of the sharp decrease in hydraulic gradient in the tributaries as they approach the South Bay. These coarse-grained sediments settle in the channel and riparian floodplain, and they either remain *in situ* (in place) or are dredged or mined. Therefore, Scott's analysis accounts for only the fraction of sediment that reaches the South Bay, which yields a smaller estimate of these tributary inflows. Local tributary sediment inflow estimates by Scott are provided in Table 4.4-3 *Local Tributary Sediment Inflow Estimates*.

Table 4.4-3. Local Tributary Sediment Inflow Estimates

Study	South Bay (K tons/yr)	Far South Bay (K tons/yr)	Total (K tons/yr)
Scott (2009)	80	29	109

Key: K tons/yr = thousand tons per year

Table 4.4-4 *Sediment Budget for South Bay and Far South Bay for 1956–1990* shows the results of a sediment budget developed for the recent history of the South Bay that used bathymetric change calculations given in Ogden Beeman & Associates and Ray B. Krone & Associates (1992) for 1956 to 1990. Bathymetric change calculations were needed to estimate sediment sources and sinks associated with morphologic change. The analysis includes results both with and without the impacts of subsidence on net sediment deposition in the far South Bay. Historically, significant subsidence (on the order of 3.2 to 6.6 feet) occurred during the period of record in the far South Bay, due primarily to low rainfall and groundwater withdrawal (Ogden Beeman & Associates and Ray B. Krone & Associates 1992).

Table 4.4-4. Sediment Budget for South Bay and Far South Bay for 1956–1990

Sediment Source/Sink Term	South Bay (K tons/yr)	Far South Bay (K tons/yr)	Total (K tons/yr)
Tributary sediment inflow	80	29	109
Net erosion/deposition of bed sediments (erosion is positive) (Note: estimate accounts for SLC of +4.3 inches per year)	174	–579 (–132)	–405 (42)
Sediment exchange from the Central Bay (flux from the Central Bay to the South Bay is positive)			297 (–67)

Source: Ogden Beeman & Associates and Ray B. Krone & Associates 1992
Note: Analyses are performed with an assumed wet bulk density of bed sediment equal to 1,300 kg/m^3.
Key: K tons/yr = thousand tons per year; values in () assume no subsidence in the far South Bay

The far South Bay (south of Dumbarton Bridge) currently receives surplus sediment, which is either stored as net deposition or exported from the far South Bay via ebb currents in the main tidal channel. The crucial threshold for disruption of the recent historical morphologic trend toward net deposition in the far South Bay is the threshold sediment demand, where the system switches from a sediment-rich system to a sediment-starved system.

4.4.1.2.2 Flood Risk Management

Local water districts and municipalities currently provide a majority of the FRM services in the study area. The Federal government also contributes technically and financially to FRM projects with Federal jurisdiction and interest. This section describes the FRM infrastructure and current flood hazard management setting for the study area.

4.4.1.2.2.1 Flood Risk Management Infrastructure

Levees extend in a band along the South Bay shoreline from San Francisquito Creek in the west to approximately Auto Mall Parkway in Fremont to the east. Outboard levees (i.e., bayfront and slough/creek levees adjacent to tidal waters) were constructed in the early 1900s to enclose evaporation ponds on former tidal marshes and mudflats and to protect the former salt ponds from South Bay inundation. Inboard levees (i.e., pond dikes constructed inland along the old South Bay margin) are predominantly former salt pond dikes that were built to contain salt water in the ponds, and also provide limited incidental FRM to low-lying areas on their inland side. Additional levees separate some of the individual former salt ponds from each other and are typically smaller than the outboard levees. These areas are connected by various conduits.

The outboard levees typically consist of and are founded on clayey soils, locally known as bay mud, that have varying plasticity, compressibility, and strength characteristics. The levee materials were obtained from naturally occurring surface deposits found in the immediate vicinity of the levees. Outboard levees are in generally fair to poor condition (Geomatrix 2006). During levee construction, the soil was placed with little to no compactive effort and continues to settle and deform. Salt pond operators, and subsequently the USFWS, have spent considerable effort maintaining the outboard levees by dredging operations (and more recently imported fill) to raise low crest elevations and replace eroded soil. The levees have been augmented from time to time with bay mud fill to compensate for inboard land subsidence and for consolidation of levee-fill material and weak underlying bay mud deposits. In general, levees are low to moderate in height and have fairly flat slopes. Some dikes were constructed from imported soil, riprap, broken concrete, and other predominantly inorganic debris and therefore typically have steeper slopes than the levees constructed of bay mud.

Inboard levees generally appear to be constructed of excavated alluvium and have a more variable soil composition. Soil classifications of the inboard levee fill range from silty sand to fat clay. The 2006 Geomatrix report did not assess the condition of all inboard levees; however, the condition of inboard levees evaluated ranges from poor to good. The overall system performance is governed by the weak link in a levee series; therefore, caution should be used when interpreting reliability from more general levee conditions.

Generally, former salt pond dikes were not designed, constructed, or maintained following a well-defined standard. Levee construction methods, levee materials, and the subsurface condition are further detailed in reports by Tudor Engineering Company (1973), the USACE (1988a), and Moffatt & Nichol Engineers (2004). Levee maintenance prior to the transfer of the ponds to the USFWS was conducted by Cargill and was documented in the Cargill annual maintenance work plan and completed maintenance reports, which have been summarized in the SBSP Restoration Project Levee Assessment Report (Geomatrix 2006). Subsequent maintenance has been contracted by the USFWS to Cargill and others.

The former salt pond dikes provide some FRM (USACE 1988a) and would act to create temporary storage of floodwaters in the former salt ponds during a tidal flooding condition. If a levee were to fail during a storm event, the risk and degree of tidal inundation in adjacent developed areas would be reduced because of the ponds. Floodwaters would fill the pond sequentially, with wave action possibly causing erosion of remaining levees and reducing remaining FRM capabilities.

If tidal action is introduced to the former salt ponds, either through restoration or passively through deterioration of the levees, the effectiveness of the former salt pond complexes as FRM mechanisms would be substantially reduced. The FRM benefit of the former salt pond dikes is dependent on regular maintenance.

The levees would require substantial modifications to satisfy USACE levee safety program standards. The former salt pond dikes would not meet FEMA criteria and are not certified as FRM facilities, as defined in the FEMA's certification requirements (FEMA 1988). This is because (1) levee failure comprising overtopping, degradation, and breaching is likely to result in flooding of inland areas (analysis by the USACE in the original San Francisco Bay Shoreline Study [USACE 1988b; USACE1989]), and there are no evaluations to show that they are designed for the 1-percent ACE event, and (2) maintenance records indicate that frequent maintenance is required (Geomatrix 2006). However, the required maintenance program for certification, including a commitment by a public entity, does not exist.

4.4.1.2.2.2 Tidal Flood Hazards

Tidal flooding threats to the study area are the result of extreme tidal water levels interacting with Alviso Slough or the dike-pond system that surrounds the study area. These extreme water levels occur due to a combination of high astronomical tides and additional tidal elevation associated with meteorological events, in some cases augmented by localized wind stress along the local shoreline. Levees may also fail due to high water levels, leading to flooding of additional low-lying areas not normally accessible to tidal waters.

Historical subsidence in the study area due to past overdraft of groundwater has left some land areas such as the vicinity of Alviso, as well as most of the former salt ponds, below sea level. Extensive additional areas are below the annual high tide elevation. These low-lying areas are protected from tidal flooding under normal circumstances by former salt pond dikes. Creeks entering into sloughs in the study area are generally lined by engineered FRM levees, which protect against both tidal and fluvial flooding. Within the study area, there are currently no areas of natural high ground adjacent to tidal waters. Future increases in relative sea level are expected to increase the frequency with which unusually high tidal water levels can cause tidal flooding in the study area.

Diking of the former salt ponds isolated them from the supply of sediment in the South Bay. Consequently, subsidence has not been countered by sediment deposition in the ponds, resulting in relatively low pond-bottom elevations compared to the adjacent marsh areas just outside of the outboard levees where sediment supply has kept up with subsidence. These lower elevations within the former salt ponds do not offer significant attenuation of flood levels for a condition when the outboard levee protection fails. Flooding threats to the low-lying sub-basins behind the shoreline and former salt ponds and between each creek levee system are dependent on the properties of the pond dikes and the topography within the former salt ponds. The study area is particularly vulnerable because of especially low elevations in the flood basin (Guadalupe River/Alviso Slough) to Coyote Creek).

There is a weak but not insignificant correlation between tidal residual surge (additional water elevation above the astronomical tidal elevation due to the meteorological condition) and stream/river runoff, due to their common meteorological dependence. Although the creeks are leveed, significant combinations of tidal flood levels and stream/river discharges can result in flow over the stream/river levees directly into the tidal flood basins. This added water volume can aggravate the tidal flooding threat and vice versa.

The impact of the added stream flow on the tidal flooding impact is dependent on the timing of the delivery of the stream flow volume relative to the coastal flood and the relative impacts of the individual events alone as well as whether the tidal flooding is tail water controlled or not.

4.4.1.2.2.3 Fluvial Flood Hazards

The portion of the Alviso pond complex in the study area is located at the base of the Coyote Watershed and is adjacent to the Guadalupe Watershed. Fluvial flooding has been the primary source of historical flood damages around the developed baylands. Fluvial discharges result when rainfall runoff is carried to the South Bay via natural or constructed channels. In the

South Bay area, an extensive network of levees has been constructed along various reaches of these channels to protect adjacent developed areas from being flooded by fluvial discharges. Although levees separate the channels and natural floodplain and constrict flows to an unnaturally narrow corridor, leveed reaches are designed to convey large fluvial discharges during high bay tides. During large rainstorms, high runoff flows constricted by the channel levees result in higher water surface elevations and potential overtopping of levees, and, when coincident with high bay tides, extreme runoff exceeds the design capacity of the leveed channel. Overtopping can result in inundation of adjacent areas. Out-of-bank flooding has also occurred in areas adjacent to non-leveed channels when runoff may exceed channel capacities. In addition, flooding results from local drainage that collects behind bay-front levees when discharges to the South Bay (either by pumps or gravity flow) are inadequate.

Land subsidence in the Santa Clara Valley has been observed since the early 1900s and was linked to extensive groundwater withdrawals until the 1960s. The mouth of Alviso Slough has subsided almost 3 feet; subsidence within the Alviso area is much more. Land subsidence has contributed to a change in the bed slope of sloughs in the Alviso pond complex. As a result of land subsidence, flood hazards in the Alviso area are the highest of any area of the study area. Groundwater recharge efforts have significantly affected subsidence trends experienced in the early 1900s, reversing groundwater level declines and arresting subsidence in the 1970s. Elevations are still being monitored for any further subsidence. The salt pond dikes were constructed as part of the salt manufacturing process but were built up to offset subsidence and reduce potential for flooding from contiguous sloughs, creeks, and the bay tide.

Construction of levees decreased the volume of bay water entering sloughs and reduced tidal exchange through the channels. Sediment deposition occurred as the slow-moving currents deposited clay and silt from the outboard mudflats that were carried into the sloughs by tides. The SCVWD dredged Alviso Slough in 1963 to realign the channel and restore stormwater conveyance. Marsh accretion followed as vegetation began to grow on bench margins between the low-flow channel and the levees. Levees were sequentially raised to increase channel conveyance and offset marsh accumulation in the slough.

4.4.1.2.3 Summary of the Geotechnical Condition

The geotechnical condition is described in Appendix G *Geotechnical Investigation and Analysis, South San Francisco Bay Shoreline Study, F3 Milestone, without Project*. In general, the Alviso area of the project is mapped as bay mud (Qhbm), which is recently deposited fine-grained soil of marine origin. Bay mud soils are generally clayey, of varying plasticity but usually high, highly compressible, and weak. Bay mud was found to be less than 20 feet deep in the immediate study area and becomes deeper, up to about 35 to 40 feet thick, along the outer pond dikes adjacent to the bay and northwest of the study area. Below the bay mud and in areas landward of the bay mud limits, the subsurface soils are generally classified as alluvial floodplain deposits that range in grain size from coarse to fine and are generally medium dense to dense/stiff in consistency. The inner levees for the study area appear to be constructed from excavated alluvial deposits common to the region, while the outer levees are interpreted to be constructed of sidecast bay mud excavation spoils. From a geotechnical design and construction standpoint, the presence and thickness of the bay mud is one of the most important geotechnical aspects to the cost of the proposed alternatives. The USACE San Francisco District Geo-Sciences team member interpreted the thickness of the bay mud using Cone Penetration Technology and boring explorations along the inner and outer levees. The interpretation is shown on Figure 4.4-1 *Interpreted Bay Mud Thickness Contours (Feet of Bay Mud)*.

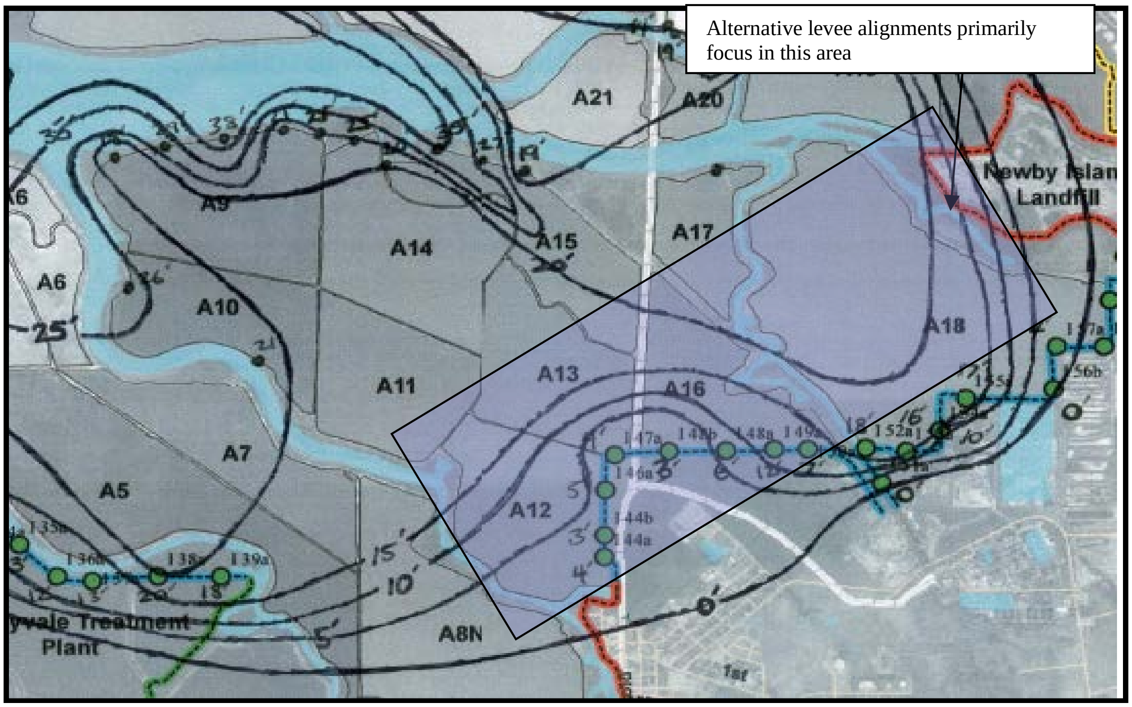

Figure 4.4-1. Interpreted Bay Mud Thickness Contours (Feet of Bay Mud)

4.4.1.3 National environmental Policy Act and Engineer Regulation 1105-2-100: Planning Guidance Notebook Baseline Condition

The NEPA and Planning Guidance Notebook baseline condition compares effects among alternatives against the effects of the future No Action condition under the NEPA and USACE Planning Guidance.

For hydrology and FRM, the NEPA and Planning Guidance Notebook baseline condition is determined by projecting how the resource condition might change between the current condition discussed in Section 4.4.1 *Affected Environment* and the start of construction. Hydrologic and flooding conditions do not change quickly and thus are not expected to be different for the NEPA and Planning Guidance Notebook baseline year from what is described in Section 4.4.1.2 *Physical Setting (CEQA Baseline)*. The biggest difference would be in the form of hydrologic change implemented as part of the SBSP Restoration Project, which is adjacent to the Shoreline Phase I Project. Data analysis completed in support of Section 4.4.2 *Environmental Consequences* assumed that hydrologic changes associated with SBSP Restoration Project activity planned for completion by 2017 are in place, although these assumed changes were minor. The NEPA and Planning Guidance Notebook baseline year of

2017 is expected the same as the existing condition (CEQA baseline) for the purposes of the analysis. Net deposition in Ponds A6, A8, A19, A20, and A21 is an existing condition and additional deposition associated with SLC will increase gradually, with essentially no differentiation over a period of three years.

Projections of sedimentation rates are important to predict the evolution of former salt ponds reopened to tidal circulation. Estimates of the sediment budget for the baseline condition[2] based on measured rates where available and/or computer simulations are provided in Table 4.4-5 *2017 Sediment Budget for the South Bay and the Far South Bay* (Brown 2010). The numerical modeling analysis shows that, for the limited increase in sediment demand due to the proposed pond-breaching projects associated with the baseline condition, the sediment needed to supply these ponds will likely be derived from outside the far South Bay system. This means that the equilibrium between the sediment supply and the hydrodynamic condition should be maintained throughout the period of analysis and should keep up with SLC for the USACE Low SLC scenario.

Table 4.4-5. 2017 Sediment Budget for the South Bay and the Far South Bay

Sediment Source/Sink Term	South Bay (K tons/yr)	Far South Bay (K tons/yr)	Total (K tons/yr)
Tributary sediment inflow	80	29	109
Net erosion/deposition of bed sediments (erosion is positive)	174 (0)	0	174 (0)
Net deposition associated with restored ponds: A6, A8, A19, A20, and A21	0	–69	–69
Additional deposition due to accelerated SLC (0.12 inch of sediment per year)	0	–58	–58
Sediment exchange from the Central Bay (flux from the Central Bay to the South Bay is positive)			–155 (19)

Key: K tons/yr = thousand tons per year

4.4.2 Environmental Consequences

This section describes environmental impacts and mitigation measures related to hydrology, FRM, and FRM infrastructure. It includes a discussion of the criteria used to determine the significance of impacts. Potential impacts were characterized by evaluating direct, indirect, short-term (temporary), and long-term effects.

4.4.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

Avoidance and minimization measures are those parameters that have been built into the design of the Proposed Project and are committed to as part of project implementation. These

[2] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

measures are generally included in the alternatives description of this report (Section 3.7 *Final Array of Alternatives*), but, where appropriate, the specific measures related to the impact evaluations are also summarized in the resource chapters.

The following design feature, which is associated with all of the action alternatives, would avoid or reduce adverse environmental impacts:

- **AMM-HYD-1: Flood Warnings** – Install public warning signs and sirens to improve public awareness and response to inundation emergencies (e.g., flooding and tsunamis). This action will enhance safety for people using and working in the area.

4.4.2.2 Methodology for Impact Analysis and Significance Thresholds

Hydrology and flood risk were assessed by comparing the expected condition in the future under each alternative against the NEPA and Planning Guidance Notebook baseline condition at the start of construction. The NEPA and Planning Guidance Notebook baseline year of 2018 is expected the same as the existing condition (CEQA baseline) for the purposes of the analysis. Net deposition in ponds A6, A8, A19, A20 and A21is an existing condition and additional deposition associated with SLC will increase gradually, with essentially no differentiation over a period of three years.

In preparation of this document, the authors used information from previous studies and from technical studies for this project to identify potential hydrology and FRM impacts, as follows:

- Previous studies: review technical studies conducted for the SBSP Restoration Project
- Technical studies completed in support of the Shoreline Study interim feasibility study

For the purposes of this Integrated Document, the Proposed Project would have a significant impact on hydrology or flooding if it would:

- **Impact HYD-1:** Alter existing drainage patterns in a manner that would result in scour that could cause substantial erosion or siltation, on- or off-site
- **Impact HYD-2:** Increase the risk of flooding that could cause injury, death, or substantial property loss
- **Impact HYD-3:** Conduct excavation activities, fill placement, construction dewatering, and structure building in a manner that could affect adjacent existing levees (geotechnical issues)
- **Impact HYD-4:** Place non-flood risk hazard reduction structures within the 1-percent ACE flood hazard area that would impede or redirect flood flows

For the purpose of this NEPA/CEQA impact assessment, the thresholds of significance are applied to changes from the baseline condition that result from factors within the control of the project proponents. For CEQA assessment, thresholds are applied to the impacts to determine whether they are significant or less than significant under the CEQA. Sea level change, though part of the changes discussed in the impact sections, is considered outside the control of the project proponents.

4.4.2.3 Alternatives Evaluation

This section includes a discussion of the impacts of the No Action and action alternatives.

4.4.2.3.1 No Action Alternative

This section includes a discussion of the No Action Alternative for baseline (CEQA and NEPA baselines are expected to be the same) and 2067 conditions. The topics discussed include hydrology, including sediment transport and hydrodynamics, and tidal flood hazards.

4.4.2.3.1.1 Hydrology and Sediment Budget

Existing hydrology data for the study area were obtained and analyzed from several sources: the SCVWD, the Alameda County Flood Control and Water Conservation District, and the USACE San Francisco District. No major land use changes that would affect the hydrologic condition within the study area are expected through the technical period of analysis (2017 to 2067)[3]. There is also limited capacity of the storm drain system within the area, thereby becoming the limiting factor for hydrologic effects on the area. Based on these considerations, the hydrology is assumed to remain unchanged throughout the period of analysis.

Estimates of the sediment budget for the year 2067 condition are provided in Table 4.4-6 *Future Without-Project (2067) Sediment Budget for the South Bay and the Far South Bay*.

Table 4.4-6. Future Without-Project (67) Sediment Budget for the South Bay and the Far South Bay

Sediment Source/Sink Term	South Bay (K tons/yr)	Far South Bay (K tons/yr)	Total (K tons/yr)
Tributary sediment inflow	80	29	109
Net erosion/deposition of bed sediments (erosion is positive)	174 (0)	0	174 (0)
Net deposition associated with restored ponds: A6, A8, and the Island Ponds	0	–23	–23
Sea level change (+0.23 inch per year)	0	–150	–150
Sediment exchange from the Central Bay (flux from the Central Bay to the South Bay is positive)			–110 (64)

Source: Brown 2010

Note: Values in parentheses are calculations assuming no subsidence in the far South Bay. This table was adopted from the Brown 2010 report, therefore the units are different.

Key: K tons/yr = thousand tons per year

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[3] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

To evaluate the effects of uncertainty in the future rate of SLC, the following rates of SLC are being considered for the Shoreline Phase I Study:

- USACE Low SLC scenario (total change of +0.51 foot from 2017 to 2067)
- USACE Intermediate SLC scenario (total change of +0.1.02 feet from 2017 to 2067)
- USACE High SLC scenario (total change of +2.59 feet from 2017 to 2067)

These three rates of SLC were used to estimate the sensitivity of flooding at 2067 to the uncertainty about the sea level at the Shoreline Phase I Study Area boundary.

Figure 4.4-2 *Estimated Bathymetry at 2067 Based on the Modeling and Analysis by Brown (2010)* is the resulting color contour plot of the expected 2067 bathymetry (Brown 2010). The overall planform elevation has increased by 0.65 meter over the 2017 planform elevation, to account for the total SLC over the project life. Pond A6 is filled completely, and Pond A8 is partially filled.

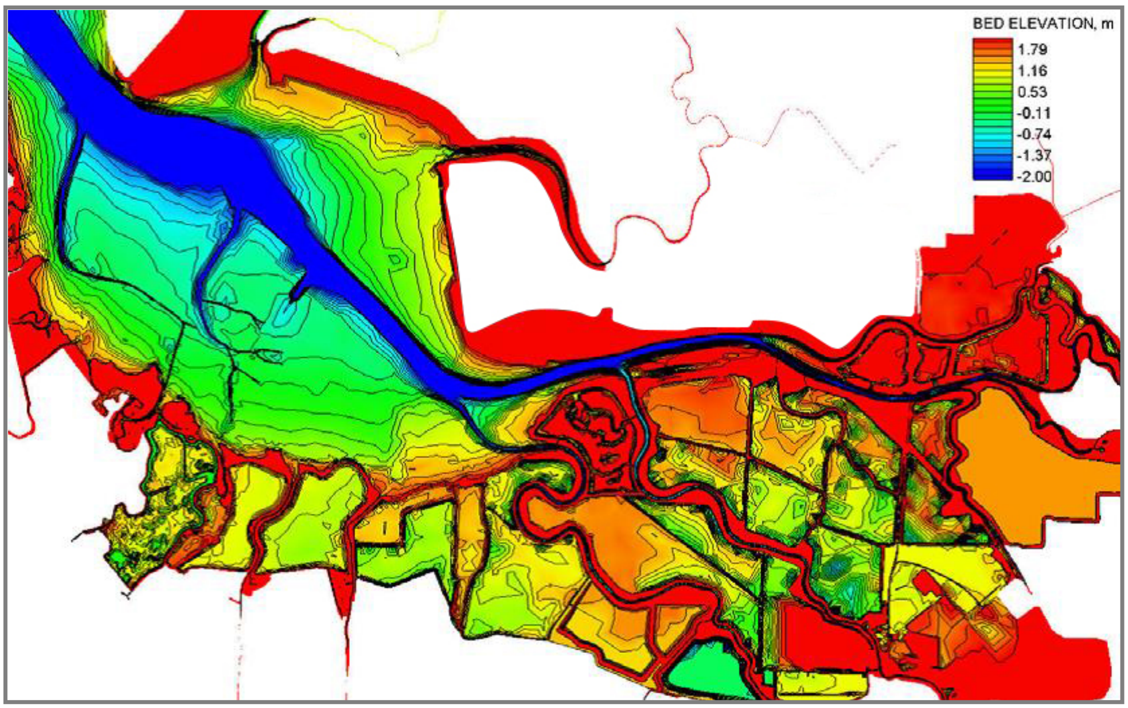

Figure 4.4-2. Estimated Bathymetry at 2067 Based on the Modeling and Analysis by Brown (2010)

Future levels of maintenance to be performed by the USFWS on levees surrounding the former salt ponds in the Alviso pond complex are a source of uncertainty for year 2067 condition analysis. The following assumptions with regard to levee maintenance were used in the engineering analysis of the period of analysis:

- The levees are assumed to be maintained in their existing condition, with repairs conducted when breaches occur.
- Levees are maintained for habitat purposes, not FRM.

- The analysis assumed that only a single breach would occur at six locations: Ponds A9, A14, A15, A17, and A18 and the NCM.
- The dimensions of a breach are conservatively assumed to reach equilibrium immediately. The equilibrium area of the breach is based on the empirical analysis of Hubel (2012; in Andes et al. 2012), which used local observations of breaches, literature data on levee breach dimensions, and the empirical equation of Nagy 2006).The flooding estimates were evaluated using the UnTRIM hydrodynamics model to produce look-ups tables for various index points within the study area. The look-up tables in combination with the Cumulative Distribution Functions of astronomical tide, residual tide, local wind speed and direction, and levee failure were then used as input into a Monte Carlo Simulation program to determine the flood inundation statistics versus return period. The analysis found that levee breaches and consequent tidal flooding are projected to occur much more frequently in the near future (2017) than they have in the past. Tidal flooding frequencies and extents mapped in this study have not been seen in the local historical record and do not occur at the present time. These results are due to large projected increases in the frequency of levee breaches affecting low-lying areas currently protected by these levees.

4.4.2.3.1.2 Tidal Flood Hazards

The future study area condition is impacted by SLC (rise), which in turn further reduces the performance and reliability of the existing west and east dike pond systems preventing tidal flooding in the study area under the No Action Alternative. Under the three SLC scenarios, the assumption is that the tidal ranges in San Francisco Bay remain unchanged, but shift to higher levels and inland. The water level statistics are projected forward under the three SLC rates. The ability of the existing dike-pond systems to prevent tidal flooding declines significantly and rapidly under the USACE High SLC scenario.

Sea Level Change Projections

Tidal flood risk projections developed for with- and without-project conditions are based on procedures prescribed by Engineer Regulation (ER) 1100-2-8162 *Incorporating Sea Level Change in Civil Works Programs* (USACE 2013). The geographically closest suitable National Oceanic and Atmospheric Administration (NOAA) tide gauge to the study area is the San Francisco, California, NOAA tide gauge, Station ID: 9414290 (Figure 4.4-3 *Vicinity Map Showing Location of Tide Gauges Used in the Shoreline Phase I Study*). The San Francisco tide gauge has a long record length (110 years) and has been referenced to NAVD 88. Sea level change projections for the project area in South San Francisco Bay will use the current relative sea level rise (RSLR) rate for the San Francisco tide gauge—2.06 millimeters/year (mm/yr)—based on 1983–2001 National Tidal Datum Epoch (NTDE). The NOAA tide gauge at Coyote Creek, California, Station ID: 9414575, is located within 5 miles of the project area and has been intermittently operated to collect observed data. The gauge does have an established tidal datum based on the current NTDE and has predicted tide data available.

The planning, design, and construction of a large water resources infrastructure project can take decades. Though initially justified over a 50-year economic period of analysis, USACE projects can remain in service much longer. The climate for which the project was designed can change over the full lifetime of a project to the extent that stability, maintenance, and operation may be impacted, possibly with serious consequences, but also potentially with beneficial consequences. Given these factors, the project planning horizon (not to be confused with the economic period of analysis) should be 100 years, consistent with ER 1110-2-8159 *Life Cycle Design and Performance* (USACE 1997).

Figure 4.4-3. Vicinity Map Showing Location of Tide Gauges Used in the Shoreline Phase I Study

Water level changes have been developed for the end of the Shoreline Phase I Study 50-year economic and 100-year planning analyses periods using the current RSLR for the San Francisco NOAA tide gauge (2.06 mm/yr; Table 4.4-7. *50-Year Relative Sea Level Rise Low, Intermediate, and High Estimates for the Shoreline Phase I Study Economic and Planning Analyses Periods*). Projections have been made to the year 2100.

Table 4.4-7. 50-Year Relative Sea Level Rise Low, Intermediate, and High Estimates for the Shoreline Phase I Study Economic and Planning Analyses Periods

South San Francisco Bay Scenario – Economic Analyses Period	2017–2067 Change (in feet)		
	Low	Intermediate	High
Coyote Creek Tide Gauge /Alviso	0.51	1.01	2.59
South San Francisco Bay Scenario – Planning Analyses Period	**2017–2100 Change (in feet)**		
	Low	**Intermediate**	**High**
Coyote Creek Tide Gauge /Alviso	0.73	1.77	5.05

The NOAA has operated a tide gauge at Coyote Creek, Station ID 9414575, intermittently since the 1980s. Water surface measurements archived between March and August 2011 were used to update the tidal datum. The mean lower low water (MLLW) datum plane for the Coyote Creek tide gauge was referenced to NAVD 88. The relationship between the San Francisco and Coyote Creek tide gauges is shown on Figure 4.4-4 *Datum Relationship between San Francisco and Coyote Creek Tide Gauges*.

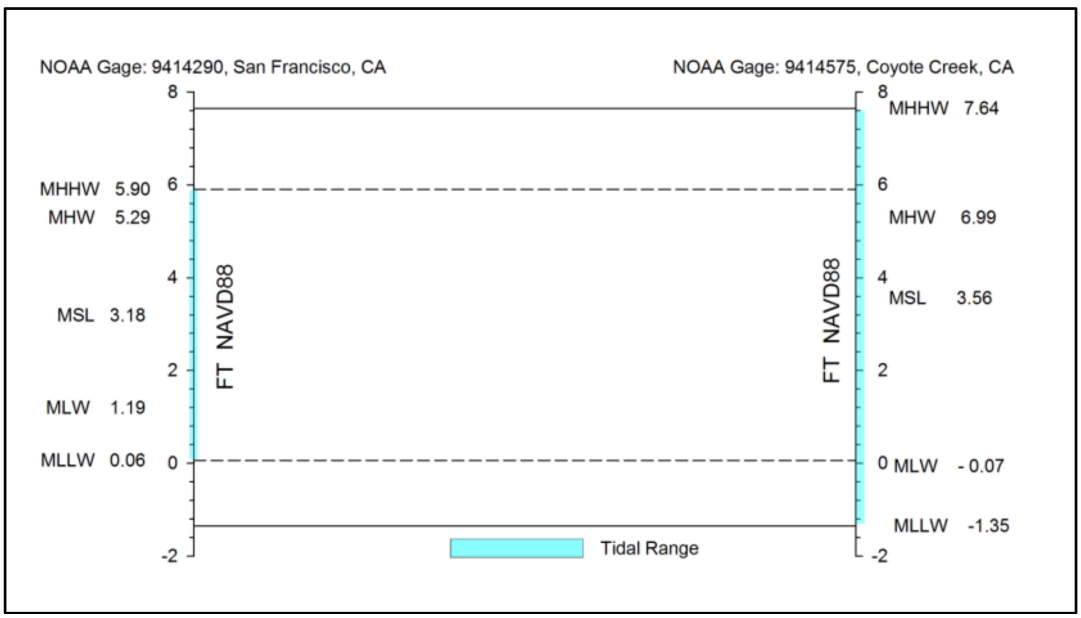

Figure 4.4-4. Datum Relationship between San Francisco and Coyote Creek Tide Gauges

MHHW=mean higher high water; MHW=mean high water; MSL=mean sea level; MLW=mean low water; MLLW=mean lower low water

The RSLR projections for the project area are based on the NOAA tide gauge rate because the Coyote Creek gauge lacks sufficient records needed to develop a rate. It should be noted that

NOAA now updates sea level change rates annually, and the rate used in this study (2.06 mm/yr) has been updated to 1.92 mm/yr as of 2014. Although the mean trend may change from year to year, there is no statistically significant difference between the calculated trends if their 95-percent confidence intervals overlap. Therefore, the most recent calculated trend is not necessarily more accurate than the previous trends; it is merely a little more precise. If several recent years have anomalously high or low water levels, the values may actually move slightly away from the true long-term linear trend (NOAA 2014).

The RSLR projections for local mean sea level to the year 2100 based on the current NTDE and referenced to NAVD 88 are shown on Figure 4.4-5 *Relative Sea Level Rise Projections, Local Mean Sea Level*. The solid lines represent the low, medium, and high RSLC projections; the dashed lines provide MLLW and MHHW water surface levels for comparison.

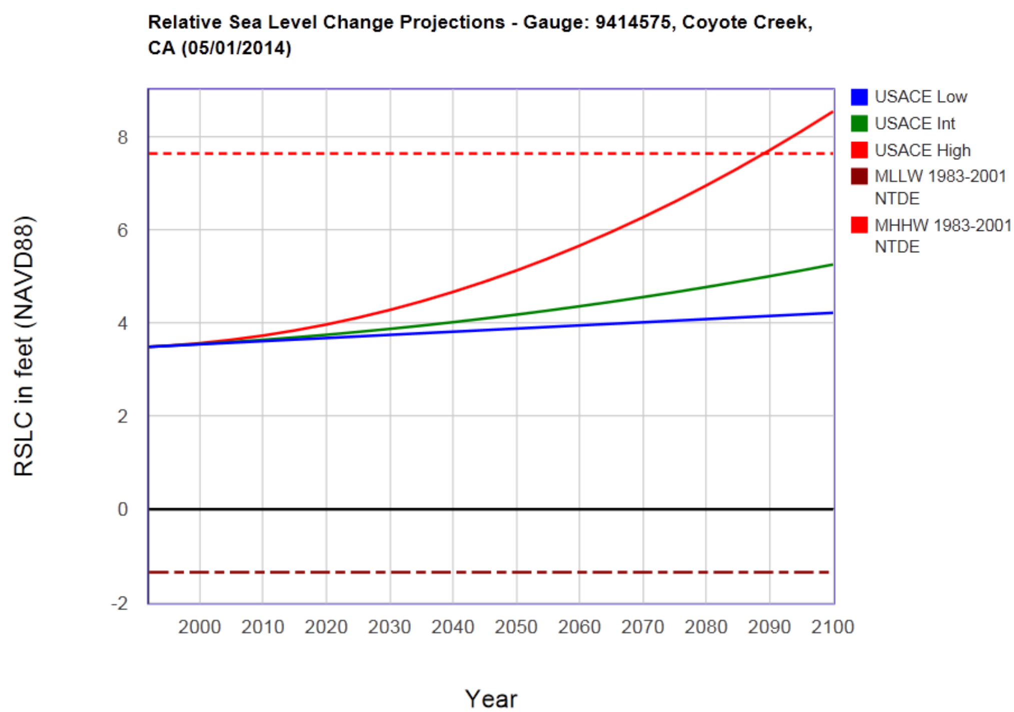

Figure 4.4-5. Relative Sea Level Rise Projections, Local Mean Sea Level
Source: www.corpsclimate.us; Sea Level Change Calculator

Maps depicting current and future changes from relative sea level change level impact on the project area were created using the NOAA sea level rise viewer (http://coast.noaa.gov/digitalcoast/tools/slr). Areas that are hydrologically connected are shown in shades of blue (darker blue = greater depth). Low-lying areas, displayed in green, are hydrologically "unconnected" areas that may flood. They are determined solely by how well the elevation data captures the area's hydraulics. A more-detailed analysis of these areas is required to determine the susceptibility to flooding (NOAA 2014a).

Figure 4.4-6 *Potential Inundation (without Salt Pond Berms) for Existing Conditions at Mean Higher High Water (High Tide) in the Study Area* shows the potential inundation of the study area if there were no salt pond berms under existing mean higher high water (MHHW; 7.64 feet NAVD 88) conditions. Impacts are shown in blue (water covered) and green (low lying areas) and cover a large portion of the study area.

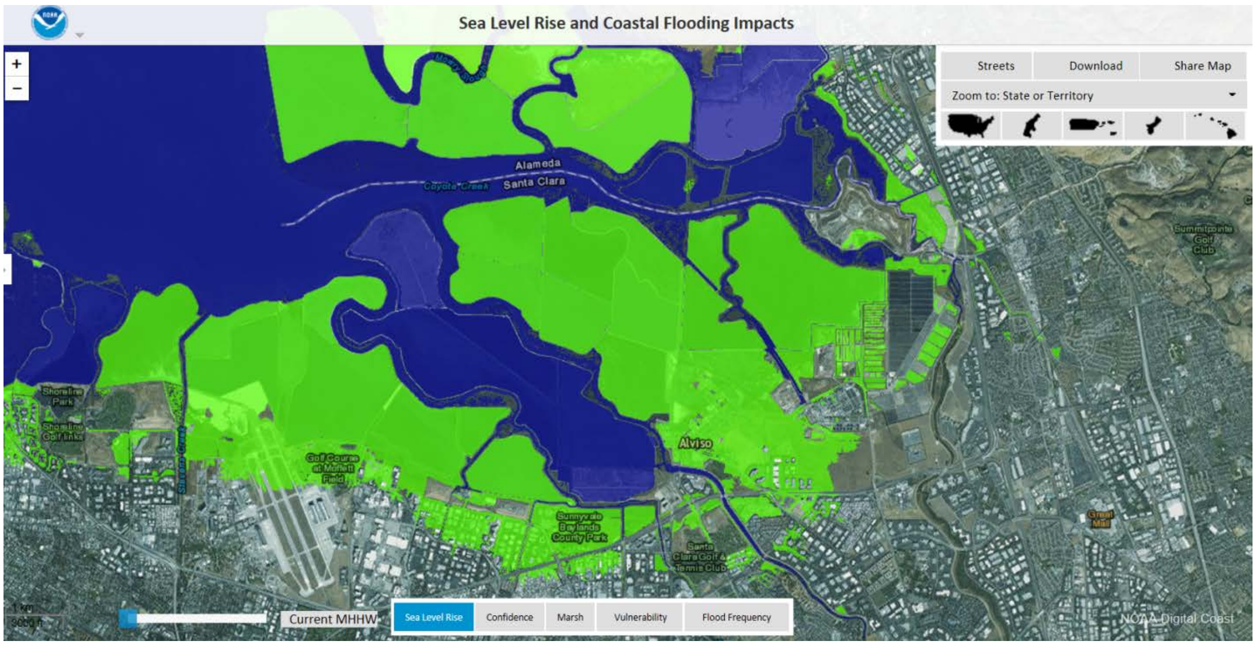

Figure 4.4-6. Potential Inundation (without Salt Pond Berms) for Existing Conditions at Mean Higher High Water (High Tide) in the Study Area

Figure 4.4-7 *Potential Inundation (without Salt Pond Berms) for a Future Condition Potential Inundation (without Salt Pond Berms) for a Future Condition (6 Feet above Existing Mean Higher High Water)* shows the potential inundation of the study area if there were no salt pond berms for a water surface elevation of existing conditions (MHHW) plus 6 feet sea level rise (SLR; equivalent to 13.64 feet NAVD 88 [7.64 feet + 6 feet = 13.64 feet]). Significant portions of the study area are inundated and shown as light and dark blue (previously shown as low lying areas (green) in Figure 4.4-5). This water level is roughly equivalent to the 0.2-percent ACE levels in 2067 under a high sea level change scenario and is higher than the existing system of outboard and inboard salt pond levees. The projected high rates at 1-percent and 0.2-percent ACE for tidal flood elevations at year 2067 are 13.18 feet NAVD 88 and 13.63 feet NAVD 88, respectively.

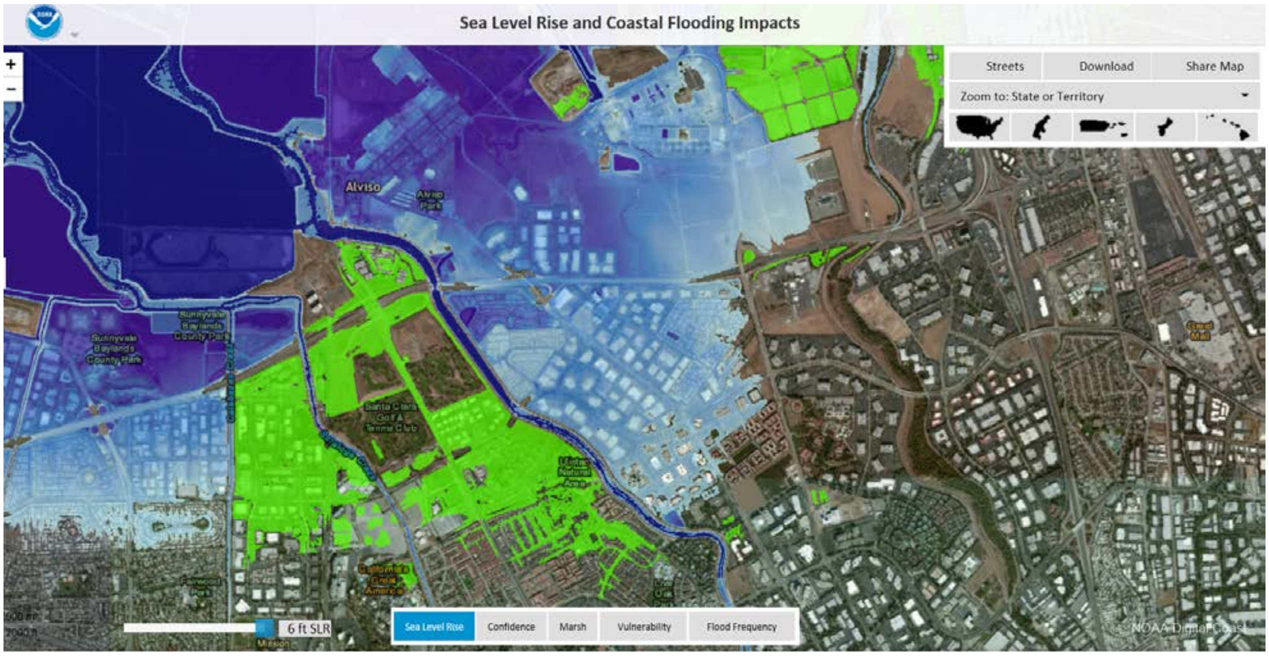

Figure 4.4-7. Potential Inundation (without Salt Pond Berms) for a Future Condition (6 Feet above Existing Mean Higher High Water)
Map created with NOAA sea level rise viewer (http://go.usa.gov/3X5sm)

Sea Level Change Impacts

The impact of SLC on the performance of the dike-pond system and the change in exterior-interior water surface elevation relationship is shown on Figure 4.4-8 *No Action Alternative Water Levels for Coyote Creek and Alviso for 2017 and 2067 under the High Sea Level Change Scenario*. The change in mean sea level, potentially several feet higher under the USACE High SLC scenario, effectively eliminates any flood risk reduction benefit that is provided by the current dike-pond system through storage. Water would only need to rise by 1 to 1.5 feet for the inboard dikes to be overtopped and fail. The transition to a completely open system now occurs at the 50-percent ACE, and the exterior-interior relationship is no longer in effect. Water surface elevations are developed in 10-year increments for the baseline year 2017 through 2067 using the web tool at https://corpsclimate.us/ccaceslcurves.cfm. The USACE Low SLC scenario rate is used for all 2017 scenarios since the baseline year of 2017 is so close to the current year.

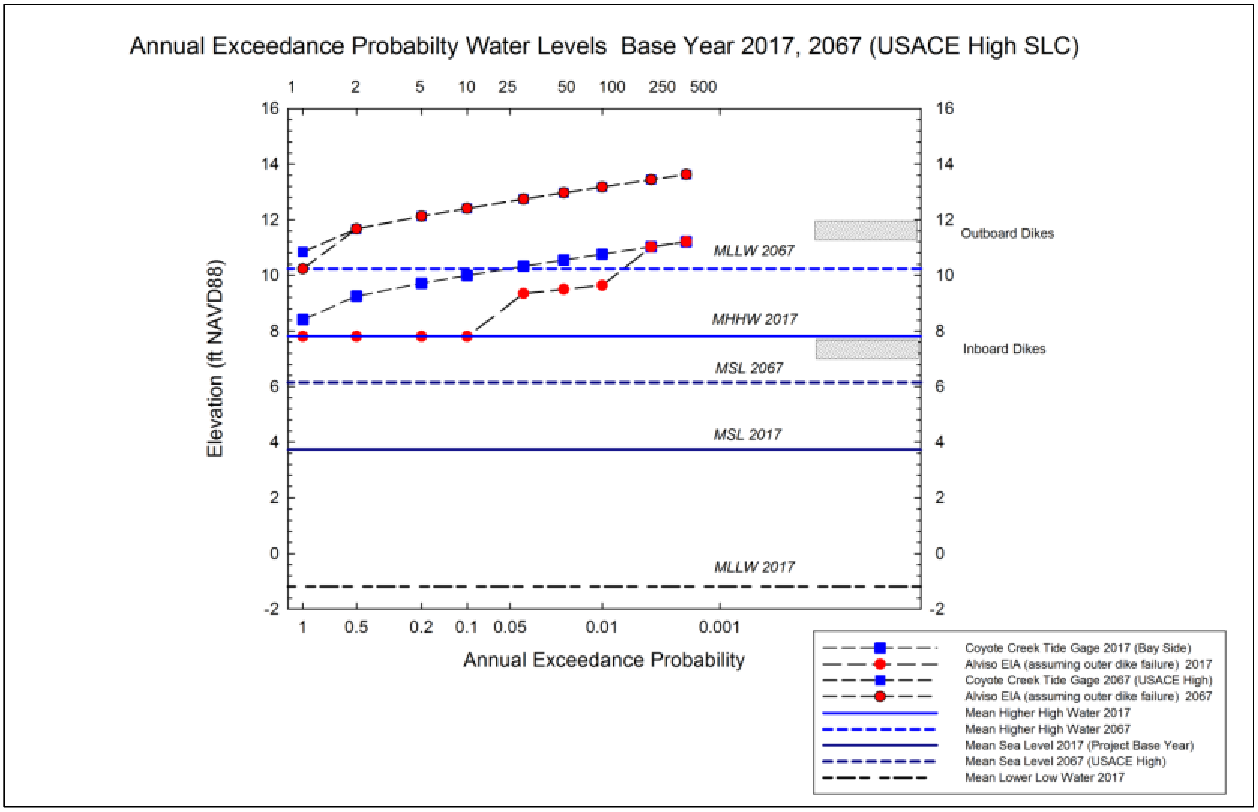

Figure 4.4-8. No Action Alternative Water Levels for Coyote Creek and Alviso for 2017 and 2067 under the High Sea Level Change Scenario

Exterior-interior relationships between the Coyote Creek tide gauge and Alviso based on breach analysis developed for the existing without-project condition (that is, the No Action Alternative) are estimated for the future SLC scenarios, accounting for changes affecting performance. Table 4.4-8 *USACE Low SLC Scenario – No Action Alternative ACE Water Levels, Ext – Coyote Creek Gauge, Int – Alviso*, Table 4.4-9 *USACE Intermediate SLC Scenario – No Action Alternative ACE Water Levels, Ext – Coyote Creek Gauge, Int – Alviso*, and Table 4.4-10 *USACE High SLC Scenario – No Action Alternative ACE Water Levels, Ext – Coyote Creek Gauge, Int – Alviso* show ACE water levels for the three SLC scenarios: USACE Low, Intermediate, and High in 10-year increments.

Table 4.4-8. USACE Low SLC Scenario – No Action Alternative ACE Water Levels, Ext – Coyote Creek Gauge, Int – Alviso

ACE (%)	2017		2027		2037		2047		2057		2067	
	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)
99.99	8.42	7.811	8.49	7.881	8.55	7.941	8.62	8.011	8.69	8.081	8.76	8.151
50	9.25	7.811	9.32	7.881	9.38	7.941	9.45	8.011	9.52	8.081	9.59	8.151
20	9.71	7.811	9.78	7.881	9.84	8.50	9.91	8.45	9.98	8.65	10.05	9.20
10	9.99	7.811	10.06	8.30	10.12	8.70	10.19	8.90	10.26	9.15	10.33	9.45
4	10.32	9.34	10.39	9.36	10.45	9.65	10.52	9.80	10.59	9.99	10.66	10.20
2	10.55	9.49	10.62	9.57	10.68	9.75	10.75	9.92	10.82	10.70	10.89	10.80
1	10.76	9.63	10.83	9.75	10.89	9.85	10.96	10.80	11.03	11.03	11.10	11.10
0.4	11.02	11.02	11.09	11.09	11.15	11.15	11.22	11.22	11.29	11.66	11.36	11.36
0.2	11.21	11.21	11.28	11.28	11.34	11.37	11.41	11.41	11.48	11.85	11.85	11.85

Key: Ext = Exterior; Int = Interior; ft = feet

Table 4.4-9. USACE Intermediate SLC Scenario – No Action Alternative ACE Water Levels, Ext – Coyote Creek Gauge, Int – Alviso

ACE (%)	2017		2027		2037		2047		2057		2067	
	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)
99.99	8.42	7.811	8.60	7.991	8.73	8.121	8.89	8.281	9.06	8.451	9.26	8.651
50	9.25	7.811	9.43	7.991	9.56	8.121	9.72	8.281	9.89	8.451	10.09	8.651
20	9.71	7.811	9.89	7.991	10.02	8.50	10.18	9.45	10.35	9.78	10.55	10.55
10	9.99	7.811	10.17	8.50	10.30	9.50	10.46	9.65	10.63	10.49	10.83	10.83
4	10.32	9.34	10.50	9.40	10.63	9.80	10.79	10.40	10.96	10.96	11.16	11.16
2	10.55	9.49	10.73	9.68	10.86	10.60	11.02	11.02	11.19	11.19	11.39	11.39
1	10.76	9.63	10.94	10.55	11.07	11.07	11.23	11.23	11.40	11.40	11.60	11.60
0.4	11.02	11.02	11.20	11.20	11.33	11.33	11.49	11.49	11.66	11.66	11.86	11.86
0.2	11.21	11.21	11.39	11.39	11.52	11.52	11.68	11.68	11.85	11.85	12.05	12.05

Key: Ext = Exterior; Int = Interior; ft = feet

Table 4.4-10. USACE High SLC Scenario – No Action Alternative ACE Water Levels, Ext – Coyote Creek Gauge, Int – Alviso

ACE (%)	2017		2027		2037		2047		2057		2067	
	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)	Ext (ft)	Int (ft)
99.99	8.42	7.811	8.94	8.331	9.30	8.691	9.74	9.131	10.26	9.651	10.84	10.231
50	9.25	7.811	9.77	8.331	10.13	8.691	10.57	9.85	11.09	11.09	11.67	11.67
20	9.71	7.811	10.23	8.75	10.59	9.70	11.03	11.03	11.55	11.55	12.13	12.13
10	9.99	7.811	10.51	9.50	10.87	10.10	11.31	11.31	11.83	11.83	12.41	12.41
4	10.32	9.34	10.84	9.80	11.20	11.20	11.64	11.64	12.16	12.16	12.74	12.74
2	10.55	9.49	11.07	11.07	11.43	11.43	11.87	11.87	12.39	12.39	12.97	12.97
1	10.76	9.63	11.28	11.28	11.64	11.64	12.08	12.08	12.60	12.60	13.18	13.18
0.4	11.02	11.02	11.54	11.54	11.90	11.90	12.34	12.34	12.86	12.86	13.44	13.44
0.2	11.21	11.21	11.73	11.73	12.09	12.90	12.53	12.53	13.05	13.05	13.63	13.63

Key: Ext = Exterior; Int = Interior; ft = feet

4.4.2.3.2 Action Alternatives

This section describes the effects on hydrology and FRM resulting from the action alternatives. All action alternatives would have similar impacts to hydrology and flood management and the alternatives are discussed together. The analysis of effects presented in this section considers the implementation of the project elements presented below. All action alternatives include a FRM levee. As described in Section 3.7 *Final Array of Alternatives*, although some of the action alternatives differ in the location of the FRM levee. The location of the levee does not alter the analysis as the levee will provide flood protection regardless of alignment and impacts are associated with construction, which are the same for each alignment. As described in Section 3.7 *Final Array of Alternatives*, all action alternatives would include restoration of tidal action in Ponds A9–A15 and Pond A18 through implementation of outboard pond dike breaching, internal berm breaches, and borrow ditch block construction; in-water construction such as the construction of a pedestrian bridge crossing over Artesian Slough; and the construction of a flood gate structure across Artesian Slough. The effects of these features are discussed for construction (2018) and for long-term operation and maintenance (after construction, up until 2071).

Impact HYD-1: Alter existing drainage patterns in a manner that would result in scour that could cause substantial erosion or siltation

Construction of project facilities included in the action alternatives would cause temporary disruptions to drainage paths and facilities. Activities that could interfere with drainage paths would include excavation, grading, or stockpiling at project facility sites or at temporary work sites. For excavation, existing drainage facilities may need to be removed or abandoned in place. Interference with drainage paths and removal of existing drainage facilities have the potential to block, reroute, or detain drainage relative to drainage that occurs under the existing condition. This would result in increases and decreases in flow velocities and depths (or water surface elevations). These changes in flow velocities and depths could result in changes in the potential for erosion, sediment transport, and sedimentation, but these impacts would be minor. The extents of activities that could affect drainage patterns and sediment transport during construction for all action alternatives are expected to be relatively small (see Section 4.5 *Surface Water and Sediment Quality* for more detailed analysis of surface water impacts). Also, most of the construction activities would be conducted in dry or dewatered areas before outboard and inboard levees would be breached. Potential erosion and sedimentation effects would be eliminated or minimized with the development and implementation of a SWPPP and a drainage plan for the project.

The construction of a pedestrian bridge crossing flood gate structure in Artesian Slough would require activities in the slough. For these activities, cofferdams may be required. The cofferdams would impede slough flows, resulting in hydraulic impacts. The SWPPP would include a bypass plan for construction in Artesian Slough that would minimize the hydraulic impacts in the slough.

Construction related impacts to erosion and siltation would be less than significant.

Effects on hydrology would result from breaching of outboard and inboard levees for restoring the ponds. Hydraulics and sediment transport would change in the pond areas and in the nearby creek channels. Potential effects related to salinity are discussed in Section 4.5 *Surface Water and Sediment Quality*.

Under the baseline condition, the pond areas and inner levees would be exposed to tidal action only on failure of an outboard levee, which would likely occur relatively infrequently. With the project, the pond areas and inner levees (including the FRM levee) would be exposed to tidal action on a daily basis. Compared to normal pond operation (under the baseline condition), tidal action includes different regime of flows. Tidal action includes alternately deeper flows and shallower flows, daily exchanges of colder and less-saline water, higher flow rates, changes in flow rates and directions, higher sediment loads, and tidal wave action. Opening up the ponds would also increase fetch length, which would increase wind set up and wave run-up. The effects of these changes are discussed later in this section but are also discussed below for FRM and other resources.

Sedimentation analysis (Delta Modeling Associates 2012) indicates that a net deposition, generally, is expected in the restored pond areas. By the end of the project period, about a foot of sediment deposition is expected in the ponds. This effect is discussed below for other resources.

Modeling results (Delta Modeling Associates 2012) indicate that substantial scour of up to 6 feet or more is expected in Coyote Creek between Calaveras Point and Pond A9 by 2067, primarily as the result of restoring Ponds A9 through A15 to tidal action and the corresponding increase in tidal prism. Some scour is also predicted between the mouth of Guadalupe Slough and the south west breach of Pond A6, primarily resulting from the restoration of Pond A6 to tidal action in December 2010. Between 1.3 and 5.3 feet of additional scour is predicted in

Coyote Creek between the mouth of Mud Slough and Pond A18. Some scour is also predicted in the channels of Mud Slough, Mowry Slough, and Newark Slough. This scour is likely the result of increased tidal prism of these sloughs due to SLC. The patterns and magnitude of scour predicted through this analysis are consistent with the scour observed following the breach of the Island Ponds. This predicted scour could affect the structural integrity of infrastructure in and around the channel where the scour occurs including the railroad bridge piers and the PG&E infrastructure in and near Coyote Creek. Also, some portions of the existing levees along Coyote Creek, Artesian Slough, and Alviso Slough are adjacent to the predicted channel scour. This effect would be significant.

Scour may also occur over time in the restored pond areas. Although the general trend is expected to include deposition, some pond areas may be prone to scour. PG&E infrastructure that is located in breached ponds would continue to be maintained consistent with agreements with the USFWS for Ponds A9 through A15. The structural integrity of PG&E towers in Pond A18, which is owned and managed by the City of San José, could be affected by increased scour around the marine foundation. Increases in water levels and tidal action due to levee breaching could affect PG&E towers if the concrete cover were not adequate to protect the base of the steel structure from saline bay water. Inundation or wind wave splash on steel portions of the tower would potentially accelerate corrosion and reduce the strength of the material. Protecting tower foundations against corrosion may necessitate increasing the amount of concrete armoring around steel elements. Where the structural integrity of towers would be adversely affected by breached ponds, the project partners would coordinate with PG&E to ensure that all necessary upgrades are completed prior to breaching Pond A18.

Existing sloughs and channels in the pond areas could scour as they are opened up to tidal action and increased velocities. New sloughs could also form. As these are natural processes that would occur entirely within restored ponds and would not affect existing or upgraded infrastructure, this impact would be less than significant.

In the long term, project changes could result in scour that threatens the railroad bridge and channel banks, which would be a significant impact. Mitigation would be required to address this impact (see Section 4.4.3 Mitigation Measures*). Other long-term impacts associated with scour or siltation would be less than significant.*

The effects of changes in hydrology are also discussed in relation to other resources, such as FRM (in the following section titled *Impact HYD-2: Increase the risk of flooding that could cause injury, death, or substantial property loss*), surface water and sediment quality (Section 4.5 *Surface Water and Sediment Quality*), and biological resources (Section 4.6 *Aquatic Biological Resources* and Section 4.7 *Terrestrial Biological Resources*).

Impact HYD-2: Increase the risk of flooding that could cause injury, death, or substantial property loss

Construction activities would not have substantial effects on flood-risk management, although some localized geotechnical effects may occur to the levees in the areas where the FRM levee connects to the existing levees. As discussed above, hydrology, including hydraulics and sediment transport, would not change substantially during construction. Furthermore, the FRM levee, which would have improved FRM over existing levees, would be constructed before any outboard levees would be breached.

Construction activities would include excavation activities, fill placement, construction dewatering, and structure building that could affect adjacent existing levees. Excavation activities in these weak bay mud soils could create an unstable condition and could induce seepage in an unfavorable direction. Fill placement (including permanent fill placement and temporary placement of excavation spoils) introduces additional loading on the ground surface and could increase the risk for slope instability and long-term settlement due to the weak and potentially compressible foundation and levee materials. Structure building could introduce excavations, foundation installation, temporary vibrations, and temporary materials storage that could induce settlement and slope instability. However, design measures would be developed for shoring for excavations, fill placement, dewatering, and structure building in accordance with current standards to minimize risk to adjacent existing levees. In addition, there could be long-term effects due to settlement, but design and construction of new and existing levees would include design measures to minimize these effects.

Construction-related impacts to flooding would be less than significant.

The main long-term effect of the project on FRM would be the increase in the level of FRM in Alviso from the tidal flood hazards. The FRM levee would be constructed using accepted engineering standards so that it would be expected to withstand larger, less-frequent storm events than could be withstood by the existing pond berms. Levee design would account for the changes in hydrology discussed above, including the exposure of the levee to tidal and wind wave action and the increased frequency of exposure to those elements. The risk of flooding from tidal hazards in Alviso would decrease with construction of the new levee. The with-project condition would have a levee of either 12.5 feet NAVD 88 or 15.2 feet NAVD 88 elevation in height. Even under the USACE High SLC rate, the residual tidal flood risk would be significantly reduced, below the 0.2-percent ACE (500-year return period) tidal flood. This effect is a benefit that is consistent with the objectives of the project.

Besides the small residual tidal flood risk, there is also a larger residual flood risk from riverine sources. Residual fluvial flood risk from Coyote Creek would be minor, since the flood waters break out above the study area and do not inundate the study area (see Appendix D1 *Coastal Engineering and Riverine Hydraulics Summary*, Annex 1 *Riverine Hydraulics*). The largest residual flood risk in the study area would come from the Guadalupe River. Plate 55 in Annex 1 *Riverine Hydraulics* of Appendix D1 *Coastal Engineering and Riverine Hydraulics Summary* shows the residual flood risk from the Guadalupe River. There is also the possibility of nuisance flooding from the existing storm drain network in the study area. The network was originally designed to contain a 33-percent ACE (3-year return period) flood and may be assumed to be currently under capacity (Schaaf & Wheeler 2010).

Also included as part of the project, public warning signs and sirens would improve public awareness and response to inundation emergencies (AMM-HYD-1: Flood Warnings).

The long-term effect related to flood risk is a benefit that is consistent with the objectives of the project.

Impact HYD-3: Conduct excavation activities, fill placement, construction dewatering, and structure building in a manner that could affect adjacent existing levees (geotechnical issues)

Sediment Transport

As discussed above, modeling results (Delta Modeling Associates 2012) indicate that substantial scour is expected in Coyote Creek between Calaveras Point and Pond A9 by 2067, primarily as the result of restoring Ponds A9 through A15 to tidal action. Some scour is also predicted between the mouth of Guadalupe Slough and the southwest breach of Pond A6, primarily resulting from the restoration of Pond A6 to tidal action in December 2010. Scour is predicted in Coyote Creek between the mouth of Mud Slough and Pond A18.

Some scour is also predicted in the channels of Mud Slough, Mowry Slough, and Newark Slough. This scour is likely the result of increased tidal prism of these sloughs due to SLC and not due to the project. Thus, mitigation is not proposed for this effect. Figure 4.4-9 *Predicted Bathymetric Change for year 2067 from Delta Modeling Associates (2012)* depicts the predicted bathymetric change for year 2067.

Project-related impacts to sediment transport would be less than significant.

Geotechnical Considerations

Activities to construct adjacent levees would include fill placement. Fill placement introduces additional loading on the ground surface and could increase the risk for slope instability and settlement due to the weak and potentially compressible foundation and levee materials. Although the slope instability could be an acute effect, the settlement would continue to occur over a long period of time (potentially 40 to 50 years) after the project is constructed. Standard design measures (e.g., wick drains) would be utilized for fill placement and construction dewatering in accordance with current standards to minimize effects. In addition, there could be long-term effects due to settlement, but the design and construction of new and existing levees would include design measures to minimize effects.

The effects of adjacent levee construction on geotechnical-related issues would be less than significant.

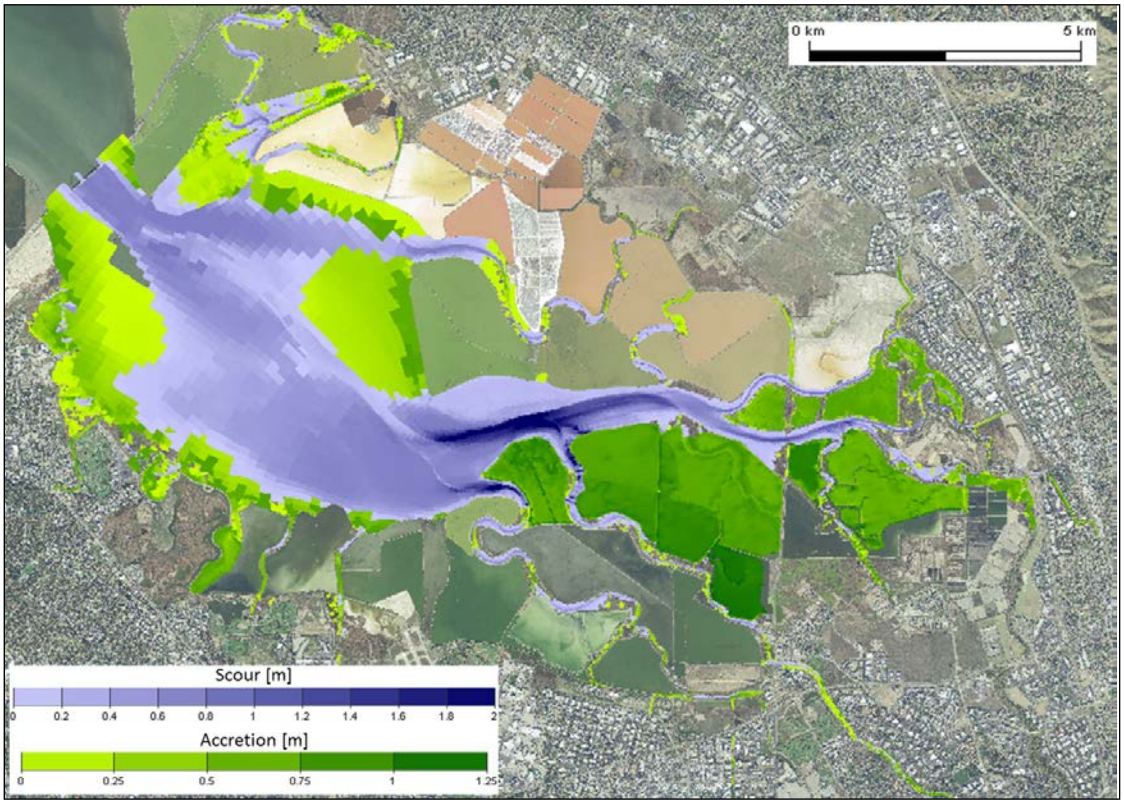

Figure 4.4-9. Predicted Bathymetric Change for Year 2067 from Delta Modeling Associates (2012)

Impact HYD-4: Place non-flood risk hazard reduction structures within the 1-percent ACE flood hazard area that would impede or redirect flood flows

The project involves the construction of flood reduction facilities and the restoration of salt ponds. The Project will not place non-flood risk hazard reduction structures in the 1-percent ACE flood hazard area and will not redirect flood flows to developed areas.

There is no impact related to placing structures in the flood zone or redirecting flood flows.

4.4.2.3.2.2 Comparison of Action Alternatives

Impacts on hydrology and FRM would be similar for all action alternatives. None of the project alternatives would alter drainage patterns in a manner that would result in substantial erosion or siltation; increase the risk of flooding that could cause injury, death, or substantial property loss; create safety hazards for people boating in the area; increase or contribute runoff that would exceed existing stormwater drainage capacity in the area; or place structures that would impede or redirect flood flows in the 1-percent ACE flood hazard. The levee height is the main difference among the alternatives, which ranges from 12.5 feet NAVD 88 (Alternative 2) to 15.2 feet NAVD 88 (Alternatives 3, 4, and 5). Based on provision of flood and tsunami warning signs and sirens, and improved FRM, the need for emergency response may be reduced for all action alternatives compared to the baseline condition. The need for emergency response resources may be slightly increased for Alternative 2, which provides a lower level of FRM due to the shorter levee, compared to alternatives that construct a 15.2-foot NAVD 88 levee. The time available for evacuation and emergency response after a potential failure of the FRM levee would be slightly less for the alternatives with alignments closer to development.

4.4.2.3.3 Impact of Relative Sea Level Change on Action Alternatives

USACE ETL 100-2-1, Procedures to Evaluate Sea Level Change: Impacts, Responses, and Adaptation, prescribes a project planning horizon of 100 years. Performance for Alternatives 2 and 3 against the 1-percent bayside ACE water level may be assessed across the range of relative sea level change (RSLC) scenarios through the year 2100. Figure 4.4-10 *Low Relative Sea Level Change Scenario 1-percent ACE Projection to 2100 Compared to Alternatives 2 and 3 Designs* and Figure 4.4-11 *High Relative Sea Level Change Scenario 1-percent ACE Water Level Projection to 2100 Compared to Alternatives 2 and 3 Designs* show the “tipping points” or times where the 1-percent ACE water level reaches the design elevations for Alternatives 2 and 3 for future Low and High RSLC 1-percent water level projections, respectively.

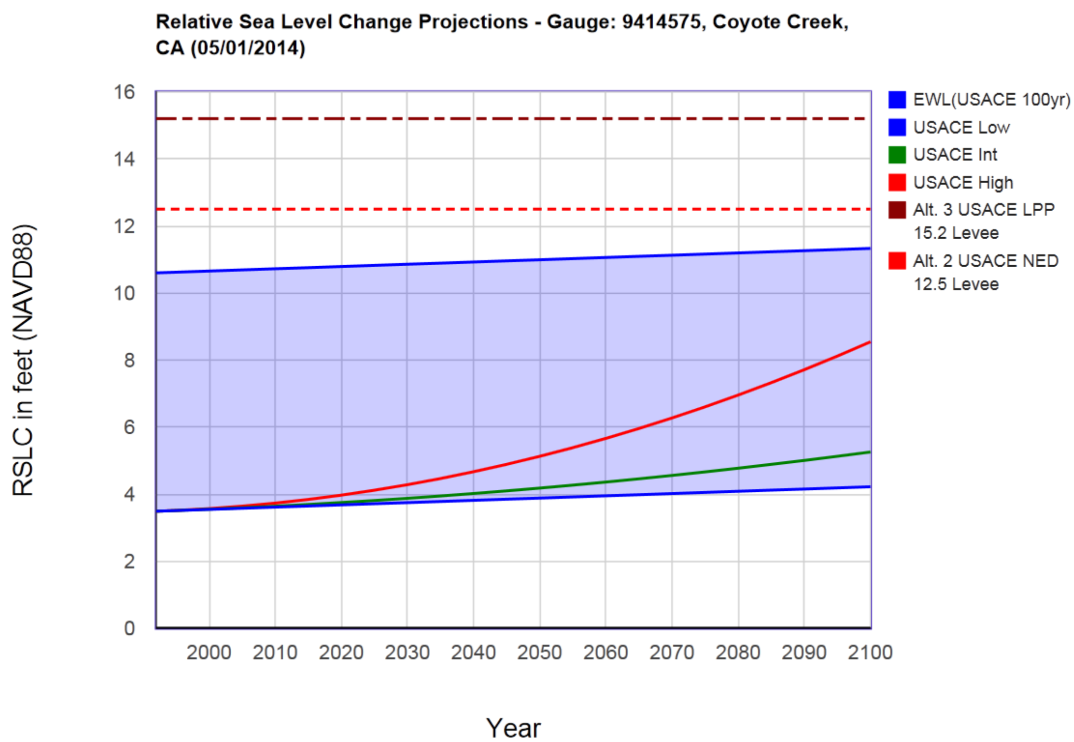

Figure 4.4-10. Low Relative Sea Level Change Scenario 1-percent ACE Projection to 2100 Compared to Alternatives 2 and 3 Designs

Figure 4.4-10 *Low Relative Sea Level Change Scenario 1-percent ACE Projection to 2100 Compared to Alternatives 2 and 3 Designs* shows that both alternatives would provide a level of risk reduction for the 1-percent bayside water level through the year 2100 under the low or observed RSLC scenario. The current FEMA certification requirement of 2 feet of freeboard would also be maintained for Alternative 3, with the year 2100 1-percent projected bayside water level at 11.3 feet NAVD 88; Alternative 3 remains above the required 1-percent + 2 foot of freeboard condition (11.3 feet NAVD 88 + 2 feet = 13.3 feet NAVD 88). The Alternative 2 levee design at 12.5 feet NAVD 88 is robust to the 1-percent water level projection through 2100 but does not meet the FEMA certification requirement starting in the base year.

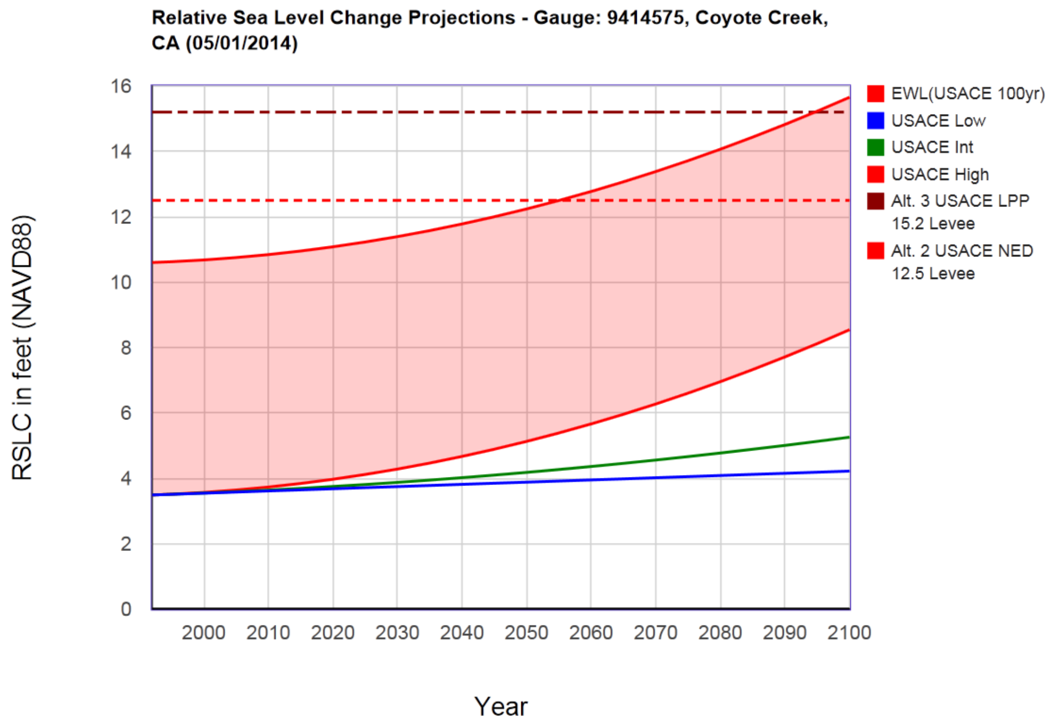

Figure 4.4-11. High Relative Sea Level Change Scenario 1-percent ACE Water Level Projection to 2100 Compared to Alternatives 2 and 3 Designs

Figure 4.4-11 *High Relative Sea Level Change Scenario 1-percent ACE Water Level Projection to 2100 Compared to Alternatives 2 and 3 Designs* shows that, under the high RSLC, both alternatives provide risk reduction against the 1-percent bayside ACE water level through 2055 and 2094, where the projected 1-percent water level reaches the design elevations for Alternatives 2 and 3, respectively. The 2-foot FEMA certification requirement is maintained until 2067 for Alternative 3. Alternative 2 does not meet the FEMA certification requirement in the base year. Both Alternatives have adaptive capacity to elevation 16.0 feet NAVD 88, which has been established as an adaptation threshold for the project. Considering this threshold, the 2-foot FEMA freeboard requirement could not be maintained past 2079 without a significant expansion of the project base to include actions to address fluvial and stormwater interior drainage in the project area. Based on consideration of actionable climate science, the earliest date that would trigger a comprehensive revision of flood risk in the area would be year 2067 if a significant acceleration of SLC occurred, resulting in the high SLC scenario under Alternative 3.

4.4.3 Mitigation Measures

Mitigation measures are measures that would be required to be implemented to avoid or minimize adverse effects of the Proposed Project. Mitigation measures are requirements that have not been specifically included as part of the overall project (or alternative) description.

The project could cause significant impacts related to geotechnical hazard and scour. The following mitigation measures would reduce these adverse effects to a less-than-significant level. These measures would be implemented only upon discovery of impacts to/from the project, and armoring measures would be implemented only when all other reasonable alternatives have been deemed impractical. These measures, which may be adopted as part of any alternative, include the following:

- **M-HYD-1a:** For any unforeseen excessive scour on the side slopes and crown of the levee, levee maintenance will be adjusted or levee improvements will be implemented (e.g., raise or widen the shoulder or armor the levee).
- **M-HYD-1b:** For unforeseen excessive scour at the levee toe, natural and geotextile fabric, and/or rock armoring, will be placed to prevent further erosion.
- **M-HYD-1c:** A plan for protecting the Union Pacific Railroad bridge crossing Coyote Creek will be developed prior to the start of construction and implemented if necessary based on monitoring. Possible measures to protect the bridge include:
  - Modify the bridge structure, such as by constructing new pilings and underpinnings, to accommodate the scour.
  - Place rock armoring across the channel for some distance upstream and/or downstream of the bridge to limit scour at the bridge supports and approaches.
  - Place rock armor along the bed and banks of the channel at the bridge and along the bed and railway embankment on both sides of the bridge to limit scour.

The project proponents will implement mitigation measures M-HYD-1a, 1b and 1c, which require monitoring of the Railroad bridge, channels and levees subject to scour. If scour is present, action will be taken to avoid or minimize any damage. Actions may include placement of geotextile fabric, rock armoring, or new pilings. With implementation of these measures, impacts from scour will be less than significant.

4.4.3.1 Residual Impacts and Additional Measures Necessary to Mitigate Significant Impacts

Because the project design and incorporation of mitigation measures would avoid impacts, there are no residual impacts that require mitigation.

4.4.4 Cumulative Effects

The cumulative study area is the Shoreline Phase I Study Area, which is influenced by the hydrology of the Coyote Creek and Guadalupe River watersheds, and the South Bay, which is that part of the bay south of Dumbarton Bridge. This area was chosen because of focused ecosystem restoration associated with the SBSP Restoration Project and the Shoreline Phase I Project and the importance of the Coyote Creek and Guadalupe River watersheds to the hydrology of the bay. While the hydrologic condition of the entire San Francisco Bay is important when considering hydrology and flooding in the Bay Area, this analysis considers only the South Bay because its hydrology is much different from the north part of the bay, which has a much higher freshwater input and a hydrologic regime that is closely tied to the Sacramento–San Joaquin Delta. Past projects have resulted in a substantial amount of development that has substantial altered drainage patterns and put structures and people at risk from flooding, which has resulted in existing cumulative impacts.

Within this analysis area, ongoing and future actions that have could affect hydrology and flooding include ongoing implementation of the SBSP Restoration Project, ongoing implementation of Wastewater Facility Plant Master Plan (City of San José 2013a, 2013b, 2013c), and commercial, light industrial, and residential development in the lower parts of the Coyote Creek and Guadalupe River watersheds. Current and future activities include habitat restoration and upgrades to and maintenance of FRM levees along various tributaries to the South Bay, including the Guadalupe River and Coyote Creek.

Tidal wetland restoration projects such as the Shoreline Phase I Project and the SBSP Restoration Project are expected to influence regional changes in South Bay bathymetry and hydrodynamics, whereas other projects (non-tidal wetland restoration) are not expected to influence bay bathymetry and hydrodynamics.

Many thousands of acres of tidal wetlands have been restored or are planned to be restored in the South Bay. Opening up additional restoration areas to tidal action as part of the Shoreline Phase I Project could exacerbate predicted scour in existing creeks and sloughs, which could potentially increase tidal flood risks. This is particularly true when the potential scour effects of the SBSP Restoration Project and Shoreline Phase I Project are combined.

Flood risk management measures implemented with the Shoreline Phase I Project would improve levels of tidal FRM over the long term; however, significant uncertainties exist with respect to the type and geographic extent of potential Shoreline Phase I Study actions and the eventual phasing of the Shoreline Phase I Project implementation. Throughout the 50-year planning horizon, temporary (and perhaps permanent) increases in tidal flood risks associated with changes in bay bathymetry and hydrodynamics are likely to exist. These types of changes would occur with or without the Shoreline Phase I Project, and the extent to which the Shoreline Phase I Project might influence the potential change is unknown. The combined effects of the Shoreline Phase I Project, SBSP Restoration Project, and other restoration projects could affect tidal flood risks resulting from changes in bathymetry and hydrodynamics.

Mitigation required as part of the Shoreline Phase I Project will require future monitoring and corrective action if necessary, which will avoid significant impacts from scour. With mitigation, the project does not substantially contribute to a cumulative impact.

Sea level change is likely to increase the frequency and severity of tidal floods, increases shoreline erosion, and increases the inundation frequency of tidal wetlands, intertidal mudflats, and low-lying land. As discussed in Impact 3.3-2 in Section 3.3 of the SBSP Restoration Project Final EIS/EIR (EDAW et al. 2007), SLC would cause additional regional changes in bay bathymetry and hydrodynamics and would result in an increased tidal flood risk. Consequently, SLC could result in substantial impacts associated with increased tidal flood risks. Sea level change would occur with or without the Shoreline Phase I Project, the SBSP Restoration Project, and other restoration projects, and these projects would not affect the rate of SLC. The Shoreline Phase I Project would, however, provide valuable near-term FRM that could also lessen the long-term effects of SLC.

Construction-related effects would be short term and less than significant. Construction of other projects in the local area, including phased demolition, construction, and reconstruction of facilities at the Wastewater Facility, ongoing development in the lower parts of the Coyote Creek and Guadalupe River watersheds, and implementation of the SBSP Restoration Project, could cause temporary, short-term hydrologic effects. Some construction could be simultaneous, but in all cases the projects would need to ensure compliance with local, State, and Federal laws that regulate development in flood-prone areas and that regulate how to manage stormwater during and after construction. Because these types of effects would be avoided for all construction projects, the construction-related effects of the Shoreline Phase I Project are not expected to contribute to short-term cumulatively considerable adverse hydrology and FRM conditions.

In summary, the effects of the Shoreline Phase I Project could combine with the effects of other actions to cause cumulative effects related to predicted scour in existing creeks and sloughs, which could potentially increase tidal flood risks. The extent of the Shoreline Phase I Project's contributions to cumulative, adverse changes in bathymetry and hydrodynamics is unknown. Sea level change is expected to affect bathymetry and hydrodynamics, and the effects of numerous restoration projects, including the Shoreline Phase I Project, could contribute to long-term change, but mitigation is incorporated to monitor for adverse affects and provide corrective action as needed.

4.4.5 Summary

Table 4.4-11 *Hydrology and Flood Risk Management NEPA Impact Conclusions* summarizes the project effects under the NEPA.

Table 4.4-11. Hydrology and Flood Risk Management NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
HYD-1: Alter existing drainage patterns in a manner that would result in scour that could cause substantial erosion or siltation	Negative	Moderate	Medium term	Possible	Local
HYD-2: Increase the risk of flooding that could cause injury, death, or substantial property loss	Positive	Major	Long term	Probable	Local
HYD-3: Conduct excavation activities, fill placement, construction dewatering, and structure building in a manner that could affect adjacent existing levees (geotechnical issues)	Negative	Minor	Medium term	Possible	Local
HYD-4: Place non-flood risk hazard reduction structures within the 1-percent ACE flood hazard area that would impede or redirect flood flows	Neutral	None	None	None	Local

Table 4.4-12 *Hydrology and Flood Risk Management CEQA Impact Conclusions* summarizes the project effects under the CEQA.

Table 4.4-12. Hydrology and Flood Risk Management CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
HYD-1: Alter existing drainage patterns in a manner that would result in scour that could cause substantial erosion or siltation		S	M-HYD-01a: levee maintenance will be adjusted or levee improvements implemented If excessive scour occurs of the levee crown or sides. M-HYD-01b: Fabric and/or rock armoring will be installed for excessive scour at the levee toe. M-HYD-01c: Develop and implement plan to protect UPRR bridge crossing of Coyote Creek	LTS
HYD-2: Increase the risk of flooding that could cause injury, death, or substantial property loss	AMM-HYD-1: Flood Warnings	B	None	B
HYD-3: Conduct excavation activities, fill placement, construction dewatering, and structure building in a manner that could affect adjacent existing levees (geotechnical issues)		LTS	None	LTS
HYD-4: Place non-flood risk hazard reduction structures within the 1-percent ACE flood hazard area that would impede or redirect flood flows		NI	None	NI

NI = No Impact

LTS = less than significant

S = significant

B = beneficial

NA = not applicable

Construction of the project would alter drainage patterns, but the changes would not result in scour that could cause substantial erosion or siltation. Excavation activities would not occur in a manner that could affect adjacent existing levees.

In the long term, the project could cause channel scour along parts of Coyote Creek, Artesian Slough, and Alviso Slough and near the railroad bridge, which would be a significant impact. Implementation of mitigation measures M-HYD-1a, 1b, and 1c, would reduce these impacts by monitoring for scour and taking appropriate action as necessary.

The project would have a beneficial effect for FRM.

4.5 Surface Water and Sediment Quality

This section describes the regulatory setting and existing condition for surface water and sediment quality within the Shoreline Phase I Study Area and the potential impacts on water and sediment quality resulting from the Proposed Project alternatives.

The study area includes eight ponds that were formerly used for commercial salt production, about 5.2 miles of Coyote Creek and associated tidal flats and wetlands, and two sloughs (Alviso Slough and Artesian Slough) (Figure 4.1-1 *Alviso Pond Complex and Shoreline Phase I Study Area* in Section 4.1.3 *Shoreline Phase I Study Area*). The study area is surrounded by and includes other former salt ponds that are being restored through the SBSP Restoration Project. Because of the historical hydrologic connections to these other former salt ponds, they are frequently referenced in the following discussion as the Alviso ponds or by name. Even though it does not include much open water associated with San Francisco Bay (about 0.26 acre), the study area influences and is influenced by water quality in this adjacent body of water. Finally, the following discussion frequently references the Guadalupe River, which becomes Alviso Slough in the study area. Located upstream of the study area, the Guadalupe River influences water quality in the study area.

Information provided in this section has been incorporated directly, or with minor modifications, from the *Shoreline Study Water and Sediment Quality Environmental Setting Report* (Brown and Caldwell 2008), as well as the SBSP Restoration Project's San Francisco Bay Regional Water Quality Control Board (SFBRWQCB or Board) waste discharge requirements (WDR), the SBSP Restoration Project's Water Quality Certification Order No. R2-2008-0078, and other documents as cited.

4.5.1 Affected Environment

This section reviews the regulatory and physical settings for the Shoreline Phase I Project related to surface water and sediment quality. Aspects of surface water and sediment quality addressed in this section focus on the Shoreline Phase I Study Area, which is at the base of the Coyote Creek and Guadalupe River watersheds. Because of the study area's proximity to these watersheds, the discussion in Section 4.5.1.2 *Physical Setting (CEQA Baseline)* is described within the context of the lower parts of these two watersheds. The discussion in Section 4.5.1.2 *Physical Setting (CEQA Baseline)* also addresses the condition of the southern part of San Francisco Bay. Information presented in this Affected Environment section is based on previously published information such as reports prepared in support of the SBSP Restoration Project and the Shoreline Phase I Project and other publicly available data.

4.5.1.1 Regulatory Setting – Surface Water and Sediment Quality

Surface water and sediment quality are protected under Federal, State, and local regulations. In the study area, regulations for water quality are implemented primarily by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). The SFBRWQCB derives its regulatory authority and mandates from the State's Porter-Cologne Act and the Federal CWA. The San Francisco Bay Region (Region 2) Water Quality Control Plan (Basin Plan) (SFBRWQCB 2011) is the Board's master water quality control planning document. It designates beneficial uses and water quality objectives (WQOs) for waters of the State and includes programs of implementation to achieve WQOs. Table 4.5-1 *Surface Water and Sediment Quality Regulations That Apply to the Shoreline Phase I Study Area* summarizes the regulations relevant to water and sediment quality, the agencies that implement the regulations, and the regulations' applicability to the Shoreline Phase I Project. A detailed discussion of the Basin Plan follows the table.

Table 4.5-1. Surface Water and Sediment Quality Regulations That Apply to the Shoreline Phase I Study Area

Regulation	Implementing Agency	Regulation Summary	Applicability to Shoreline Phase I Project
Federal Regulations			
Clean Water Act, Section 303	U.S. Environmental Protection Agency; State Water Resources Control Board (SWRCB) and its nine regional boards (the SFBRWQCB in the Shoreline Phase I Study Area)	Section 303(c)(2)(b), the National Toxics Rule (NTR), requires States to adopt numeric criteria for the priority toxic pollutants listed in Section 307(a) if those pollutants could be reasonably expected to interfere with the designated uses of a state's waters. California's water quality standards, established in 2000, apply to inland surface waters, enclosed bays, and estuaries. Section 303(d) requires that states identify water bodies that do not meet water quality standards and the pollutants or factors that impair them. The law requires California's RWQCBs to develop Total Maximum Daily Loads (TMDLs) for these impaired waters. TMDLs represent the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards.	Project discharges must meet California's water quality standards. Part of San Francisco Bay in the study area (0.26 acre) is identified as a Section 303(d) water.
Clean Water Act, Section 401	Delegated to the SWRCB and its nine regional boards (the SFBRWQCB in the Shoreline Phase I Study Area)	A Federal agency cannot issue a license or permit to conduct any activity that may result in a discharge into waters of the United States until the state government of the state where the discharge would originate has granted or waived a Section 401 Certification that any such discharge will not violate state water quality standards.	Project activity would require filling waters of the United States, so a water quality certification would be required.
Clean Water Act, Section 402	SWRCB responsible for permit administration, permits issued by regional boards (SFBRWQB for the Shoreline Phase I Study Area)	Used to implement the NPDES program, which regulates all discharges of pollutants from point-source waters of the United States. Includes long-term and temporary (construction-related) discharge permits.	Construction of the project would require compliance with the State's general permit for construction-related stormwater runoff. As part of the project, the contractor would prepare, submit, and follow a SWPPP; this plan would describe BMPs and other measures that would be applied during project construction to avoid or minimize impacts on water quality. The Wastewater Facility discharges to Artesian Slough under an NPDES permit; this permit will continue to apply to activity on the Wastewater Facility property.
Clean Water Act, Section 404	The USACE authorizes the discharge of fill to waters of the United States. The U.S. Environmental Protection Agency has oversight authority.	Regulates discharges of dredged or fill material into waters of the United States.	Project activity could require the discharge of fill material to waters of the United States. Because of this, project activity would require compliance with the existing Nationwide Permit program or a separate general permit.

Table 4.5-1. Surface Water and Sediment Quality Regulations That Apply to the Shoreline Phase I Study Area

Regulation	Implementing Agency	Regulation Summary	Applicability to Shoreline Phase I Project
Coastal Zone Management Act	Delegated to the State; implemented locally by the San Francisco Bay Conservation and Development Commission (BCDC)	Federal agencies must make a determination that their activities are consistent with the adopted local coastal program. Activities within designated coastal zones that are undertaken by non-Federal entities must go through a permitting process. If such activities require a Federal permit, would also require consideration of consistency.	The study area is within a designated coastal zone. Federal activity on Federally owned land is excluded from the act's provisions, but the project is still subject to a consistency determination because it could affect resources in the coastal zone. If local agencies propose work on non-Federal land in the Shoreline Phase I Study Area in the future, such agencies would be able to use this Integrated Document to demonstrate consistency as part of a permit application to the BCDC.
State Regulations			
Porter-Cologne Water Quality Control Act	SWRCB; some regulatory authority delegated to the State's nine regional boards	Authority to regulate discharges of waste into waters of the State, which are defined as "any surface or groundwater, including saline water, within the boundaries of the State" (California Water Code, Section 13050). This definition includes, but is broader than, waters of the United States. Primarily implemented through waste discharge requirements (WDRs).	WDR Order No. R2-2008-0078 established limitations on the discharge of waste associated with the SBSP Restoration Project activity for restoration of 3,069 acres of former salt ponds and ongoing maintenance. Either this WDR would be amended to apply to the Shoreline Phase I Project or the Shoreline Phase I Project would have a similar WDR order.
California Water Code		Dictates that the water resources of the State of California meet their beneficial uses to the fullest extent of which they are capable and that the conservation of water is exercised in the interest of the people and for public welfare. Section 8100 et. seq. of the Code contains guidelines for the construction of public works and improvements including the protection and restoration of watersheds, levees, or check dams to prevent overflow or flooding, conservation of the floodwaters, and the effects of construction projects on adjacent counties (especially upstream and downstream along a river).	Beneficial uses identified in the San Francisco Bay Basin Plan must be protected (such as through WDRs). Levee construction must comply with State requirements.

4.5.1.1.1 San Francisco Bay Basin Plan

The Basin Plan is the master policy document that describes the legal, technical, and programmatic bases of water-quality regulation in the San Francisco Bay region. The plan includes a statement of beneficial water uses that the SFBRWQCB will protect, water-quality objectives to protect designated beneficial water uses, and implementation plans for achieving water-quality objectives through its regulatory programs (SFBRWQCB 2011). The Basin Plan makes reference to salt marsh ecosystems, specifically within the context of wetland restoration using dredged material. However, there is no direct reference to the South Bay's former salt ponds, particularly with regard to land-use plans or decisions. Identified beneficial uses for surface waters in the San Francisco Bay estuary include estuarine habitat (EST), commercial and sport fishing (COMM), preservation of Rare and Endangered species (RARE), water contact recreation (REC1), noncontact water recreation (REC2), wildlife habitat (WILD), fish migration (MIGR), and fish spawning (SPWN). Table 4.5-2 *Basin Plan Beneficial Uses of Surface Waters and Wetlands in the Shoreline Phase I Study Area* lists the specific beneficial uses for Coyote Slough (Coyote Creek) and Alviso Slough and for saline wetlands that are identified in the Basin Plan. Artesian Slough is not specifically identified in the Basin Plan.

Table 4.5-2. Basin Plan Beneficial Uses of Surface Waters and Wetlands in the Shoreline Phase I Study Area

Surface Water Body	Beneficial Use							
	EST	MIGR	COMM	RARE	WILD	SPWN	REC1	REC2
Coyote Slough[a]	X			X	X		X	X
Alviso Slough	X	X		X	X		X	X
South Bay Saline Wetlands	X		X	X	X	X	X	X

Source: SFBRWQCB 2011

Note: This table lists beneficial uses only as identified in the 2011 Basin Plan. The beneficial uses of any specifically identified water body generally apply to all of its tributaries. Because of the large number of small and noncontiguous wetlands, the State did not find it practical to delineate and specify the beneficial uses of every wetland area. Therefore, beneficial uses may be determined site-specifically as needed (SFBRWQCB 2011).

[a] Coyote Creek is called Coyote Slough in the area of tidal influence.

The Basin Plan provides both narrative and numeric water quality objectives to avoid adverse water-quality impacts. Table 4.5-3 *Basin Plan Narrative Standards for Surface Water* through Table 4.5-6 *Other Basin Plan Surface Water Criteria for the Study Area* summarize the Basin Plan standards and the objectives that apply to the Shoreline Phase I Study Area. For the South Bay south of the Dumbarton Bridge, numeric criteria published in the California Toxics Rule (CTR) apply (40 CFR Part 131.38); the CTR criteria are incorporated into the Basin Plan.

Table 4.5-3. Basin Plan Narrative Standards for Surface Water

Objective	Standard
Bioaccumulation	Many pollutants can accumulate on particles, accumulate in sediment, or bioaccumulate in fish and other aquatic organisms. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered.
Biostimulatory Substances	Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses. Changes in chlorophyll-a and associated phytoplankton communities follow complex dynamics that are sometimes associated with a discharge of biostimulatory substances. Irregular and extreme levels of chlorophyll and/or phytoplankton blooms may indicate exceedance of this objective and require investigation.
Color	Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.
Dissolved Oxygen	For tidal waters, 5.0 milligrams per liter (mg/L) minimum downstream of Carquinez Bridge. For non-tidal waters, 7.0 mg/L minimum for cold water habitat and 5.0 mg/L minimum warm water habitat. The median dissolved oxygen concentration for any 3 consecutive months shall not be less than 80 percent of the dissolved oxygen content at saturation. Dissolved oxygen is a general index of the state of the health of receiving waters. Although minimum concentrations of 5 mg/L and 7 mg/L are frequently used as objectives to protect fish life, higher concentrations are generally desirable to protect sensitive aquatic forms. In areas unaffected by waste discharges, a level of about 85 percent of oxygen saturation exists. A 3-month median objective of 80 percent of oxygen saturation allows some degradation from this level but still requires consistently high oxygen content in the receiving water.
Floating Material	Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.
Oil and Grease	Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water that cause nuisance, or that otherwise adversely affect beneficial uses.
pH	The pH shall not be depressed below 6.5 nor raised above 8.5. This encompasses the pH range usually found in waters within the basin. Controllable water quality factors shall not cause changes greater than 0.5 units in normal ambient pH levels.
Population and Community Ecology	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce significant alterations in population or community ecology or receiving water biota. In addition, the health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ substantially from those for the same waters in areas unaffected by controllable water quality factors.
Radioactivity	Radionuclides shall not be present in concentrations that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life. Waters designated for use as domestic or municipal supply shall not contain concentrations of radionuclides in excess of the limits specified in Table 4 of Section 64443 (Radioactivity) of Title 22 of the California Code of Regulations (CCR), which is incorporated by reference into the Basin Plan. This incorporation is prospective, including future changes to the incorporated provisions as the changes take effect
Salinity	Controllable water quality factors shall not increase the total dissolved solids or salinity of waters of the State so as to adversely affect beneficial uses, particularly fish migration and estuarine habitat.
Sediment	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses. Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life.
Settleable Material	Waters shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses.
Suspended Material	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

Table 4.5-3. Basin Plan Narrative Standards for Surface Water

Objective	Standard
Sulfides	All water shall be free from dissolved sulfide concentrations above natural background levels. Sulfide occurs in bay muds as a result of bacterial action on organic matter in an anaerobic environment. Concentrations of only a few hundredths of a milligram per liter can cause a noticeable odor or be toxic to aquatic life. Violation of the sulfide objective will reflect violation of dissolved oxygen objectives as sulfides cannot exist to a significant degree in an oxygenated environment.
Tastes and Odors	Waters shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance, or that adversely affect beneficial uses.
Temperature	Temperature objectives for enclosed bays and estuaries are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California," including any revisions to the plan. In addition, the following temperature objectives apply to surface waters: The natural receiving water temperature of inland surface waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses. The temperature of any cold or warm freshwater habitat shall not be increased by more than 5°Fahrenheit (°F) (2.8°Celsius [°C]) above natural receiving water temperature.
Toxicity	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. Detrimental responses include, but are not limited to, decreased growth rate and decreased reproductive success of resident or indicator species. There shall be no acute toxicity in ambient waters. Acute toxicity is defined as a median of less than 90 percent survival, or less than 70 percent survival, 10 percent of the time, of test organisms in a 96-hour static or continuous-flow test. There shall be no chronic toxicity in ambient waters. Chronic toxicity is a detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community. Attainment of this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, or toxicity tests (including those described in Chapter 4 of the Basin Plan), or other methods selected by the SWRCB. The SWRCB will also consider other relevant information and numeric criteria and guidelines for toxic substances developed by other agencies, as appropriate. The health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ significantly from those for the same waters in areas unaffected by controllable water quality factors.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas where natural turbidity is greater than 50 NTU (nephelometric turbidity units).
Un-ionized Ammonia	The discharge of wastes shall not cause receiving waters to contain concentrations of un-ionized ammonia in excess of the following limits (in mg/L as N): • Annual Median 0.025 • Maximum, Central Bay and upstream 0.16 • Maximum, Lower Bay: 0.4 The intent of this objective is to protect against the chronic toxic effects of ammonia in the receiving waters. Ammonia (specifically un-ionized ammonia) is a demonstrated toxicant. Ammonia is generally accepted as one of the principal toxicants in municipal waste discharges. Some industries also discharge significant quantities of ammonia. Exceptions to the effluent toxicity limitations in Chapter 4 of the Basin Plan allow the discharge of ammonia in toxic amounts. In most instances, ammonia will be diluted or degraded to a nontoxic state fairly rapidly. However, this does not occur in all cases, the South Bay being a notable example. The ammonia limit is recommended in order to preclude any build-up of ammonia in the receiving water. A more stringent maximum objective is desirable for the northern reach of the bay for the protection of the migratory corridor running through the Central Bay, San Pablo Bay, and upstream reaches.

Source: SFBRWQCB 2011

Table 4.5-4. Basin Plan Surface Water Metals Criteria for Waters in the Shoreline Phase I Study Area

	Water Quality Objective South of Dumbarton Bridge (µg/L)	
	Continuous (4-Day Average)	Maximum (1-Hour Average)
Arsenic	36	69
Cadmium	9.3	42
Chromium	50	1,100
Copper	6.9	10.8
Lead	8.1	210
Nickel	11.9	62.4
Selenium[6] (total recoverable)	5	20
Silver	—	1.9
Zinc	81	90

Source: 40 CFR Part 131.38 as cited in Brown and Caldwell 2008

Table 4.5-5. Basin Plan Water Quality Objectives for Mercury in the Study Area

Measure	Fish Tissue Standard[a]	Average Wet Weight Concentration
San Francisco Bay[b] – Marine[c] Water Quality Objective		
Protection of human health	0.2 mg mercury per kg fish tissue	Measured in edible portion of trophic level 3 and trophic level 4 for fish
Protection of aquatic organisms	0.03 mg mercury per kg fish	Measured in whole fish 3–5 cm in length
Guadalupe River – Freshwater Water Quality Objective		
Protection of Aquatic Organisms and Wildlife[d]	0.05 mg methylmercury per kg fish	Average wet weight concentration measured in whole trophic level 3 fish 5–15 cm in length
	0.1 mg methylmercury per kg fish	Average wet weight concentration measured in whole trophic level 3 fish 15–35 cm in length

mg = milligrams; kg = kilograms; cm = centimeters

Source: SFBRWQCB 2011

[a] Compliance shall be determined by analysis of fish tissue as described in Chapter 6 of the Basin Plan.

[b] Objectives apply to all segments of San Francisco Bay, including Sacramento–San Joaquin River Delta (within the San Francisco Bay region), Suisun Bay, Carquinez Strait, San Pablo Bay, Richardson Bay, Central San Francisco Bay, Lower San Francisco Bay, and South San Francisco Bay (including the Lower South Bay).

[c] Marine waters are those in which the salinity is equal to or greater than 10 parts per thousand 95 percent of the time, as set forth in Chapter 4 of the Basin Plan. For waters in which the salinity is between 1 and 10 parts per thousand, the applicable objectives are the more stringent of the freshwater or marine objectives.

[d] The freshwater water quality objectives for the protection of aquatic organisms and wildlife also protect humans who consume fish from the Walker Creek and Guadalupe River watersheds.

Table 4.5-6. Other Basin Plan Surface Water Criteria for the Study Area

Pollutant	Evaluation Criterion
Bacteria[a]	
Fecal Coliform (MPN/100 mL)	
Contact water recreation	Geometric mean <200 90th percentile <400
Noncontact water recreation	Mean <2000 90th percentile <4,000
Total Coliform (MPN/100 mL)	
Contact water recreation	Median <240 no sample >10,000
Noncontact water recreation	—
Enterococcus (MPN/100 mL)	
Contact water recreation	Geometric mean <35 No sample >104
Noncontact water recreation	—
Cyanide (marine waters)	2.9 ng/L 4-day avg; 9.4 ng/L 1-hour avg
Polychlorinated biphenyl (PCB)	30 ng/L[b]
	0.00017 µg/L total, in San Francisco Bay water
Polycyclic aromatic hydrocarbons (PAH)	15.0 µg/L[c]
Polybrominated diphenyl ether (PBDE)	Not regulated
Dioxins and furans	0.014 pg/L[d]
Total petroleum hydrocarbons (TPH) – diesel	200 mg/L
Pesticides[e]	
Chlordane	2.2 ng/L
Dichlorodiphenyltrichloroethane (DDT)	0.59 ng/L

Sources: Brown and Caldwell 2008; SFBRWQCB 2011

Key: MPN = most probable number; mL = milliliters; mg/L = milligrams per liter; µg/L = micrograms per liter; ng/L = nanograms per liter; pg/L = picograms per liter; avg = average

[a] Based on a minimum of five consecutive samples equally spaced over a 30-day period.

[b] PCBs = Value for protection of aquatic life and uses.

[c] The water quality objective for PAHs is based on a 24-hour average, salinity over 10 parts per thousand (ppt).

[d] Dioxins and Furans = water quality objective value for human health for consumption of organisms, 10^{-6} risk.

[e] Pesticides = Several water quality criteria available.

4.5.1.1.2 Clean Water Act Section 303(d) List of Impaired Waterbodies

Section 303(d) of the CWA requires that every 2 years each State submit to the USEPA a list of bays, rivers, streams, creeks, and coastal areas for which pollution control or requirements have failed to provide for water quality. The SFBRWQCB and SWRCB work together to research and update the list for the San Francisco region of California.

Based on a review of this list and its associated Total Maximum Daily Load (TMDL) Priority Schedule, Coyote Creek, the Guadalupe River, and South San Francisco Bay are listed as impaired for pesticides, mercury, trash, invasive species, and selenium (Table 4.5-7 *Clean Water Act Section 303(d) Listings for Water Bodies in the Shoreline Phase I Study Area*).

Table 4.5-7. Clean Water Act Section 303(d) Listings for Water Bodies in the Shoreline Phase I Study Area

Water Body Name	Listed Area	Pollutant/Stressor	TMDL Status/ Completion Date
Coyote Creek	55 miles total (3.1 miles of listed segment in the Shoreline Phase I Study Area)	Diazinon	Removed in 2006 with approval of TMDL
		Trash	Estimated complete 2021
Guadalupe River	18 miles total (1.53 miles of listed segment in the study area)	Diazinon	Removed in 2006 with approval of TMDL
		Mercury	Complete; EPA approved 2008.
		Trash	Estimated complete 2021
San Francisco Bay (South)	9,204 acres (0.26 acre of listed area in the study area)	Chlordane	Estimated complete 2013[a]
		DDT	Estimated complete 2013[a]
		Dieldrin	Estimated complete 2013[a]
		Dioxin compounds[b]	Estimated complete 2019
		Invasive species	Estimated complete 2019
		Furan compounds[c]	Estimated complete 2019
		Mercury (TMDL in effect)	Complete; EPA approved 2008.
		PCBs (polychlorinated biphenyls)	Complete; EPA approved 2010
		PCBs (polychlorinated biphenyls) (dioxin-like)[d]	Complete; EPA approved 2010
		Selenium	Estimated complete 2019

Sources: SFBRWQCB 2006a, 2006b; SWRCB 2010

[a] In progress (Ponton, pers. comm. 2014). SWRCB 2010 states "303(d) listing decisions made prior to 2006 were not held in an assessment database. The Regional Boards will update this decision when new data and information become available and are assessed."

[b] Dioxin compounds consist of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD),1,2,3,7,8-pentachlorodibenzo-p-dioxin (PeCDD), 1,2,3,4,7,8-hexachlorodibenzo-p-dioxin (HxCDD),1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, and 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin (HpCDD),

[c] Furan compounds consist of 2,3,7,8-tetrachlorodibenzofuran (TCDF),1,2,3,7,8-pentachlorodibenzofuran (PeCDF), 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-hexachlorodibenzofuran (HxCDF), 1,2,3,6,7,8-HxCDF,1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-heptachlorodibenzofuran (HpCDF), 1,2,3,4,7,8,9-HpCDF, and octachlorodibenzofuran (OCDF).

[d] PCBs (dioxin like) consist of3,4,4,5- tetrachlorobiphenyl (TCB) (81), 3,3,3,3-TCB (77), 3,3,4,4,5- pentachlorobiphenyl (PeCB)(126), 3,3,4,4,4,4- hexachlorobiphenyl (HxCB) (169), 2,3,3,4,4-PeCB (105), 2,3,4,4,5- PeCB (114), 2,3,4,4,5-PeCB (118), 2,3,4,4,5- PeCB (123), 2,3,3,4,4,5-HxCB (156), 2,3,3,4,4,5-HxCB (157), 2,3,4,4,5,5,-HxCB (167), and 2,3,3,4,4,5,5-heptachlorobiphenyl (HpCB)(189).

The purposes of each TMDL and its associated plan are to accelerate the achievement of water quality objectives in the area, protect fish and wildlife, ensure the maximum practical pollution prevention by municipal and industrial wastewater dischargers, and more clearly incorporate risk-reduction measures addressing public health impacts on subsistence fishers and their families. TMDL action plans are complete for and approved by the USEPA for the Guadalupe River (mercury, approved June 2010), San Francisco Bay (PCBs approved March 2010; mercury approved June 2010), and urban creeks (pesticides approved May 2007).

The Guadalupe River watershed, which is upstream of the study area and discharges into the study area via Alviso Slough, is of interest to the project because it is a large source of mercury to the South Bay; due to a legacy of historical mercury mining in the upper watershed at the New Almaden Mining District, mercury is still released to the environment. Scheduled for completion in 2013, San Francisco Bay TMDLs are still in progress for the organochlorine pesticides chlordane, DDT, and dieldrin (Ponton, pers. comm. 2014).

With respect to mercury, specific numeric targets are incorporated within the TMDL to protect San Francisco Bay and its beneficial uses.

- To protect sport fishing and human health, the average mercury concentration in bay fish tissue should be reduced by about 40 percent to 0.2 parts per million (ppm).
- To protect wildlife and rare and endangered species, the mercury concentration in wild bird eggs should be reduced more than 25 percent to a concentration below 0.5 ppm.
- To achieve the fish tissue and bird egg targets and to attain water quality standards, the mercury concentration in suspended sediment should be reduced by about 50 percent; the median mercury concentration in sediment should be 0.2 ppm.

In 2010, the USEPA approved a San Francisco Bay TMDL for PCBs entering San Francisco Bay that establishes the total mass of PCBs that can enter the bay via stormwater without adversely affecting beneficial uses such as resident fish consumption. The TMDL for PCBs in San Francisco Bay is 10 kg/year. The San Francisco Bay PCB TMDL specifies a target for the total concentration of PCBs in bay sediments (1 part per billion) as well. Adopted as an amendment to the Basin Plan, the TMDL includes waste load allocations for various categories of dischargers, including municipal stormwater dischargers.

4.5.1.1.3 Fish Ingestion Advisories

The first fish consumption advisory for San Francisco Bay and the Sacramento–San Joaquin Delta was issued in 1972 for striped bass due to mercury contamination (OEHHA 2011). Office of Environmental Health Hazard Assessment (OEHHA) updated the striped bass advisory in 1993 and then incorporated it into the San Francisco Bay and Sacramento–San Joaquin Delta 1994 interim fish advisory for mercury and PCBs. In 2011, using available fish tissue data and risk-based methodologies, OEHHA issued mercury- and PCB-based species-specific fish ingestion advisories for eight additional fish species caught from San Francisco Bay and updated the striped bass advisory (OEHHA 2011). The eight additional fish species are rockfish, jacksmelt, king salmon, halibut, white croaker, sharks, white sturgeon, and surfperches. Of the nine total species (red rock crab was also included), OEHHA recommends no ingestion of surfperches by any group at any frequency due to mercury. Also in the study area, since 1987 OEHHA has recommended no ingestion of fish from the Guadalupe River watershed, also due to mercury (OEHHA 2014).

4.5.1.1.4 Proposition 65

The Safe Drinking Water and Toxic Enforcement Act of 1986 requires that California's governor revise and republish at least once per year the list of chemicals known to the State to cause cancer or reproductive toxicity. Mercury and mercury compounds were added to the list in July 1990 for developmental toxicity. Methylmercury was added to the list in July 1987 for developmental toxicity as well, while methylmercury compounds were added in May 1986 as being potential carcinogens.

4.5.1.2 Physical Setting (CEQA Baseline)

This section describes the physical setting of the Proposed Project for water and sediment quality in the Shoreline Phase I Study Area, parts of the Coyote Creek and Guadalupe River Watershed, and part of the South Bay. This section summarizes available data for the study area, past actions that have led to the current condition, and specific regulatory criteria applicable to evaluation of water and sediment quality impacts due to the proposed actions.

4.5.1.2.1 Watersheds

The Shoreline Phase I Study Area is located at the base of the Coyote Watershed and is adjacent to the Guadalupe Watershed in Santa Clara County (Figure 4.3-1 *General Overview of Land Uses in the Study Region*). Drainages in these watersheds include Coyote Creek/Mud Slough, Artesian Slough, and Guadalupe River/Alviso Slough. The largest contributing watershed, Coyote Creek, encompasses approximately 48 percent of the total contributing area. The Shoreline Phase I Study Area sloughs and streams are listed in Table 4.5-8 *Sloughs and Streams in the Shoreline Phase I Study Area*.

Table 4.5-8. Sloughs and Streams in the Shoreline Phase I Study Area

Watershed	Sloughs and Streams
Guadalupe River	Alviso Slough (4.2 miles)
Coyote Creek	Coyote Creek, which becomes Mud Slough (5.2 miles) Artesian Slough (2.6 miles)

Guadalupe River, which becomes Alviso Slough in the study area, is not within the Shoreline Phase I Study Area. However, because this river flows adjacent to the Ponds A9, A10, A11, A12, A13, A14, and A15, its water quality can have an effect on the water quality condition in the study area.

Most of the floor of the Santa Clara Valley consists of broad alluvial fans that were formed as streamflows emerged from the foothills, flattened, slowed, and spread out, depositing unconsolidated material. The lowest portions of the valley are flat and are covered with fine alluvium. Areas currently or formerly exposed to regular tidal influence were generally flat or sculpted to some degree by tidal currents but in many areas are now leveed or otherwise modified by human activities.

4.5.1.2.1.1 Watershed Monitoring Programs

The Shoreline Phase I Study Area watersheds include urban, agricultural, and rural land-use areas. Urban areas contribute stormwater and urban dry weather runoff (such as landscape irrigation runoff) that can carry contaminants, including trace metals, industrial chemicals, petroleum hydrocarbons, lawn and garden care chemicals, nutrients, and trash. Surface water monitoring programs (e.g., the San Francisco Bay Regional Monitoring Program [RMP]) funded by dischargers track the effects of historical and current discharges on water and sediment quality in San Francisco Bay. The U.S. Geological Survey's Ecosystem Program is an extensive program of monitoring and research focused on changes in the habitat, hydrography, water, and sediment quality of San Francisco Bay (USGS 2014). Urban runoff programs and wastewater treatment plants also conduct focused monitoring to evaluate the benefits of pollution control and the remaining potential for receiving water impacts.

4.5.1.2.2 Current Surface Water and Sediment Quality

The contaminants and parameters of interest in the Shoreline Phase I Study Area can be grouped into the following seven broad categories, which are discussed in this section:

- Bioaccumulative contaminants
- Nonbioaccumulative toxic contaminants
- Other contaminants of concern
- Fisheries parameters
- Turbidity
- Water temperature
- Phytoplankton and dissolved oxygen (DO)

Each contaminant group and parameter is discussed below.

4.5.1.2.2.1 Bioaccumulative Contaminants

Bioaccumulative contaminants are chemicals that sequester in tissue at a rate faster than the body can excrete them. Often, bioaccumulative contaminants become more concentrated in the tissues of organisms as they move up the food chain, a process called bioaccumulation. As they concentrate in upper trophic organisms, these contaminants can threaten or impair the beneficial uses of fishing, wildlife habitat, and the protection of Rare and Endangered species. Various bioaccumulative contaminants are of sufficient concern in San Francisco Bay and the Guadalupe River to require posted health warnings regarding consumption of certain species (Section 4.5.1.1.3 *Fish Ingestion Advisories*).

The bioaccumulative contaminants of primary concern in the Shoreline Phase I Study Area are mercury and methylmercury, polychlorinated biphenyls (PCBs), legacy organochlorine pesticides (DDT, chlordane, and dieldrin), and selenium. These contaminants have different sources, fates, and effects on the food web that are summarized in this section. Additional bioaccumulative contaminants discussed below include PBDEs, dioxins, and furans.

Mercury and Methylmercury

Mercury (chemical symbol Hg) is negatively affecting the beneficial uses of many of California's waters by making fish unsafe for human and wildlife consumption (SWRCB 2014). Although mercury occurs naturally in the environment, mercury concentrations exceed background levels because of human activities. Gold and mercury mines, atmospheric deposition, industrial and municipal wastewater discharges, and urban storm water runoff are sources of mercury.

In humans, elevated mercury levels can cause serious health problems. Children and fetuses are most vulnerable. Health effects can result from short- or long-term exposure, and exposure can cause harm before symptoms arise. When symptoms do arise, health problems can include tremors, changes in vision or hearing, insomnia, weakness, difficulty with memory, headache, irritability, shyness, and nervousness. In young children, exposure to metallic mercury can damage the central nervous system. Long-term mercury exposure can cause children to have learning disorders. In wildlife, though lower-trophic organisms can be highly tolerant of mercury burdens, physiological effects have been demonstrated in top predators at low concentrations. For example, Ackerman and Eagles-Smith (2008) found that environmental mercury reduced hatching success, nest survival, and chick survival in resident Forster's terns in San Francisco Bay.

Mercury (also called inorganic mercury) is toxic in all of its forms, but methylmercury (MeHg) is one form that is most toxic and readily available for bioaccumulation in fish, birds, and people (SWRCB 2014). MeHg is formed in the environment when inorganic mercury is methylated by bacterial action. This process often occurs in open-water and wetland habitats where sediments are low in oxygen and bacteria are present. MeHg binds to organic matter, including phytoplankton at the base of the aquatic food web. Small organisms consume the contaminated phytoplankton, which are then fed upon by small fish, which in turn are fed upon by large fish. MeHg accumulates in each species as it moves through the aquatic food web, with the highest concentrations of MeHg usually found in large, old fish such as bass, which eat smaller fish.

The legacy of mercury contamination in San Francisco Bay dates back more than 150 years to the California Gold Rush. Mercury was mined in California's Coast Range and exported to the Sierra Nevada where it was used in the gold extraction process. Now, legacy mercury is transported to the bay in runoff from both directions; sediment and surface water contamination from mercury mines in the Coast Range and the gold mines in the Sierra Nevada continue to contribute to mercury contamination found in the bay today. Data currently available indicate that the yearly mercury load in the San Francisco Bay estuary amounts to approximately 30 to 500 kg, depending on the hydrologic condition, with higher loads associated with increased runoff.

South Bay sediment mercury concentrations are elevated by approximately 5 to 10 times compared to the preindustrial condition. Gehrke and others (2010) found that the mercury in South Bay sediments is primarily a result of mercury released from historical Coast Range mercury mines and exhibits a distinct fingerprint. Locally, the historic New Almaden Mining

District's legacy is a dominant mercury load factor to the Shoreline Phase I Study Area. Recent estimates of mercury loads to the South Bay from the Guadalupe River watershed estimate that 8–116 kg of mercury annually is washed down into the South Bay attached to sediments contaminated by mine tailings that still remain within the New Almaden mining district and Guadalupe River watershed (McKee et al. 2010). The Guadalupe River drains into Alviso Slough, which is adjacent to Ponds A9–A15.

Sediment Concentrations

Miles and Ricca (2010) found total mercury (THg) levels in surficial sediments of Ponds A10–A15 to range from 0.10 to 3.11 µg/g dry weight, and MeHg in these sediments to range from 0.38 to 4.95 ng/g dry weight. Mercury was also found buried in sediments of the adjacent Alviso Slough, with a median concentration of 0.80 µg/g THg, ranging from 0.08 to 2.83 µg/g dry weight.

Studies performed in support of the SBSP Restoration Project have also measured mercury and MeHg in local sediments. Figure 4.5-1 *Total Mercury Concentrations in Ponds in the Alviso Complex* and Figure 4.5-2 *Methylmercury Concentrations in Ponds in the Alviso Complex* show the spatial variability of THg and MeHg measured in pond sediments from Alviso Complex ponds that are in and near the Shoreline Phase I Study Area. Within the Shoreline Phase I Study Area, SBSP Restoration Project THg and MeHg monitoring detected the highest concentrations in Pond A12. The monitoring detected a clear spatial pattern, with the highest mercury sediment concentrations located adjacent to Alviso Slough, the current discharge location of the Guadalupe River. In most cases, higher sediment concentrations were reported in samples collected from the surface (0 to 2 inches) than in samples collected from the subsurface (6 to 8 inches), and there was little correlation between the THg and the MeHg levels in sediment. Based on sediment samples collected in 2003, 2004, and 2005, Ponds A12 and A13 yielded THg above the USEPA criterion for contaminated sediments (1.0 mg/kg).

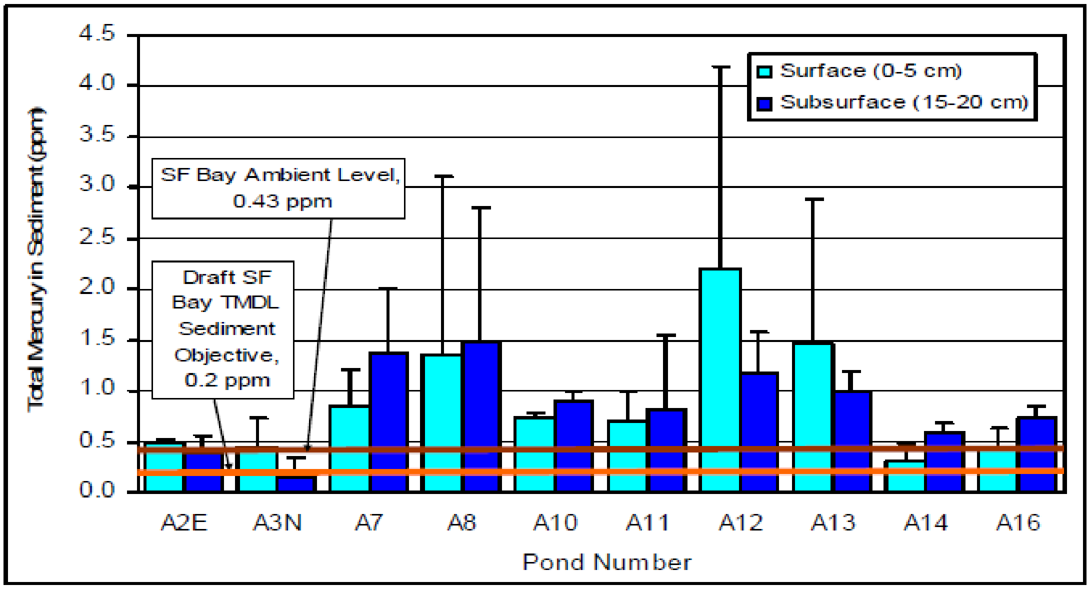

Figure 4.5-1. Total Mercury Concentrations in Ponds in the Alviso Complex

Source: Brown and Caldwell 2008

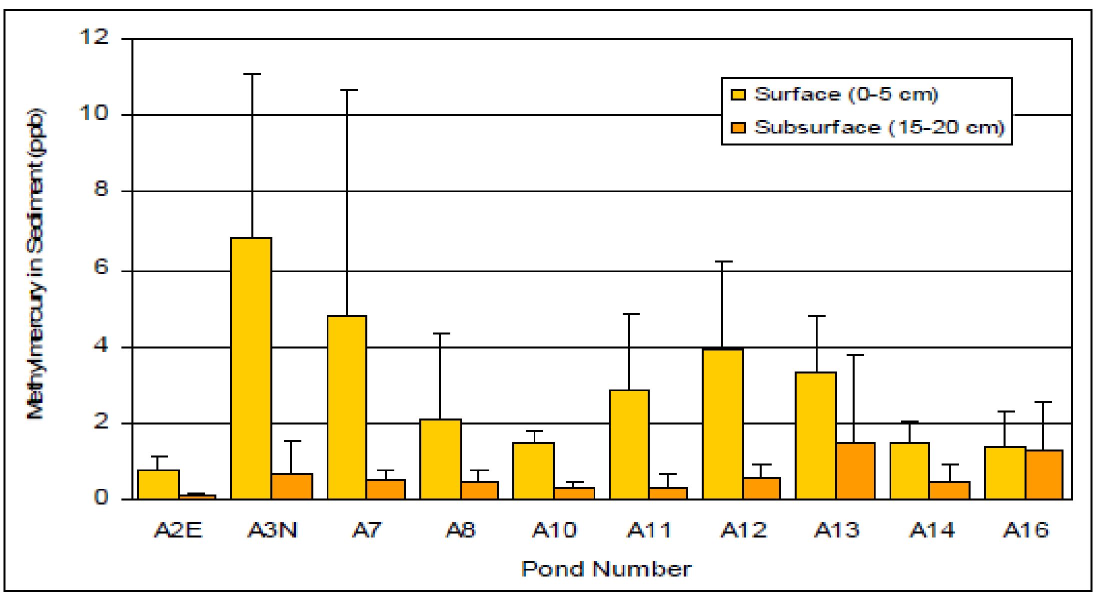

Figure 4.5-2. Methylmercury Concentrations in Ponds in the Alviso Complex

Source: Brown and Caldwell 2008

Surface Water Concentrations

Sampling of the Guadalupe River system in October 2000 by the USGS under dry and wet conditions (Thomas et al. 2002) showed that 6 of 14 samples exceeded the WQO for mercury (at that time, the standard was 0.025 µg/L in water; the standard is now 0.05 mg mercury per kg fish tissue). The Guadalupe River is not in the study area but discharges to Alviso Slough, which forms the western boundary of the study area. The highest THg at the USGS gauge (0.139 µg/L) was associated with the highest observed flow.

Food Web Dynamics

Different areas within the Shoreline Phase I Study Area have different food web structures, resulting in potentially different levels of MeHg exposure to foragers at the top of the food web in areas with roughly comparable loads and methylation rates. When complete, at any particular location, the type of restored wetland can minimize or enhance MeHg production and biotic exposure.

Biological indicators of mercury methylation and bioaccumulation have been developed by the South Baylands Mercury Project to focus discussions about the complex relationships between vegetation, microbial communities, and physical and chemical factors as they affect mercury bioaccumulation in the food web (Greiner et al. 2010). Biological indicators consist of fish, birds, and brine flies. Using the biosentinel species as indicators for wetlands will help the SBMP management team make informed recommendations based on relative mercury risk about where and how to restore salt ponds to wetlands.

A comprehensive study on mercury bioaccumulation as a result of restoration of salt ponds was undertaken in 2010 and 2011 (Ackerman et al. 2013). To investigate the effect of the restoration of Pond A5/A7/A8 and the opening of the Pond A8 notch in June 2011, researchers conducted mercury biogeochemisty and bioaccumulation studies in Pond A8 and Alviso Slough during 2010 (before restoration actions) and 2011 (during and after restoration actions). Samples included water, sediment, three fish species (threespine stickleback, longjaw mudsucker, and Mississippi silverside); and two bird species (Forster's tern and American avocet). Brine flies had not yet been selected as a biosentinel species and were not sampled.

The results indicate that, in 2011, fish in the Pond A5/A7/A8 complex had higher mercury levels compared to fish from reference ponds during 2010 (pre-notch opening). Fish within the Pond A5/A7/A8 complex exhibited an increase in mercury tissue concentration between 2010 and 2011, prior to the June 1, 2011 notch opening, relative to reference ponds. Models indicate these increases were strongly related to restoration construction activities during the fall 2010/winter 2010–2011 period. Once the notch was opened to 5 feet in June 2011, mercury in fish decreased noticeably (to below 2010 levels) in the Pond A5/A7/A8 complex during the remainder of 2011.

The decrease in fish mercury concentrations within the Pond A5/A7/A8 complex after the opening of the notch appeared to be linked to a change in MeHg availability at the base of the food web, associated with dramatic changes in water chemistry, suspended particulate composition, and mercury partitioning between particulates and the dissolved phase. By the end of the study, fish tissue mercury concentrations remained elevated in the Pond A5/A7/A8 complex compared to the reference ponds but were lower than observed in 2010.

Fish-eating birds take up mercury in the fish they eat, and, in some species, such as terns, that mercury can be transferred to the egg prior to egg-laying. In 2010, mercury in tern eggs was already high prior to the restoration activity, with 90 percent of eggs having concentrations over the reproductive toxicity threshold. Tern egg mercury concentrations increased 67 percent to 78 percent in Ponds A7 and A8 between 2010 and 2011. In 2011, tern nesting started prior to the notch opening, so egg levels likely reflect perturbations from construction activities. These are very large increases in mercury, and it is estimated that 100 percent of the terns exceeded reproductive toxicity levels during 2011. Avocet eggs also had slight increases from 4 percent to 15 percent from 2010 to 2011, but this was a minor statistical increase compared to reference ponds.

Fish in Alviso Slough also experienced changes in tissue mercury concentration coincident with the opening of the Pond A8 notch on June 1, 2011. There were four sample locations in Alviso Slough: one just upstream of the notch, one at the notch, one downstream midway down the slough, and one downstream at the slough mouth (near Pond A6). By the end of the study in October 2011, there was no change in Alviso Slough fish mercury levels for either Mississippi silverside or threespine stickleback compared to 2010; however, slough fish mercury concentrations increased in mercury after the notch was opened on June 1 until between August and October when the mercury concentration decreased.

The increase in mercury after the notch opening was more pronounced at the locations closest to the notch than at downstream locations. Thus, the increase in mercury in slough fish was short-lived and seen mostly in upstream fish. The increase seems to be linked to changes in water chemistry and MeHg availability to the base of the food web and not to sediment scour directly.

There were no observed changes in sediment mercury chemistry in either Alviso Slough or Pond A5/A7/A8. In the water samples, dissolved MeHg in the Pond A5/A7/A8 complex decreased significantly in 2011 compared to 2010 after the notch opening, which was due to a combination of simple dilution and a shift in partitioning between the dissolved and particulate phases (the material that is suspended in the water). As pointed out above, MeHg is the form of mercury that is most readily moved up the food web. The transfer of MeHg from the dissolved phase and onto suspended particles increased from 2010 to 2011 and was associated with a decrease in both salinity and dissolved organic carbon. The composition of the suspended particles also changed after the notch opening with a higher proportion of terrestrial and/or marsh plant particulates evident during 2011 (which is reasonable to expect since water from the surrounding bay and marshes was pouring into Pond A5/A7/A8).

Phytoplankton concentrations (an indicator of algae and other small organisms) also increased modestly in the Pond A5/A7/A8 complex in 2011 compared to 2010. But the higher proportion of terrestrial particulates and the partitioning of MeHg onto particulates appeared to result in MeHg becoming less bioavailable to fish after the initial notch opening, resulting in the observed decrease in fish mercury concentration within the Pond A5/A7/A8 complex after the notch was opened.

In upper Alviso Slough, there was a significant shift in MeHg partitioning toward the dissolved phase between 2010 and 2011, which was coincident with the short-lived increase in slough fish mercury concentrations in this region of the slough. Thus, the changes in MeHg between dissolved and particulate phases observed between 2010 and 2011 were in opposite directions for the Pond A5/A7/A8 complex and Alviso Slough. The water chemistry results help explain the short-lived increases in fish mercury concentrations in Alviso Slough after the notch was opened, while there was a decrease in fish mercury concentrations within Pond A5/A7/A8 after the notch was opened.

In summary, mercury in pond fish increased in Pond A5/A7/A8 due to the construction activities, then decreased after the opening of the Pond A8 notch. The terns feeding on the fish laid eggs that had substantially higher mercury after the restoration activities than before. However, another bird species, the avocet, had little change in mercury levels after the restoration activities or compared to reference areas. Also, although slough fish increased in mercury at first, by October the concentrations were down to levels seen before the restoration activities. In both pond fish and slough fish, the decrease in mercury happened within a few months of opening the notch. Tern eggs remained high in mercury because eggs represent an aggregate of mercury in the environment, so one nesting season would not show a decreased response as quickly as did the fish. The increase in mercury seen in tern eggs and fish could be related to the construction activities, where a perturbation in a system can increase mercury in biota for a period of time before going back down.

Polychlorinated Biphenyls and Legacy Organochlorine Pesticides

PCBs are a class of synthetic chemicals that were widely used from the 1930s until their production was banned, effective 1979. There are 209 individual compounds, or “congeners,” that are collectively referred to as PCBs. Primary sources of PCBs include industrial lubricants and electrical transformers. Although new production in the United States was banned in 1979, the use of PCBs in completely closed electrical transformers remains legal to this day. The life expectancy of such transformers is decades, so hundreds of thousands of kilograms of PCBs remain in use in the San Francisco Bay Area. This inventory will gradually decline over time as old transformers are replaced.

PCBs and organochlorines are an environmental concern because they are potent carcinogens and toxins that are extremely persistent in the environment. They accumulate in the fats of organisms and are transferred up the food chain, increasing in concentration at each step. In contrast to mercury, for which microbial transformations are the key to bioaccumulation, biochemical transformation of PCBs or organochlorines is not a necessary precursor to biomagnification. Consequently, the conceptual model for management of PCBs in the South Bay is a direct food web model that relates PCB concentrations in sediments directly to PCB concentrations in fish.

Two other PCBs are hexachlorobenze (HCB) and chlorophenols. HCB occurs as a contaminant in the production of other chlorinated solvents (e.g., carbon tetrachloride, a widely used solvent) and in the production of nitroso-rubber for tires so it can enter the environment via surface run off from road. Chlorophenols are synthetic organic compounds which have fungicidal and bactericidal properties. They have primarily been used for long-term wood preservation and for short-term wood protection to control sap stain and mold on freshly cut lumber. Two of the main members of this family used for wood preservation are pentachlorophenol (PCP) and tetrachlorophenol (TCP).

Examples of organochlorine pesticides include methoxychlor, dieldrin, chlordane, toxaphene, mirex, kepone, lindane, and benzene hexachloride.

Sediment Results. Concentrations of PCBs and legacy organochlorine pesticides have been reasonably well characterized in surface sediments of some sloughs in the Shoreline Phase I Study Area. Compared to ambient concentrations measured in bay sediments, concentrations of PCBs measured in Shoreline Phase I Study Area sediments in the Alviso Pond complex, Alviso Slough, and Coyote Creek all exceeded ambient concentrations (the Guadalupe River sediments did not). PCBs and legacy organochlorines in sediments of the margins and estuary interface areas of the far South Bay are moderately higher than ambient concentrations measured for San Francisco Bay sediments; the statistical significance of the difference is not great, usually within one standard deviation of the measurements. The observed landward increase is consistent with conceptual models for the sources and fate of PCBs and legacy organochlorine pesticides (Connor et al. 2004; Davis et al. 2006).

In general, legacy organochlorine pesticide concentrations in sediments are greater in the shallow areas at the edges of the bay than farther out in San Francisco Bay (Connor et al. 2007). Organochlorine pesticide concentrations also tend to increase in deeper sediments of the region compared to shallow sediments (Venkatesan et al. 1999). Both of these spatial gradients, which are similar to those of PCBs, are consistent with known use and release of organochlorine pesticides in urban and agricultural areas, followed by a ban on manufacture and use.

Surface Water Results. The San Francisco Estuary Institute analyzed samples from stormwater in the Guadalupe River (upstream of the study area) for PCBs. Data were collected in water years 2003 and 2004. In 2003, total PCB concentrations ranged from 3.4 to 90 nanograms per liter (ng/L) and had a flow-weighted mean concentration of 55 ng/L. In 2004, total PCB concentrations ranged from 0.7 to 66 ng/L and had a flow-weighted mean of 26 ng/L. In 2004, PCB loads were estimated at 0.56 to 126 ng/day with a total seasonal load of 0.70 kg (McKee et al. 2006).

Surface water samples collected from the Guadalupe River from 2003 to 2005 exceed the Basin Plan objective, i.e. the California Toxics Rule (CTR) criteria, for dieldrin and chlordanes in freshwater. Total DDT (a legacy organochlorine) ranged from 0.6 to 71 ng/L, dieldrin ranged from 0.2 to 6.0 ng/L, and chlordanes ranged from 0.6 to 64 ng/L (Connor et al. 2007). Dry-season total water concentrations measured in the far South Bay from 1993 to 2003 (mean ± standard error) were as follows: DDT 372±57 pg/L, chlordanes 136±18 pg/L, and dieldrin 59±8 pg/L (Connor et al. 2007). The mean concentrations did not exceed the surface water criteria.

Selenium

Selenium is a naturally occurring element that is an essential nutrient in small amounts but can be toxic at higher concentrations. At higher concentrations, selenium can be toxic to aquatic life outright. Selenium also bioaccumulates in organisms that are tolerant of the high burdens and is subsequently toxic to birds that consume the organisms.

Selenium is locally elevated above the surface water quality objective of 5 μg/L (4-day average) in Alviso Slough, which runs along the western boundary of the Shoreline Phase I Study Area (Abu-Saba and Ogle 2005). The reason for this local water column elevation is unknown. One possible explanation is the presence of selenium (2 to 8 μg/L) in groundwater wells within the Coyote Creek and Guadalupe River floodplains (SCVWD 1994). Although these concentrations approach and exceed the surface water quality objective of 5 μg/L, they are well below the drinking water maximum contaminant level of 50 μg/L. Samples taken during development of the SBSP Restoration Project showed that average selenium concentrations in sediments from the Alviso Ponds (some of which are in the study area) and other ponds north of the Shoreline Phase I Study Area were somewhat higher than ambient the condition in San Francisco Bay (Brown and Caldwell 2008). Samples taken from Ponds A9, A10, A13, and A15 all showed concentrations higher than the South Bay ambient level. Since several of the sampled ponds were far from Alviso Slough, these data suggest that the elevated selenium concentrations are not necessarily related to the selenium concentrations in the slough's water. Further investigation and evidence would be necessary to determine whether the high selenium in surface water is related to groundwater use or another source.

Other Bioaccumulative Contaminants

Polybrominated Diphenyl Ethers

PBDEs, which are used primarily as flame retardants, are an emerging class of chemicals of concern that have been identified in San Francisco Bay fish (SFEI 2006). Despite the United States having phased out the manufacture and import of two types of PBDEs (pentaBDE and octaBDE) in 2004, their component congeners are being detected in humans and the environment, and some reports indicate that levels are increasing. One potential source is imported articles to which these compounds have been added. Another is the possible breakdown of decaBDE in the environment to more toxic and bioaccumulative PBDE congeners.

Based on the USEPA's screening-level review of hazard and exposure information, the USEPA's action plan called for an initiation of rulemaking in the autumn of 2010 to add commercial PDBE mixtures and/or the congeners they contain to the Concern List under the Toxic Substances Control Act as chemicals that present or may present an unreasonable risk of injury to health or the environment. The USEPA developed a significant new use rule requiring notice to USEPA prior to the manufacture or import of articles to which c-pentaBDE or c-octaBDE have been added. As of early 2013, the USEPA continues to work on the new rule.

PBDE concentrations in humans and wildlife in the San Francisco Bay Area are among the highest reported in the world; however, this may be skewed by a lack of sufficient data in other areas (SFEI 2007). PBDE surface water concentrations in San Francisco Bay range from 0.03 to 0.51 ng/L with the greatest concentrations in the far South Bay, where they have been measured from 0.10 to 0.51 ng/L (Oros et al. 2005). PBDE concentrations measured in the

Guadalupe River upstream of the study area in 2005 ranged from 15.3 to 370.3 ng/L (McKee et al. 2006), orders of magnitude greater than the concentrations detected in the South Bay. The far South Bay, within which the Shoreline Phase I Project would be located, receives 26 percent of the wastewater treatment plant effluent that flows to the estuary (Oros et al. 2005). Based on a study conducted at the Regional Water Quality Control Plant in Palo Alto, levels of PBDEs in plant effluent suggest that wastewater treatment plant discharges could be a significant source of PBDEs in the estuary.

PBDE concentrations in sediments in the far South Bay range from below the detection limit to 21.2 parts per billion (ppb). Detections in the South Bay are up to three orders of magnitude greater than those in other San Francisco Bay segments (Oros et al. 2005). Spatial gradients in the regional setting tend to increase toward certain urbanized areas, including developed areas in and near the Shoreline Phase I Study Area.

Guadalupe River loads monitoring upstream of the study area (McKee et al. 2006) includes PBDEs in the list of analytes monitored. The concentration maximum observed in the far South Bay can reasonably be expected to persist over the next decade. For the next 50 years, increased scrutiny may lead to management actions that reduce and control PBDEs, assuming that CWA implementation and other regional policies follow a course similar to that taken for PCBs and organochlorine pesticides (Brown and Caldwell 2008).

Dioxins and Furans

Dioxins and furans are inadvertent by-products formed during high temperature combustion processes in the presence of chlorine. Sources include burning of municipal and medical waste, iron and steel production, electrical power generation, and fuel and wood burning. Natural sources include forest fires and volcanic eruptions. Like PCBs, these compounds are potent carcinogens that accumulate in fatty tissues. Dioxins and furans are on the CWA Section 303(d) list for San Francisco Bay. The current level of knowledge indicates that stormwater is the primary conveyance of dioxins and furans to San Francisco Bay, and the most likely source to stormwater is atmospheric deposition.

Total dioxins/furans analyzed in surface water samples collected from Pond A9 in the Shoreline Phase I Study Area and three other locations in San Francisco Bay, including a site near the Dumbarton Bridge, exceeded the CTR standard of 0.013 pg/L and the USEPA criterion of 0.005 pg/L established for the protection of human health (Connor et al. 2005). Though sediment quality values for dioxin have been developed by several entities (EPA 2010), no standards or criteria exist to evaluate sediment concentrations of dioxins and furans in San Francisco Bay. The USEPA and the National Oceanic and Atmospheric Administration (NOAA) analyzed 56 sediment samples collected around San Francisco Bay in 2000 for dioxins, furans, and dioxin-like, co-planar PCBs. They concluded that dioxin levels in San Francisco Bay were comparable to levels in other urban bays and estuaries (Connor et al. 2005).

In general, limited data are available for dioxins in fish in the study area. Dioxin concentrations in some species collected from Coyote Creek exceed the screening values developed for impairment assessment. These data indicate that further monitoring and evaluation of human health risk are warranted (Connor et al. 2005, Brown and Caldwell 2008).

4.5.1.2.2.2 Nonbioaccumulative Toxic Contaminants

Nonbioaccumulative toxic contaminants threaten or impair aquatic habitats and beneficial uses of the impaired water body. The primary organic constituents analyzed in the RMP are PAHs and organochlorine pesticides. Organochlorine pesticides, which include chlordanes, DDTs, and some PAHs, are known to be environmentally persistent and pose a concern for bioaccumulation and are discussed above.

Polycyclic Aromatic Hydrocarbons

PAHs are a class of compounds that enter the aquatic environment, either directly through petroleum-related spills or indirectly through combustion of petroleum, coal, coke, and other carbon sources. Although they can accumulate in fatty tissues, the biomagnification of PAHs is typically not as great as for PCBs and other compounds considered here. A few of the many PAH compounds (e.g., benzo-a-pyrene) are known or suspected carcinogens. The PAH compounds that are carcinogenic have much more stringent water-quality objectives, i.e., the CTR criteria, because of their risk to human health. Many water column samples in San Francisco Bay exceed the CTR criteria for these constituents. Although there has not been a robust risk-based analysis that supports a finding of impairment based on PAH concentrations in fish, PAHs in sediment are a growing concern for potential impacts on early life stages of fish (SFEI 2007). A study by San Francisco Estuary Institute found that atmospheric deposition may be a significant source of PAHs in San Francisco Bay (Tsai et al. 2005).

PAH concentrations greater than ambient surface water concentrations measured in San Francisco Bay have been detected in water bodies in the Shoreline Phase I Study Area, including the Guadalupe River upstream of the Shoreline Phase I Study Area (147 ng/L), Coyote Creek (138 ng/L; San José site, which is upstream of the study area) and Coyote Creek near I-880 west of the study area (84 ng/L) (median concentrations from risk-management plan data collected from 1993 to 2001 [Ross and Oros 2004]). Surface water concentrations of PAHs are significantly higher in and near the Shoreline Phase I Study Area than in other San Francisco Bay areas (Ross and Oros 2004). The higher concentrations in the far South Bay may be attributed to the urbanized and industrialized watershed as well as the greater residence time compared to the other San Francisco Bay segments (Oros et al. 2007). Conversely, PAH concentrations in the Shoreline Phase I Study Area sediments (87 milligrams per kilogram [mg/kg] total organic carbon [TOC]) are less than those in the Central Bay (230 mg/kg TOC) and the South Bay (217 mg/kg TOC) (Ross and Oros 2004). This may be due to differences in the grain-size distributions and organic content of the sediments. PAHs preferentially partition to sediments with high organic content and fine grain sizes. Sedimentation rates and the complex sediment dynamics within San Francisco Bay are likely also influencing the spatial distribution of sediment contamination (Krone 1979).

Urban Pesticides

Surface water samples collected from the Guadalupe River upstream of the study area from 2003 to 2005 exceed Basin Plan objectives, i.e., CTR criteria, for dieldrin and chlordanes. In January and June 2005, the SCVWD collected sediment samples in an area adjacent to Pond A8, which is not in the Shoreline Phase I Study Area but is adjacent to its southwestern corner. The January samples were collected at depths of 1.5 and 3.5 feet and were analyzed for chlordane, DDD (dichlorodiphenyldichloroethane), DDE (dichlorodiphenyldichloroethylene), DDT, and dieldrin. The June sample was collected from a depth of 1.5 feet and was analyzed only for chlordane (Earth Tech 2006). Sediment criteria have not been promulgated, so sediment concentrations were compared to probable effects levels (PEL) gleaned from the literature. Average chlordane concentrations exceeded the PEL in all three samples (two in June and one in January). Dieldrin concentrations in the January samples exceeded the PEL at both depths.

Since 1993, the RMP has included ongoing analysis of diazinon and chlorpyrifos monitoring at several stations, but none of the data have come from the study area. Mean concentrations of RMP monitoring in South Bay sloughs are 11 ng/L for diazinon and 1.4 ng/L for chlorpyrifos, which are less than the CDFW and USEPA freshwater and saltwater aquatic life criteria for each chemical (Ogle 2005). As noted, there is a TMDL in effect for diazinon for Coyote Creek and the Guadalupe River (Section 4.5.1.1.3 *Fish Ingestion Advisories*).

4.5.1.2.2.3 Other Contaminants of Concern

Metals

The USFWS has conducted some assessment of trace metals within the Shoreline Phase I Study Area (USFWS 2002). In general, trace metal concentrations (arsenic, cadmium, nickel, and zinc) in sediments do not exceed the effects range-median concentration from Long et al (1995), which is a potential indicator of concern. The nickel concentration exceeds the effects range-median in the Alviso pond complex. However, this is known to be a regional feature of sediments due to the presence of natural local mineralogy rather than human-originating sources; note that the nickel concentration in the Alviso pond complex (of which the Shoreline Phase I Study Area is a part) is consistently at or below the ambient condition. Occasional exceedance of water-quality objectives for some trace metals has been observed in monitoring studies, but the cause is not known. In the past, releases of trace metals, including copper, near the Palo Alto mud flats (west of the study area) were found to impair the reproductive success of clams, but, since the CWA was passed in the 1970s, dramatic reductions in metal discharges have reduced this impairment (Moon et al. 2003). The positive trends observed are expected to continue in the Shoreline Phase I Study Area for the foreseeable future because of continued regional monitoring and pollution-prevention efforts. Development of sediment quality objectives by the State of California may trigger the need for additional actions in discrete locations, such as marinas and harbors, which may have elevated metal concentrations in sediments.

Petroleum Hydrocarbons

Petroleum hydrocarbons typically enter the environment as a result of stormwater runoff, illegal dumping of used motor oil, operation of two-stroke boat engines, and fuel spills from storage tanks and fueling operations. Exposure to fuel spills can result in larval abnormalities in some aquatic organisms (Singer et al. 1998). Much larger fuel spills can lead to the tarring of charismatic organisms such as seals and birds (Kay 2007). Also of concern is low-grade toxicity as a result of residues left after spills and transport from urban stormwater. Because oil tanker lightering (ship-to-ship transfer of oil cargo) and other large-vessel traffic is confined to the northern and central reaches of San Francisco Bay, fuel and oil spills do not occur with any significant frequency in the Shoreline Phase I Study Area and the far South Bay.

Petroleum hydrocarbons were detected in sampling conducted at Pond A18. Gasoline was not detected and concentrations are assumed to be below detection limits, but diesel total petroleum hydrocarbons ranged from 110 to 240 μg/L. There are no surface water quality objectives to refer to for total petroleum hydrocarbons; however, the Santa Clara Valley Urban Runoff Pollution Prevention Program's NPDES general permit for treated groundwater discharges specifies a maximum daily limitation of 50 μg/L total petroleum hydrocarbons in surface water discharges to both drinking water source and nonsource areas (SFBRWQCB 2006d). The SCVWD also collected sediment samples from an area adjacent to Pond A8, which is near the southwestern corner of the study area, in January and June 2005. Samples were analyzed for total recoverable petroleum hydrocarbons (Earth Tech 2006). Samples collected in January averaged 465 mg/kg at 1.5 feet deep and 242 mg/kg at 3.5 feet deep. Samples collected in June were considerably lower, averaging 1.5 mg/kg at 1.5 feet deep and 0.59 mg/kg at 3.5 feet deep.

Trash

Trash is introduced to the watershed by people littering directly near the water and indirectly through stormwater flows. Stormwater runoff can carry litter from parking lots, roads, and adjacent areas to creeks and sloughs via overland flow and stormwater drains.

In 2009, the SFBRWQCB identified the Central and South Bays and 24 bay tributaries as impaired by trash under the Federal CWA.

The SCVWD, Santa Clara County Parks and Recreation, and the City of San José participate in the Creek Connections Action Group, which sponsors two volunteer creek cleanup days a year in Santa Clara County: a river cleanup day and a coastal cleanup day. The SCVWD also sponsors an Adopt-A-Creek program through which volunteers help preserve the health and beauty of local creeks year-round. TMDLs to manage and control the amount of trash reaching Guadalupe River and Coyote Creek are scheduled to be developed by 2021 (Section 4.5.1.1.3 *Fish Ingestion Advisories*).

Pathogens

South Bay waters in and adjacent to the Shoreline Phase I Study Area are listed as supporting the beneficial use of water contact recreation. Water contact recreation is also an existing or potential beneficial use of many of the streams that drain into the Shoreline Phase I Study Area.

This beneficial use can potentially be affected by pathogenic bacteria and associated viral pathogens. Pathogenic bacteria can also be an issue for wildlife.

As noted in Table 4.5-6 *Other Basin Plan Surface Water Criteria for the Study Area*, the 2011 Basin Plan includes surface water criteria for bacteria related to both water contact recreation and noncontact water recreation.

4.5.1.2.2.4 Fisheries Parameters

Traditional water quality parameters related to healthy habitat for fish include DO, turbidity, salinity, ammonia, and temperature. At certain levels, these parameters can be considered contaminants that threaten fisheries, wetland, and estuarine habitat and beneficial uses. Tidal waters such as San Francisco Bay and sloughs are designated in the San Francisco Bay Basin Plan as cold water and warm water fish habitat (SFBRWQCB 2011). The salt ponds and former salt ponds in the greater South Bay and Shoreline Phase I Study Area are designated as estuarine habit. Estuarine habitats are generally associated with moderate seasonal fluctuations in DO, pH, and temperature and with a wide range in turbidity (SFBRWQCB 2011). Table 4.5-9 *Pond A8 2011 Summarized Water Quality Values (Mean ± Standard Deviation)* presents the water quality values collected in 2011 from Pond A8, which is near the southwestern corner of the study area (but outside the future project footprint) and generally represents long-term water quality parameters that could be observed in Ponds A12 through A15 and A18.

Table 4.5-9. Pond A8 2011 Summarized Water Quality Values (Mean ± Standard Deviation)[a]

Month	DO (mg/L)[b]	pH (units)	Temperature (varies)[c]	Salinity (ppt)
June	7.06 ± 2.0	8.40 ± 0.3	22.10°C ± 1.8	11.80 ± 3.8
July	7.10 ±1.9	8.80 ± 0.3	22.70°C ± 1.5	9.30 ± 2.5
August	6.40 ± 2.3	8.50 ± 0.2	22.80°C ± 0.9	8.10 ± 2.0
September	6.40 ± 3.2	8.30 ± 0.2	22.00°C ± 1.2	7.30 ± 2.0
October	7.10 ± 4.0	8.40 ± 0.3	20.00°C ± 1.5	10.20 ± 2.2
Basin Plan WQO	5.0[b]	8.5	20°F[c]	44

DO = dissolved oxygen; pH = power of hydrogen; ppt = parts per thousand; WQO = Water Quality Objectives

[a] Pond A8 is a muted tidal area, with bay waters entering through water control structures. Therefore, the water quality parameters may be slightly different from what would be found in fully restored ponds, the open sloughs, or a former salt pond that is being managed by the Refuge (such as Ponds A9–A15).

[b] The Basin Plan WQO for DO is 5.0 mg/L; however, due to the infeasibility of meeting this instantaneous limit, the Basin Plan states that, if the DO concentration falls below a 10th percentile of 3.3 mg/L (calculated on a weekly basis) at the point of discharge, BMPs will be implemented.

[c] The Basin Plan states that the temperature of the discharged water shall not exceed the natural temperature of the receiving water by 20°F and discharges shall not cause temperatures to rise greater than 4°F above the natural temperatures of the receiving water at any time or place.

4.5.1.2.2.5 Turbidity

Turbidity is a measure of the clarity of water. Low turbidity measurements indicate clear water, and high turbidity indicates more-opaque water with suspended sediments. Turbidity in San

Francisco Bay is strongly influenced by re-suspension of fine sediments in shallow water by wind waves, particularly in the spring and summer. Unstable stream banks and upstream activities, such as road construction, can lead to increased suspended sediments and, therefore, increased turbidity in water. Mixing from river flows and tides can also increase turbidity in water.

Turbidity can be a habitat-limiting factor for tributaries to San Francisco Bay, and, within San Francisco Bay itself, turbidity influences phytoplankton populations. Phytoplankton are free-floating aquatic plants, and their growth in San Francisco Bay is primarily limited by light penetration, which is a function of turbidity. One of the adaptive management actions of the SBSP Restoration Project is to investigate whether decreases in turbidity around levee breaches lead to significant shifts in phytoplankton population and overall bay ecology. This same approach would be applied to the Shoreline Phase I Project.

4.5.1.2.2.6 Water Temperature

Water temperature is a concern for fish and wildlife, with both warm and cool temperatures being desirable to different species. Temperature data collected by RMP sampling in the far South Bay and South Bay sloughs range from 46 to 77 degrees Fahrenheit (°F). The median temperature is 66°F. Water temperature is expected to vary seasonally with ambient air temperature and changes in tides and freshwater inflows. The USGS measures temperature in the Alviso pond complex monthly. From 2003 to 2006, pond water temperatures ranged from 45 to 98°F with a mean of 66°F. Ponds tend to be warmest in July and coolest in December. Temperature dynamics in the former salt ponds planned for restoration are expected to change as ponds are opened to tidal action and typical water depths are altered.

4.5.1.2.2.7 Phytoplankton and Dissolved Oxygen

Phytoplankton are free-floating plants that are similar to terrestrial plants in that they contain chlorophyll and require sunlight in order to live and grow. Most phytoplankton are buoyant and float in the upper part of the ocean, where sunlight penetrates the water. A sufficient but not excessive supply of phytoplankton is necessary to support the food web, habitat, and beneficial uses of San Francisco Bay. Phytoplankton grow through photosynthesis and die naturally and through predation by zooplankton in the water column and mollusks and other benthic (occurring on the bottom of a body of water) feeders in the sediment. Incidences of rapid phytoplankton growth, known as blooms, occur when growth rates exceed mortality, predation, and external transport. Eutrophication, caused by an excess of organic matter such as nitrogen and phosphorous, and changes to the phytoplankton assemblage are potential concerns in the Shoreline Phase I Study Area (Brown and Caldwell 2008).

Dissolved oxygen (DO) in surface waters is required for the survival and health of aquatic life. The target DO concentration for a healthy ecosystem is dependent on the environment. As shown in Table 4.5-3 *Basin Plan Narrative Standards for Surface Water*, the Basin Plan sets the DO minimum at 5 mg/L. The plan does allow periodic lower concentrations by acknowledging that a 3-month median concentration of 80 percent oxygen saturation (about 6.5 mg/L) is sufficient to protect the beneficial uses of the area.

In San Francisco Bay–adjacent saline ponds and tidal marshes, lower DO concentrations are not unusual. Biological oxygen demand and chemical oxygen demand loadings to San Francisco Bay decreased substantially from 1962 through 1986 with improved wastewater treatment processes and changing land use in the watershed. Biological oxygen demand loads were reduced from nearly 100,000 pounds per day in 1962 to around 6,000 pounds per day in 1986.

Primary concern over phytoplankton blooms in the Shoreline Phase I Study Area stems from the buildup of organic matter. The organisms that decompose this organic matter use oxygen and their activity can lead to depressed DO. An additional concern is harmful changes to the phytoplankton community assemblage. The principal factor that could affect this condition during the next 10 years is the decrease in suspended sediments that results from developing accretional tidal habitat as a result of the Shoreline Phase I Project and other restoration such as that being carried out through the SBSP Restoration Project. In 2005, the USGS predicted an approximate 10 percent decrease in turbidity over the following 10 years (USGS 2005b). This could lead to changes in the timing and magnitude of algal blooms, but the overall ecosystem response is difficult to predict because of complicating factors such as benthic grazing and the ability of different algal species to produce complex agents that reduce metal bioavailability.

Low DO levels are a potential concern for the Shoreline Phase I Project actions (and ongoing SBSP Restoration Project actions) during implementation (May and Abusaba 2007). This concern stems from the low DO levels observed in the receiving waters throughout the SBSP Restoration Project area during development of the SBSP Restoration Project ISP in the early 2000s. The ISP (Life Science 2003) noted that San Francisco Bay waters are circulating through the ponds to stop the salt-making process and to lower salinities. In 2004, the first year of the ISP operations, discharges from Ponds A2W, A3W, and A7, which are not in the Shoreline Phase I Study Area but are in the Alviso pond complex, failed to meet the DO discharge requirement 23 percent, 94 percent, and 83 percent of the time, respectively. The accumulation and decomposition of phytoplankton biomass within the ISP-managed ponds have produced within-pond fish kills and odor problems that point to poor within-pond water quality. Landowners, in coordination with the USGS, implemented several corrective actions to increase compliance (USFWS 2006).

Although the USFWS and the CDFW continue to take corrective measures and make adjustments and modifications to SBSP Restoration Project ISP pond management to improve water quality and meet discharge requirements, many of the ponds continue to have periods of noncompliance (Brown and Caldwell 2008). It is likely that the Shoreline Phase I Project ponds will experience the same types of compliance challenges. Marginal locations in the Shoreline Phase I Study Area, such as sloughs and managed ponds, are at risk for low DO when increased residence times lead to accumulation of organic matter and biological oxygen demand (BOD). This can affect adjacent waters because of tidal exchange and direct discharge. Because of problems with low DO encountered during the ISP, adaptive management tools have been developed to monitor for, and avoid impacts due to, low DO and for changes in algal species composition.

4.5.1.2.3 Sediment Transport and Sediment Budget

Sediment is an important water quality consideration. Detailed information about sediment transport and the sediment budget for the Shoreline Phase I Study Area is included in Section 4.4 *Hydrology and Flood Risk Management.*

4.5.1.3 National Environmental Policy Act and Engineer Regulation 1105-2-100: *Planning Guidance Notebook* Baseline Condition

For surface water and sediment quality, the NEPA and the Planning Guidance Notebook baseline condition is determined by projecting how the resource condition might change between the current condition discussed in Section 4.5.1 *Affected Environment* and the baseline condition. The water quality condition does not change quickly and thus are not expected to be different for the NEPA and the Planning Guidance Notebook baseline year from what is described in Section 4.5.1.2 *Physical Setting (CEQA Baseline)*. Other projects in the vicinity of the Shoreline Phase I Study Area, such as ongoing implementation of the SBSP Restoration Project and the Wastewater Facility Plant Master Plan, are expected to have minor, temporary effects on surface water. Temporary construction-related effects could affect local surface waters, but projects such as these will need to comply with the CWA and the Porter-Cologne Water Quality Control Act to minimize potential water quality effects. As a result, these projects are not expected to change the physical setting over the next three years and, therefore, the NEPA and the Planning Guidance Notebook baseline condition is the same as that described in the physical setting for the purposes of the impact analysis.

4.5.1.3.1 Future Surface Water Conditions

Numerous regional planning efforts underway and/or likely to be implemented within the foreseeable future are expected to improve surface-water and sediment-quality conditions within the Shoreline Phase I Study Area. Table 4.5-10 *Likely Future Status of Water Quality Contaminants in the Shoreline Phase I Study Area* summarizes regional planning efforts and likely future conditions for surface-water and sediment contaminants discussed above.

Table 4.5-10. Likely Future Status of Water Quality Contaminants in the Shoreline Phase I Study Area

Contaminant	Regional Planning Efforts Underway	Likely Year 2067 Condition
Mercury and methylmercury	San Francisco Bay Mercury TMDL, Guadalupe River Mercury TMDL; SBSP Restoration Project Adaptive Management Plan	Gradual progress to reduce mercury concentrations in fish (50-to-200-year time scale)
Polychlorinated biphenyls (PCB)	San Francisco Bay PCBs TMDL	Gradual progress to reduce PCB concentrations in fish (50-to-200-year time scale)
Dioxins	Little – State regulatory action awaits USEPA dioxin reassessment; Section 303(d) listing status requires TMDL development, currently scheduled for completion in 2019	Uncertain – depends on outcomes of USEPA dioxin reassessment, subsequent decisions by the State of California regarding listing and/or management actions
Dichlorodiphenyltrichlorethane (DDT), dieldrin, and other legacy organochlorine pesticides	The Section 303(d) listing status requires TMDL development	Gradual progress to reduce legacy organochlorine concentrations in fish (50-to-200-year time scale)
Selenium	Limited – selenium action plan focuses more on the North Bay	Continued monitoring and assessment to determine whether impairment exists and, if so, which management actions are called for
Polybrominated diphenyl ethers (PBDE)	None, other than monitoring and assessment	Unknown
Petroleum hydrocarbons	Underground storage tank program, industrial stormwater inspections programs, and other preventive measures in place in upstream watersheds	Comparable to current condition, although increased precaution and spill response could diminish frequency and impacts; increases in recreational boating activity could be accompanied by increased inputs
Polycyclic aromatic hydrocarbons (PAH)	None	Continued monitoring and assessment to determine whether impairment exists and, if so, which management actions are called for
Diazinon and other currently used pesticides	Upstream and freshwater tributaries include TMDLs and implementation plans	Unknown
Nutrients	Regional Monitoring Program's Nutrients Strategy: The San Francisco Bay Nutrient Science and Management Strategy is a regional initiative for developing the science needed for informed decisions about managing nutrient loads and maintaining beneficial uses within the bay in response to the apparent changes in the bay's resilience to nutrient loading.	Loadings of biological and chemical oxygen demands to the South Bay as a result of pond restoration would need to be monitored and managed
Algae	SBSP Restoration Project Adaptive Management Plan; the USEPA's National Coastal Condition Assessment will also be sampling for harmful algal species in the bay in 2015.	SBSP Restoration Project Adaptive Management Plan will continue to monitor and manage to avoid impacts; uncertain what actions could be taken as a result of USEPA coastal assessments.
Trace metals (copper, nickel, zinc, lead, silver, and cadmium)	Water Quality Attainment Strategy for copper and nickel in the South Bay	Continued monitoring, pollution prevention will lead to constant or declining levels of metals in sediments and water column; increased marina activity would require precautionary measures against increased discharges of copper-based paints and other antifouling agents

North Bay = North San Francisco Bay; South Bay = South San Francisco Bay; TMDL = total maximum daily load; SBSP Restoration Project = South Bay Salt Pond Restoration Project; USEPA = U.S. Environmental Protection Agency

In addition to the planning efforts, urban stormwater programs are expected to reduce mercury loads to approximately 50 percent of their current levels over the next 20 years, or to make a demonstration that such a reduction is infeasible (SFBRWQCB 2006c). The Wastewater Facility, a major municipal wastewater treatment plant in the Shoreline Phase I Study Area, is also subject to mercury control measures. Because its discharges already constitute a small fraction of mercury loads to San Francisco Bay, control measures called for in the TMDL focus on mercury methylation and localized effects. Over the next decade and into the foreseeable future, the effect of stormwater and wastewater on mercury in the Shoreline Phase I Study Area can reasonably be expected to improve as a result of increased scrutiny of these regulated discharges. County health departments will continue to monitor waters where human contact recreation is popular, and persistent impairments will be addressed through TMDLs or other regional water quality control measures.

Also contributing to improved water quality will be the Shoreline Monitoring and Adaptive Management Plan (MAMP), which will be integrated with the SBSP Restoration Project Adaptive Management Plan. The MAMP will provide guidance to upstream landowners, such as the City of San José and the USFWS, on how to manage their lands to reduce water quality impacts as much as possible.

4.5.2 Environmental Consequences

4.5.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

Avoidance and minimization measures are those parameters that have been built into the design of the Proposed Project and are committed to as part of project implementation. These measures are generally included in the alternatives description of this report (Section 3.8 *Action Alternatives Component Details*), but, where appropriate, the specific measures related to the impact evaluations are also summarized in the resource chapters.

The following presents the AMMs that are part of the proposed action and a general discussion of the impact minimization measures and adaptive management actions presented in SFBRWCB WDR No. R2-2008-0078. Although the WDR permitted only SBSP Restoration Project actions, which do not include restoration of Ponds A12–A15 and A18, the WDR may be amended to include the Shoreline Phase I Project or the State may issue a new order with similar measures for the Shoreline Phase I Project.

- **AMM-WAT-1: Staging Area** – Establish staging areas for activities such as fueling, equipment storage, and fill storage.
- **AMM-WAT-2: Fuel Management Plan –** Develop and incorporate a Fuel Management Plan.
- **AMM-WAT-3: Turbidity Management Plan –** Implement a Water Quality and Turbidity Management Plan; plan will include stormwater management.
- **AMM-WAT-4: Pond Construction Timing –** Conduct pond construction activities prior to breaching to minimize turbidity and water quality degradation.

- **AMM-WAT-5: Hazardous Spill Plan –** Develop and incorporate a Hazardous Spill Plan.
- **AMM-WAT-6: Seasonal Restrictions –** Implement wet-season restrictions for water quality protection.
- **AMM-WAT-7: Minimize Footprint –** Avoid and minimize areas of disturbance; use smallest footprint necessary.
- **AMM-WAT-8: Clean Equipment –** Clean all equipment of soil, seeds, and plant material prior to arriving on site to prevent the introduction of undesirable plant species.
- **AMM-WAT-9: Site Maintenance –** Maintain project sites trash-free and contain food refuse in secure bins; trash will be removed daily. Development of trails will include trash receptacles and signage encouraging the proper disposal of waste.
- **AMM-WAT-10: In-Stream Sediment Control –** Use coffer dams and/or silt curtains to the extent feasible during construction.
- **AMM-WAT-11: Protect Hazardous Sites –** Protect potentially hazardous sites.
- **AMM-WAT-12: Use of On-Site Material –** Use on-site material and natural sedimentation processes to fill in low areas of ponds.
- **AMM-WAT-13: Sediment Accretion Areas –** Manage sediment accretion areas to maintain and create marshes and trap additional material.

Table B-8 in Appendix B (ii) of the WDR proposes adaptive management to monitor potential water quality impacts during SBSP Restoration Project Phase I activities; the WDR for the Shoreline Phase I Project is expected to be similar. The following adaptive management restoration targets will likely be included in the WDR issued to cover the Shoreline Phase I Study Area and will be implemented as part of the project. Any additional measure prescribed in the WDR issued for the project would also be implemented.

- **AMM-WAT-14: Water Quality Parameters –** Water quality parameters in ponds will meet SFBRWQCB standards.
- **AMM-WAT-15: Water Quality Baseline –** South Bay water quality will not decline from baseline levels.
- **AMM-WAT-16: Dissolved Oxygen –** DO levels will meet Basin Plan WQOs.
- **AMM-WAT-17: Mercury in Sentinel Species –** Levels of mercury in sentinel species do not show significant increases over the baseline condition, and not higher in target restoration habitats than in existing habitats.
- **AMM-WAT-18: Control of Nuisance Algae –** Nuisance and invasive species of algae are not released from the study area to the South Bay.

In addition to the restoration targets, WDR Order No. R2-2008-0078 also presents water and sediment quality monitoring parameters, methods, and frequency. The water quality monitoring parameters address salinity, pH, temperature, DO, MeHg, THg, dissolved organic carbon, TOC, suspended sediment concentration, sulfate, sulfide, and nutrients. Sediment sampling parameters are THg, MeHg, sulfate, and sulfide.

The potential to temporarily degrade water quality and exceed the limits proposed in the WDR is a possibility during construction. The WDR includes the following methods to reduce the temporary impairment of water quality; similar measures would be applied to the Shoreline Phase I Project.

- **AMM-WAT-19: Minimize In-water Construction –** In-water construction activities will be minimized to the extent practical.
- **AMM-WAT-20: Turbidity Control –** The use of BMPs for turbidity control shall be employed during all in-water work conducted in the sloughs or bay, where appropriate.
- **AMM-WAT-21: Stormwater Runoff Control –** No debris, soil, silt, sand, cement, concrete, or washings thereof, or other construction-related materials or wastes, oil, or petroleum products, or other organic or earthen material shall be allowed to enter into or be placed where it may be washed from the construction sites by rainfall or runoff into waters of the State.
- **AMM-WAT-22: Stormwater Management Plan –** A Stormwater Management Plan will be developed to ensure that, during rain events, construction activities do not increase the levels of erosion and sedimentation. This plan will include the use of erosion-control materials (i.e., baffles, fiber rolls, or hay bales; temporary containment berms) and erosion-control measures such as straw application or hydroseeding with native grasses on disturbed slopes; and floating sediment booms and/or curtains to minimize any impacts that may occur due to increased mobilization of sediments.
- **AMM-WAT-23: Use of Clean Fill –** All clean fill material proposed for upland and wetland placement will meet the qualifications set forth in the RWQCB’s waste discharge requirements (Tentative Order), approved with respect to chemical and biological suitability for uplands and wetlands by the Dredged Material Management Office.

The proposed project would disturb more than 1 acre of land, so construction activity would be subject to the State’s general permit for construction-related storm water management (Order No. 2009-000-DWQ, as amended). Complying with this general order requires the preparation of a SWPPP that outlines BMPs that would be implemented during project construction. Applying these BMPs and complying with the general order will further prevent water quality impacts during construction.

- **AMM-WAT-24: Prepare SWPPP –** Erosion will be controlled based on the SWPPP to be prepared for the project. Implementing the SWPPP measures will minimize soil erosion and related sedimentation.

The Biological Opinions (BOs) for the SBSP Restoration Project (Document 81420-08-F-0621 from the USFWS dated August 12, 2008, and Document 2007/08128- 2008/02283 from the

NMFS dated January 14, 2009) include several conservation measures to prevent water quality impacts that could affect species covered by the opinions. The USFWS Biological Opinions for the Shoreline Phase I Project were issued after release of the Integrated Document. The Shoreline Phase I Project BOs contain water quality protection measures that are similar to those listed in the SBSP Restoration Project BOs and would result in the same level of water quality protection. The SBSP Restoration Project BO measures that would protect water quality are listed below and will be adopted as they are presented in the Shoreline Phase I Project Biological Opinions.

- **AMM-WAT-25: No Treated Wood –** Treated wood will not be used in structures that come in contact with water.
- **AMM-WAT-26: Equipment Staging and Fueling –** Vehicle staging, cleaning, maintenance, refueling, and fuel storage will be located 150 feet or more from any stream, water body, or wetland. If an action cannot meet this 150-foot requirement, additional BMPs may be required and will be described for each action.
- **AMM-WAT-27: Hazardous Spill Plan –** A Hazardous Spill Plan will be developed prior to construction of each action. The plan will describe what actions will be taken in the event of a spill. The plan will also incorporate preventative measures to be implemented, such as vehicle and equipment staging, cleaning, maintenance, and refueling; and contaminant (including fuel) management and storage. In the event of a contaminant spill, work at the site will immediately cease until the contractor has contained and mitigated the spill. The contractor will immediately prevent further contamination and notify appropriate authorities and will mitigate damage as appropriate. Containers for storage, transportation, and disposal of contaminated absorbent materials will be provided on the project site.
- **AMM-WAT-28: Prevent Equipment Leaks –** All equipment will be maintained free of petroleum leaks. No equipment will enter live water except for aquatic equipment or amphibious equipment designed specifically for aquatic or amphibious use. All vehicles operated within 150 feet of any water body will be inspected daily for leaks and, if necessary, repaired before leaving the staging area. Inspections will be documented in a record that is available for review on request.
- **AMM-WAT-29: Stabilize Construction Areas –** All disturbed areas will be stabilized within 12 hours of any break in work unless construction will resume work within 7 days. Earthwork will be completed as quickly as possible, and site restoration will occur immediately following use.
- **AMM-WAT-30: Invasive Plant Prevention –** To reduce potential impacts from infestation by species such as nonnative *Spartina*, pepperweed, stinkwort (*Dittrichia graveolens*), Algerian sea lavender (*Limonium ramosissimum*), and other invasive, nonnative plant species, all equipment (including personal gear) will be cleaned of soil, seeds, and plant material prior to arriving on site to prevent introduction of undesirable plant species. Equipment and personal gear will be subject to inspection. If any

invasive, nonnative plant species are found, a qualified botanist will recommend specific measures to control the spread of nonnative plant species. All infestations will be controlled and removed in coordination with the current eradication program for *Spartina* being implemented within the bay without substantially hindering or harming the establishment of native vegetation in the restored wetlands or along levee slopes or surfaces.

4.5.2.2 Methodology for Impact Analysis

The State of California's water quality standards program is the primary basis for determining thresholds for impacts, although the USEPA can promulgate standards and intercede in NPDES permits and other Federal actions. The State's water quality program is a continuous planning process and accounts for regional or site-specific differences that may affect water quality. Therefore, WQOs may vary accordingly in space and time.

Project alternatives include two main elements: FRM activity (constructing the FRM levee) and ecosystem restoration (restoring action to the former salt pond areas). Other project elements include recreational enhancements and ongoing adaptive management prescribed by the SBSP Restoration Project Adaptive Management Plan. Any of these activities could cause water quality effects.

Actions associated with FRM and former salt pond restoration would result in a number of effects, both beneficial and adverse, on the aquatic species and habitats in the Shoreline Phase I Study Area. The NEPA does not provide quantitative thresholds to determine what constitutes a significant environmental effect or quantitative guidance for determining whether an effect is significant. However, because the State of California has adopted WQOs consistent with Federal law, this analysis considers water quality effects using the State's adopted standards.

The project's effects on water quality are deemed significant if the project would:

- **Impact WAT-1:** Result in a violation of any water quality standard or waste discharge requirement including:
  - San Francisco Basin Plan numeric or narrative standards (described in Section 4.5.1.1.1 *San Francisco Bay Basin Plan*)
  - Any discharge limitation contained in SFBRWQCB WDR No. R2-2008-0078 or similar order
  - Standards associated with adopted TMDLs for Coyote Creek (diazinon), Guadalupe River (diazinon and mercury), and South San Francisco Bay (mercury)
- **Impact WAT-2:** Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on or off site, including drainage patterns in the Coyote Creek and Guadalupe River watersheds

4.5.2.3 Alternatives Evaluation

With the exception of the No Action Alternative, levee construction and pond restoration activities of the four project alternatives would be performed in a similar manner. Detailed descriptions of proposed levee construction methods and pond restoration activities are provided in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*. The following action alternative discussions focus on construction-related impacts of each alternative and impacts associated with long-term adaptive management activities that could occur in the Shoreline Phase I Study Area.

4.5.2.3.1 No Action Alternative

The No Action Alternative assumes that no project, including no new FRM activities, no transitional habitat construction, and no ecosystem restoration would be implemented by the USACE, the USFWS, or local interests. The baseline year activities would consist of ongoing SBSP Restoration Project activity in the vicinity and ongoing Refuge management activity. At the end of the period of analysis, water quality would probably be about the same, although some conditions (such as those related to mercury, PDBE, and legacy pesticides) might improve, since the ambient levels for these substances should not (in theory) continue to increase.

Under the No Action Alternative, the USFWS would continue to manage Ponds A9 through A15 as part of the Refuge, and Pond A18 would continue to be managed by the City of San José. The ponds would most likely be managed as isolated ponds; continued management of the ponds as isolated water bodies could result in limited mixing and oxygen exchange which, coupled with continued algal growth and build-up of organic matter, could result in oxygen depletion. Under a low-oxygen condition, anaerobic decomposition processes could increase. Hydrogen sulfide, a byproduct of anaerobic respiration, is responsible for the “rotten egg” smell of brackish waters. Some metals precipitate in the presence of hydrogen sulfide, leading to adverse impacts on aquatic life.

If management is discontinued due to lack of funding or a change in land ownership, isolated ponds would become seasonal, and hydrologically connected ponds would maintain flow via gravity control structures. Seasonal ponds would fill and dry through rainfall and evaporation. It is possible that storm events or unmaintained, former salt pond dikes could breach, releasing algae to the slough and bay.

The USFWS could move forward with ecosystem restoration activities as part of Refuge management. The USFWS and the City could also perform emergency repairs on the former salt pond dikes that fail, thus potentially minimizing water quality effects associated with unintentional breaches.

The San Francisco Bay region is in a seismically active area; therefore, the pond dikes could catastrophically fail or the ponds could be inundated as a result of seismically induced seiches (a standing wave in an enclosed or partially enclosed body of water) or tsunamis, causing a large discharge into the bay. Unintentional breaching of levees would cause sudden flows of pond water into the bay. The discharged water from many ponds would be rich in algae, ammonia nitrogen, and phosphorous, as evidenced by preliminary assessments. These unintentional breaches would probably be repaired, but the schedule and complexity of the repair would depend on funding and risk involved with not repairing the breach.

Long-term exposure of pond dikes to flooding and wave action, in combination with limited levee maintenance, could eventually result in levee failures. The resulting discharge would most likely result in a short-term localized yet substantial impairment of water quality in the form of a large and rapid increase in the concentrations of salinity, suspended sediment, and other contaminants. Depending on the location of levee breaches, water quality impacts could occur within the Coyote Creek or Alviso Slough and the bay. Continual erosion or catastrophic destruction of Ponds A12, A13, and A15 could cause longer-term and more-severe water quality impacts because the ponds contain large amounts of salt (they are currently managed as batch ponds with salinity at 80 to 120 ppt) that could be released. Alviso Slough, adjacent to Pond A12, is particularly vulnerable because the slough is small and has limited tidal water exchange and dilution of potential discharges.

Within the breached pond, there may be water quality effects as well. Circulation may be inconsistent, with some areas remaining stagnant, which could result in increased algae and conditions to support MeHg production. The duration of such an impairment is difficult to estimate due to the unpredictability of the discharge. However, the significance of the impact would likely be greater than the impacts that would occur during a managed breaching. Under a managed breach, the process would be designed in advance to have appropriate circulation to avoid water quality problems associated with algae production and MeHg.

See Section 4.4 *Hydrology and Flood Risk Management* for information about flood impacts with the No Action Alternative.

4.5.2.3.2 Action Alternatives

The action alternatives include constructing a FRM levee, constructing transitional habitats on Ponds A12 and A18, and breaching existing levees and berms associated with Ponds A9 through A15 and A18. Activities would be performed based on the AMMs listed in Section 4.5.2.1 *Avoidance and Minimization Measures Incorporated into the Alternatives*. Detailed descriptions of the action alternatives are presented in Section 3.8 *Action Alternatives Component Details*.

Impact WAT-1: Result in a violation of any water quality standard or waste discharge requirement

Construction activities associated with building the FRM levee, building transitional habitats, and restoring tidal action to the former salt ponds would require using construction equipment and moving fill material into the Shoreline Phase I Study Area. This would temporarily increase the potential for discharging to or suspending pollutants (such as fuels and oils associated with heavy equipment) in water bodies in and adjacent to the study area. These impacts would be minimized by AMM-WAT-1: Staging Area; AMM-WAT-2: Fuel Management Plan; AMM-WAT-3: Turbidity Management Plan; AMM-WAT-5: Hazardous

Spill Plan; AMM-WAT-7: Minimize Footprint; AMM-WAT-11: Protect Hazardous Sites, AMM-WAT-14: Water Quality Parameters, AMM-WAT-15: Water Quality Baseline; AMM-WAT-19: Minimize In-water Construction; AMM-WAT-20: Turbidity Control; AMM-WAT-21: Stormwater Runoff Control; AMM-WAT-22: Stormwater Management Plan; AMM-WAT-24: Prepare SWPPP; AMM-WAT-26: Equipment Staging and Fueling; AMM-WAT-27: Hazardous Spill Plan; AMM-WAT-28: Prevent Equipment Leaks; AMM-WAT-29: Stabilize Construction Areas.

The extent of potential environmental impacts would depend on the erodibility of soil types encountered, type of construction practices, extent of disturbed area, duration of construction activities, timing of precipitation, and proximity to drainage channels. Construction during the winter rainfall season could be particularly problematic because of the increased potential for discharges of contaminated storm water runoff from construction sites. This potential impact would be minimized by AMM-WAT-6: Seasonal Restrictions.

Levee Construction

Construction of the FRM levee would take place in the first 3 years of the project. The following paragraphs summarize the potential water quality effects associated with levee construction.

Earth Moving. This activity would require discharging fill to areas that currently border wetlands and sloughs. For the most part, levees would be constructed on levees and berms not originally constructed for FRM (Alternatives 2, 3, and 5) or partially along an existing railroad grade (Alternative 4), but material could fall back into wetland or slough areas or, in some cases, might need to be discharged directly to wetland or slough areas. The levees would be constructed using soil available in the study area. Alternatives 2, 3, and 4 would involve disturbance along Pond A12, which has historically been identified as having sediments with THg levels that exceed Basin Plan objectives. Disturbance to sediments on the edge of Pond A12 could mobilize and transport this contaminant. Implementation of AMMs would limit water quality effects, and imported clean fill used to construct the levee would permanently cover some mercury-laden sediment (AMM-WAT-22: Stormwater Management Plan, AMM-WAT-23: Use of Clean Fill). However, earth moving could cause dust, which could fall into adjacent wetlands and sloughs. See Section 4.10 *Air Quality/Greenhouse Gases* for the air quality effects associated with dust and a discussion of dust control methods that will be implemented as part of the project. Earth-moving activity would be limited to the area needed to support levee construction and would not affect drainage patterns in the Coyote Creek and Guadalupe River watersheds.

Equipment Use. Constructing the levee would require using heavy equipment. Equipment would be staged in specific areas, thereby minimizing potential effects on water quality by physically separating equipment from sensitive areas (see Figure 3.8-2 *Potential Staging Areas* in Section 3.8.1 *Flood Risk Management Details* for potential staging locations). By fueling, conducting maintenance on, and storing equipment not being used away from wetlands and sloughs, the potential for accidental discharges of fuels, oils, and other contaminants would be minimized. Equipment failures could lead to accidental discharges during construction activities, but contractors would prepare and implement a Hazardous Spill Plan and provisions of the required SWPPP to minimize adverse effects (AMM-WAT-2, AMM-WAT-5, AMM-WAT-22, AMM-WAT-24, AMM-WAT-27, AMM-WAT-28).

Flood Gates. Construction of any of the levee options would require installing a tide gate closure system at Artesian Slough and flood gate at the Union Pacific Railroad crossing.

The Artesian Slough tide gate would be used by the Wastewater Facility in the event of tidal flooding. The proposed location of the tide gate for all alignment options would be at least 300 feet bayward of the existing Wastewater Facility outfall weir for treated water at Artesian Slough (Figure 3.5-2 *Potential Artesian Slough Crossing Options*). The gate would be installed at the time the levee is constructed and would require similar earth moving and equipment use. Because of the Artesian Slough gate's proximity to the slough, AMMs that would be implemented include measures designed to specifically protect the water quality of the slough.

All of the alternatives also include railroad flood gate where the FRM levee would cross the active railroad line just east of Pond A12. Concrete barriers would be installed on either side of the railroad right-of-way and would tie into the earthen levees. Two 60.5-foot-long by 10.25-foot-wide leaf swing gates would be connected to the barrier and would remain open during normal conditions and closed during flood conditions. There would be a 380-foot-long by 10-foot-wide pedestrian bridge over the flood gate, and the bridge would be supported on steel pipe columns to provide rail car clearance. Installing the gate and bridge would not directly affect any surface waters. Erosion-control measures in the SWPPP would prevent potential stormwater-related impacts to nearby waterbodies (AMM-WAT-24).

Artesian Slough Freshwater Transfer. Construction of any of the Alviso levee options would block a freshwater input from Artesian Slough to a freshwater marsh area near the Don Edwards Environmental Education Center. To compensate for the loss of freshwater inflow to the marsh, all of the alternatives include a small breach of an existing berm along the west side of Artesian Slough to allow gravity flow of freshwater from the slough to the marsh. The breach would be sized to provide the same amount of input that occurs under the baseline condition. Water quality of this part of Artesian Slough could be temporarily affected at the time of the breach, but, given the size of the breach, the water quality effects are not expected to be significant. For comparison, surface water effects associated with much larger breaches that would be created as part of ecosystem restoration would not cause any significant water quality effects (see the section *Ecosystem Restoration Construction* on page 4-166). Because the freshwater transfer breach would be much smaller and would not involve any other construction, its potential water quality effects are also expected to be less than significant.

Summary of FRM Construction Effects. Implementation of measures outlined in the required SWPPP would avoid or minimize adverse impacts on water quality during levee construction, flood gate installation, and the Artesian Slough freshwater transfer breach (AMM-WAT-24). Work adjacent to Pond A12 with Alternatives 2, 3, and 4 could disturb and temporarily suspend mercury-containing sediment in Pond A12, but would also permanently cover some mercury laden sediments. Construction of the levee at Pond A12 would occur prior to breaching the exterior levee, so any sediment would be contained in Pond A12.

Using designated equipment staging areas would avoid or minimize the potential for accidental equipment discharges.

Levee construction would not result in a violation of any numeric or narrative standard, exceed any discharge limitations in SFBRWQCB WDR No. R2-2008-0078, violate standards associated with adopted TMDLs, or alter drainage patterns in a way that would cause substantial erosion or siltation.

Levee construction surface water and sediment quality effects would be less than significant.

Transitional Habitat Construction

As described in Section 3.6.9 *Transitional Habitat*, Alternative 3 includes a 30:1 ecotone, and Alternatives 2, 4, and 5 include a bench for Ponds A12 and A18. Construction of the A12 transitional habitat would take place in 2019 and 2020 so that it is in place before the pond is breached. Construction of this transitional habitat would use available, on-site fill material and would not require any imported fill. Fill used for the Pond A12 transitional habitat would come from excess levee construction material and pond preparation.

The Pond A18 transitional habitat would also be constructed before the pond is breached. Some of the material for the Pond A18 transitional habitat would come from available, on-site material, but the remainder would need to be imported.

In general, transitional habitat construction would consist of similar activity as that described for FRM levee construction above. Implementation of AMMs would avoid or minimize adverse water quality impacts during transitional habitat construction (AMM-WAT-22). As described above, construction of the transitional habitat near Pond A12 could disturb and temporarily suspend mercury-containing sediment. The AMMs would also be used to minimize this potential effect. Transitional habitat construction would not result in a violation of any numeric or narrative standards, exceed any discharge limitations in SFBRWQCB WDR No. R2-2008-0078, violate standards associated with adopted TMDLs, or alter drainage patterns in a way that would cause substantial erosion or siltation.

Transitional habitat construction surface water and sediment quality effects would be less than significant.

Ecosystem Restoration Construction

In-pond preparation for ecosystem restoration would begin concurrently with levee construction (in 2018) and would continue intermittently through about 2030.

Ecosystem restoration involves many activities that would disturb upland areas, currently inundated and saturated pond areas, and points along Alviso Slough and Coyote Creek. The lowering of outboard levees, excavation of pilot channels, and breaching of outboard levees would be the primary earthwork components of restoration activities that would have the potential to affect water quality. Construction of starter channels, construction of sidecast berms, lowering of internal berms, and breaching of internal berms would take place prior to breaching when the ponds are still hydraulically isolated from the bay, and therefore would not affect water quality. Although impacts on water quality from construction activities would be mostly temporary, they may result in an exceedance of some standards or objectives.

Ecosystem restoration construction activity would be subject to water quality protection AMMs adopted as part of this project, BMPs outlined in a SWPPP for each construction phase, and WDRs. WDR Order No. R2-2008-0078 applies to the SBSP Restoration Project and could be amended to include the Shoreline Phase I Project work area. If the Shoreline Phase I Project requires a new WDR, the requirements would probably be similar to those included in the SBSP Restoration Project WDR. The following discussion assumes that an amended WDR Order No. R2-2008-0078 or a similar order would apply to the Shoreline Phase I Project.

Turbidity

Construction of the pilot channels would be achieved with an amphibious excavator. Material would be excavated from the base of the pilot channels and used to fortify existing berms in the work area. In the presence of water, this process could re-suspend sediment downgradient and in the immediate construction area, thereby increasing turbidity.

WDR Order No. R2-2008-0078 states that turbidity of waters of the State, at any location more than 100 feet from the project boundary or point of discharge, shall not increase by more than the following for more than 24 hours, to the extent practical (AMM-WAT-14: Water Quality Parameters).

Receiving Waters Background Level	**Incremental Increase**
< 50 nephelometric turbidity units (NTU)	5 NTU maximum
≥ 50 NTU	10 percent of background, maximum

These standards would be applied to the Shoreline Phase I Project restoration activities. For the proposed restoration work, the project boundary is assumed to be the existing pond dikes. Because the ponds would remain isolated during all pond restoration activities (except breaching), no significant adverse effects due to turbidity are anticipated. During and immediately following pond dike breaching, turbidity levels would be elevated as sea water entered the ponds. However, most suspended sediments are anticipated to settle within the ponds within 24 hours, and flow of pond water back into the slough and bay during the following low tide is not expected to raise turbidity more than 10 percent above background.

Turbidity impacts would not exceed limitations in SFBRWQCB WDR No. R2-2008-0078 and would be less than significant.

Temperature

Construction of the pilot channels, levee breaching activities, and construction of the inboard features should not result in temperatures that exceed the WQO. WDR Order No. R2-2008-0078 states that the construction activities shall not cause the temperature of any cold or warm freshwater habitat to be increased by more than 5°F above natural receiving water temperature, unless a qualified biologist can demonstrate that such alteration in temperature would not adversely affect beneficial uses (AMM-WAT-14).

Upon sedimentation of the pond, some shallower areas may warm that did not before. Implementing the Shoreline MAMP, which includes circulation management, will ensure that the temperature WQO is met.

Temperature impacts would not exceed limitations in SFBRWQCB WDR No. R2-2008-0078 and thus would be less than significant.

Dissolved Oxygen

Excess nutrients in the isolated ponds, especially in late summer, could lead to accelerated algal growth that could upset the balance of dissolved oxygen and lead to adverse impacts on water quality. Breaching the ponds would result in more mixing and atmospheric oxygen exchange in the ponds and would increase dissolved oxygen levels. This is a potential long-term beneficial effect. In the short term, application of AMMs incorporated into the Shoreline MAMP would minimize potential temperature effects, thus preventing excessive algae growth and related effects on DO. Ecosystem restoration activities would comply with the Basin Plan's narrative standard for DO (AMM-WAT-16: Dissolved Oxygen) and would not cause any short-term adverse effects due to depletion of dissolved oxygen.

Dissolved oxygen impacts would not exceed limitations in SFBRWQCB WDR No. R2-2008-0078 and thus would be less than significant.

Salinity

Ponds A12, A13, and A15 have recently been operated as managed ponds to maintain higher salinity levels (between 80 and 120 ppt) for brine shrimp habitat (SFBRWQCB 2008). Managed ponds are ponds that are operated to hold higher-salinity water for longer periods. WDR Order No. R2-2008-0078 for the SBSP Restoration Project established a salinity discharge limit of 44 ppt; the same limit would be applied to the Shoreline Phase I Project (AMM-WAT-14).

The Shoreline Phase I Project is specifically designed to introduce lower-salinity water (bay water) into the former salt ponds to reduce the amount of accumulated salts in the ponds to manageable levels through tidal water exchange and dilution of the existing higher-salinity pond water. When the former salt ponds are initially breached and bay water infiltrates the former salt ponds, there is a potential that the salinity of adjacent waters (slough and bay waters) may temporarily increase above the standard in WDR Order No. R2-2008-0078. However, when the USFWS and the State Coastal Conservancy breached Ponds A7, A8, and A16 as part of the SBSP Restoration Project, salinity measurements recorded at the water surface and near the bottom of the receiving water yielded results less than 44 ppt. The Shoreline MAMP (Appendix F *Shoreline Study Monitoring and Adaptive Management Plan for Ecosystem Restoration*), which would be integrated with the SBSP Restoration Project

Adaptive Management Plan, describes the water quality–protective monitoring and corrective measures that would be implemented during breach events.

Given the uncertainty, discharging water greater than 44 ppt could follow pond breaching and result in a short-term violation of this limit, which would be a significant impact. Mitigation would be required to address this impact (see Section 4.5.3 Mitigation Measures*).*

Metals

To ensure that the SBSP Restoration Project activities did not discharge metals at toxic levels, WDR Order No. R2-2008-0078 used salinity as an indicator parameter for the concentrations of metals (AMM-WAT-14). Many of the metals present in the ponds (including mercury) are present as inorganic salts. Therefore, management of salinity should result in relatively greater dilution of the metal and organic constituents to levels that would not adversely affect aquatic organisms. However, if salinity reduction operations are not controlled, adverse water quality impacts could potentially occur in receiving waters.

Table 4.5-11 *Maximum Salinity and Associated Metals Levels for the Alviso System for the South Bay Salt Pond Restoration Project* presents modeled metals concentrations based on a salinity concentration of 44 ppt. The following table was copied from WDR Order No. R2-2008-0078; similar standards would apply to the Shoreline Phase I Project. Compliance with these standards would minimize potential impacts related to metals.

Because the project would comply with the standards, impacts related to metals would be less than significant.

Table 4.5-11. Maximum Salinity and Associated Metals Levels for the Alviso System for the South Bay Salt Pond Restoration Project

Salinity	Cr (µg)	Ni (µg)	Cu (µg)	Zn (µg)	As (µg)	Se (µg)	Ag (µg)	Cd (µg)	Hg (ng)	Pb (µg)
44 ppt	1.22	8.05	2.98	1.83	10.7	0.4	0.01	0.08	1.8	0.31
WQO[a]	11.4	27	13	86	36	5.0	2.2	0.27	50	3.2

ppt = parts per thousand; µg = micrograms; WQO = Water Quality Objectives

Note: To estimate the maximum metals concentrations from the Alviso System for continuous discharges, WDR Order No. R2-2004-0018 considered an average of Regional Monitoring Program (RMP) data from 1997 to 1999 at the South Bay Station and salt ponds with salinities of 31.6 and 42 ppt.

[a] The Basin Plan specifies WQO south of Dumbarton Bridge for copper and nickel only. For the other inorganics, WQO are from the California Toxics Rule. Since the SFBRWQCB must express limits for metals in the total recoverable form, the SFBRWQCB staff used default translators to convert dissolved water quality objectives to total. The WQO for chromium, cadmium, and lead are freshwater-driven and are based on a hardness of 100 mg/L as $CaCO_3$, which is the lowest value found in sloughs (in this case, Guadalupe Slough) monitored near the discharge in the Regional Monitoring Program.

Summary of Ecosystem Restoration

Construction Effects. Without implementing the measures described in WDR Order No. R2-2008-0078 and the BMPs prescribed in the project’s SWPPP, construction of the ecosystem restoration elements of the project could cause temporary surface water quality impacts.

Implementing these water quality protection measures (AMM-WAT-14, AMM-WAT-15, AMM-WAT-16, AMM-WAT-17) would help minimize these impacts, which would be limited in geographic area (that is, limited to Pond A12 at about Year 3 [2020]; Ponds A9, A10, A11, and A18 at about Year 8 [2025]; and Ponds A13, A14, and A15 at about Year 13 [2030]) and duration (activity that could affect water quality would be short-term).

Operation of construction equipment during construction of proposed water-control structures could result in minor releases of contaminants and minor erosional impacts. Potential water quality impacts from saline discharges from project ponds into Alviso Slough and Artesian Slough from Ponds A12, A13, and A15 would be limited to a 3-to-5-week period and would be subject to WDRs that would minimize potential effects. Compliance with WDR Order No. R2-2008-0078 and the project-specific SWPPP would ensure that the beneficial uses of water are protected. Ecosystem restoration construction activity would not result in any significant effects. None of the alternatives would cause effects that would violate Basin Plan numeric and narrative standards, exceed discharge limitations in SFBRWQCB WDR No. R2-2008-0078, violate standards associated with adopted TMDLs, with the possible exception of maximum salinity into the bay. Construction efforts will not alter drainage patterns in the Coyote Creek and Guadalupe River watersheds.

Operation and Maintenance Effects. The reintroduction of tidal influence to the study area and other restoration projects in the region would generally improve water quality in the far south San Francisco Bay by reducing the amount of suspended sediment and diluting nutrients such as nitrogen and phosphorous that stimulate algal growth and can lead to increased eutrophication of the waterways in and downstream of the study area. Restoring tidal influence to the former salt ponds would reduce water stagnation that could result in production of algae blooms and subsequent oxygen depletion. Hydrologically connecting the ponds to the adjacent sloughs and creeks could help dissipate the energy of these water bodies as they reach the bay, thereby allowing more suspended sediments to settle and reducing turbidity in waters flowing into the bay. Pond restoration could also dissipate the energy of incoming waters during spring tides, which could reduce erosion and flooding. The connected ponds may also be important for pollution sequestration, since the organic material in the ponds draws in pollutants and they may therefore contain large concentrations of heavy metals.

Differences in conventional constituents (e.g., pH, temperature, total suspended solids (TSS), DO, BOD, and biostimulatory nutrients [nitrogen and phosphorus]) between the project ponds and background receiving waters are relatively low compared to the differences in salinities in the ponds and receiving waters. Therefore, careful management of salinity (less than 44 ppt) should result in small changes in conventional constituents in the receiving waters and ensure that metals are not detected above their WQO.

In the long term, the impact of the project and other wetlands restoration, enhancement, and creation projects is expected to be positive since wetlands are generally acknowledged to provide favorable water quality improvement mechanisms such as filtration, settling and entrapment of sediment, photodegradation, adsorption, and enhanced biological activity (nutrient uptake, chemical transformation, and degradation).

Changes to the Composition and Abundance of Algae

Sediment accretion in the ponds will ultimately reduce the water depth, resulting in the establishment of wetland plants in the ponds. If water is stagnant inside the pond area and circulation is poor, algal blooms and conditions for MeHg production could increase in frequency. However, the loss of suspended sediment to settling within the breached pond area can potentially increase water transparency outside the pond.

The impact analysis presented in the SBSP Restoration Project Final EIS/EIR (EDAW et al. 2007) found that the SBSP Restoration Project Phase I action at Pond A16 (which is completely surrounded by the Shoreline Phase I Study Area) would likely increase algal abundance, but, with appropriate design, operation, monitoring, and management as proposed in the MAMP (such as mechanical harvesting, limiting retention times, and excavating for deeper water depths), the effect would be less than significant, and any changes are expected to be minor. Any changes would not cause a condition that could result in a violation in established mercury standards. The Shoreline MAMP, which will be integrated with the SBSP Restoration Project Adaptive Management Plan, will be implemented such that any effect on algae populations would be less than significant (AMM-WAT-18: Control of Nuisance Algae), and any changes would be minor.

Long-term operation of the project would result in less-than-significant impacts to changes to the composition or abundance of algae.

Dissolved Oxygen

Reductions in DO have been identified as a concern in several locations where circulated pond waters would enter receiving water bodies. This concern arises from the potential that pond water may have high productivity during warmer times of the year, and the resultant BOD may affect DO levels in sloughs, creeks, and portions of the bay proper. Pond A8, which is not in the study area but is located adjacent to Alviso Slough and south of Pond A12 (which is in the study area), has experienced periods in which the water at the point of discharge contained lower levels of DO than the WQO during 2011, and in some instances levels of DO below 3.33 mg/L (the trigger for reporting noncompliance). In most cases, these periods of low DO were observed during late summer and early fall. It is possible that restoration of these former salt ponds may result in discharge water at or below the WQO, resulting in a significant impact.

Long-term operation of the project could result in significant impacts in dissolved oxygen. Mitigation would be required to address this impact (see Section 4.5.3 Mitigation Measures*).*

Methylmercury Production

Tidal restoration of the former salt ponds A10, A11, and A12 has the potential to mobilize, transport, and deposit mercury-laden sediments through scouring and enlarging of Alviso Slough. As discussed in Section 4.5.1.2.2.1 *Bioaccumulative Contaminants*, sediments in the Alviso pond complex have considerably higher mercury concentrations than other bay sediments (about 2 to 10 times the ambient bay concentration). Highest detected concentrations were reported in samples collected in Pond A12, which is adjacent to Alviso Slough. Scouring of Alviso Slough may re-suspend mercury-laden sediments, which would be circulated and deposited throughout the restored wetlands and may discharge to San Francisco Bay, potentially exceeding the bay's mercury TMDL.

As was seen with the opening of Pond A8 during SBSP Restoration Project Phase I (Ackerman et al. 2013), there is likely to be an initial increase in mercury methylation and subsequent bioaccumulation into fish and bird eggs directly after opening and breaching ponds. New but limited data suggest that this is a short-term event and that mercury levels in biota may decrease to pre-restoration levels within a few years. However, complex biogeochemical interactions that are not fully understood govern mercury methylation and bioaccumulation into the food web, so mercury monitoring subsequent to opening up ponds, especially in the Alviso area, which has some of the highest mercury levels in the San Francisco Bay estuary, is warranted.

In general, the soluble concentrations of trace metal and organic compounds are higher in the ponds than in the bay. Therefore, opening the ponds to tidal action would gradually reduce the elevated concentrations of mercury to the ambient background condition. However, opening of Ponds A9–A15 on the Alviso Slough side would also likely increase scour of sediments in Alviso Slough, as was observed with the opening of Pond A8 and as has been demonstrated with the opening of Pond A6 and subsequent scour and remobilization of mercury buried in the sediment of Alviso Slough.

Local observations of MeHg in the food web are discussed in Section 4.5.1.2.2.1 *Bioaccumulative Contaminants*. MeHg is the primary form of mercury that bioaccumulates, and the formation of MeHg is accelerated in areas of low DO. Wetlands may contribute substantially to MeHg production and subsequently to biological exposure to mercury in the bay (SFBRWQCB 2011). The biogeochemical processes affecting the conversion of mercury to MeHg and its accumulation in the food chain, the impacts of mercury mobilization and transport, and increased MeHg production and bioaccumulation are complex issues that will continue to be studied apart from the Shoreline Phase I Project.

Although the Alviso pond complex and Alviso Slough contain more THg than other areas of the South Bay (USGS 2011), wetland restoration may not necessarily increase MeHg in the local food web because MeHg production depends on many environmental factors in addition to THg concentration. Restoration activities that alter landscape morphology and vegetation would inevitably alter the microbial community composition. Whether this alteration is a positive or negative influence on net MeHg production is not clear at this time. Likewise, restoration activities could cause low DO in the study area due to changes in hydraulic residence times, algal abundance, and other factors. Low DO can enhance net MeHg production (USGS 2011). Shoreline MAMP measures, and mitigation measures below address potential DO impacts related to Pond A12, which also has some of the highest levels of mercury in sediment.

Although it is unclear how mercury cycling in the pond would change after breaching, other recently breached former salt ponds in the region (Ponds A19 and A20) showed more than five-fold increases in sediment MeHg concentrations immediately post-breach (Miles and Ricca

2010). Thus, there is the potential that MeHg concentrations in the pond may increase above the currently high levels following the initial operation of the tidal notch structure. However, a recent study of Pond A8 and Alviso Slough concluded that opening up this particular pond to tidal flushing may decrease MeHg production in the pond over the longer term (USGS 2011).

The South Baylands Mercury Project 2010 final report concluded that conversion of Pond A8 to fully tidal marsh would lessen the risk of mercury methylation because restored tidal marsh would likely produce less available organic matter than what is currently being produced in Pond A8, thus providing less fuel for methylating bacteria. Therefore, tidal marsh restoration along Alviso Slough and in other study area ponds adjacent to the slough (Ponds A9, A10, A11, and A12) would probably not result in unusually high MeHg concentrations in tidal marsh food webs (Greiner et al. 2010). Given the Shoreline Phase I Project's ponds' proximity to these other ponds and given the existing condition, the same types of effects are expected for the Shoreline Phase I Project.

With implementation of the Shoreline MAMP, the potential negative effects associated with MeHg exposure are considered to be minor and temporary (AMM-WAT-17: Mercury in Sentinel Species). Although studies are currently underway to evaluate the long-term effects, recent data suggest that MeHg concentration would decrease after restoration of tidal habitat. MeHg production would not result in significant impacts that would cause violation of adopted mercury TMDLs or Basin Plan mercury standards.

Long-term operation of the project would result in less-than-significant impacts to methylmercury.

Impact WAT-2: Substantially alter the existing drainage pattern of the site or area

Construction of project facilities will not alter drainage patters of the site or in the area as is discussed in Section 4.4 *Hydrology and Flood Risk Management*. Over time the restoration of former salt ponds will result in changes to hydraulics and sediment transport in the pond areas and in the nearby creek channels. With the project, the pond areas and inner levees (including the FRM levee) would be exposed to tidal action on a daily basis. Tidal action includes alternately deeper flows and shallower flows, daily exchanges of colder and less-saline water, higher flow rates, changes in flow rates and directions, higher sediment loads, and tidal wave action. Changes in hydraulics and sediment transport will be monitored under the MAMP.

The MAMP includes actions to monitor sediment. Sediment dynamic monitoring and potential adaptive management actions are focused on the extent to which estuarine sedimentation is sufficient to convert mudflats to vegetated marsh and the extent to which tidal habitat restoration might result in the loss of slough and bay tidal mudflat habitat regionally.

Sediment dynamics uncertainties pose a challenge for the MAMP ecosystem restoration objective. Consequently, sediment dynamics are also a constraint because of uncertainties regarding how they might change over time. The MAMP classifies sediment dynamics uncertainties into two categories and assigns success criteria associated with each. The two categories, success criteria, and monitoring metrics are listed in Table 4.5-12 *Sediment*

Dynamics Targets and Monitoring. The complete Shoreline Phase I MAMP is available for review in Appendix F *Shoreline Study Monitoring and Adaptive Management Plan for Ecosystem Restoration*.

Table 4.5-12. Sediment Dynamics Targets and Monitoring

Category	Restoration Target/Success Criterion	Monitoring Metrics
Sedimentation Inside the Ponds	• Water levels inside the ponds are similar to those just outside the ponds, allowing full exchange of water and sediments. • Accretion rate of the restored ponds is sufficient to reach marsh vegetation colonization elevations within the planning time frame.	• Water levels in ponds • Sedimentation rates in ponds • Suspended sediment concentrations in ponds
Restored Tidal Marsh Habitat (Inside the Ponds)	• Tidal marsh vegetation is on a trajectory toward other successful marsh restoration sites in the South Bay.	• Tidal marsh habitat acreage in ponds

Based on the monitoring results, pond management activity might need to change over time to achieve the restoration targets. The restoration targets and monitoring metrics apply to a large area geographically, so adaptive management measures that might need to be implemented would probably require extensive reworking of parts of the entire system. Sediment impacts are most likely to be short-term and localized, similar to those that would be expected during construction (FRM levee construction and outboard levee breaches). However, because sediment dynamics ideally must be monitored and managed systemwide (such as annual sediment flux at Dumbarton Bridge), project-related management activity that might be needed to achieve the restoration targets would need to be coordinated with other activity in the South Bay, such as ongoing Refuge management and adaptive management associated with the SBSP Restoration Project (AMM-WAT-13: Sediment Accretion Areas). Success is also dependent on other activity that is undertaken and managed by local governments and private parties, so bay-wide planning activities will need to continue to recognize the importance of estuarine ecosystem health. Overall, the habitat restoration activity should contribute positively to the restoration targets.

If any of the action alternatives are implemented, the effect determination for changes to sediment transport as a result of changed drainage patterns would be less than significant under the CEQA / beneficial under the NEPA.

4.5.2.3.2.2 Comparison of Action Alternatives

Table 4.5-13 *Summary of Impacts on Surface Water and Sediment Quality from the Action Alternatives* summarizes the impacts of each alternative.

Table 4.5-13. Summary of Impacts on Surface Water and Sediment Quality from the Action Alternatives

Alternative	Impact Summary
2- Alviso North with12.5-foot Levee and Bench	• Levee construction o Construction close to Pond A12 could temporarily suspend mercury-containing sediment. o Construction-related (temporary), short-term impacts on water quality from earth moving and from construction equipment. • Transitional habitat o Similar to levee construction impacts (temporary, construction-related impacts). • Ecosystem restoration o Construction-related (temporary), short-term impacts on water quality; impacts would be limited to areas being worked on during each breach and would be limited in duration (associated with the pond preparation and breaching activities when they happen in each area). Potential short-term impacts related to turbidity, temperature, and metals. o Potential impacts on salinity associated with breaching Ponds A12, A13, and A15. o Potential for minor releases of contaminants during ecosystem restoration construction activities. o Long-term beneficial effects from ecosystem restoration related to reduced turbidity in waters flowing to the bay; dissipation of energy that would reduce erosion and flooding; higher levels of DO in some ponds; reduced stagnation in the ponds; and pollution sequestration. o Potential adverse effects related to long-term suspension and mobilization of mercury-laden sediments and greater levels of MeHg and low-DO water being discharged from ponds adjacent to Alviso Slough (Ponds A9, A10, A11, and A12).
3 - Alviso North with 15.2-foot Levee and 30:1 Ecotone	• Levee construction – same as Alternative 2 except levee would be larger (and construction-related impacts potentially greater). • Transitional habitat – same as Alternative 2 except ecotone would be larger (and construction-related impacts greater). • Ecosystem restoration – same as Alternative 2.
4 - Alviso Railroad with 15.2-foot Levee and Bench	• Levee construction – same as Alternative 2. • Transitional habitat – same as Alternative 2. • Ecosystem restoration – same as Alternative 2.
5 - Alviso South with 15.2-foot Levee and Bench	• Levee construction o Construction-related (temporary), short-term impacts on water quality. No direct effects on Pond A12. • Transitional habitat – same as Alternative 2. • Ecosystem restoration – same as Alternative 2.

4.5.3 Mitigation Measures

Constructing the FRM levee and ecosystem restoration will be consistent with WQOs, with the possible exception of salinity after breaching of ponds and long-term dissolved oxygen levels. These significant impacts require the following mitigation measures to minimize project-related water quality impacts and ensure that impacts are less than significant.

- **M-WAT-1a: Salinity Control –** Discharge water from Ponds A12, A13, and A15 after breaching levees will be limited to a maximum salinity of 44 ppt. Breaching will done in a manner that allows for the slow release of pond water during high tide to ensure mixing and dilution. Salinity will be monitored at the time of breaches of levees around Ponds A12, A13, and A15. Corrective measures, such as slowing the release of the more-saline water, will be implemented as needed to minimize the potential effects on receiving waters.
- **M-WAT-1b: Dissolved Oxygen Control –** Discharge waters from the ponds will maintain a minimum DO of 5 mg/L. To ensure that DO does not drop below 5 mg/L, discharge water will be monitored from Pond A12 to ensure minimum DO is maintained. If DO levels fall below 5 mg/L measures will be implanted to increase DO levels in Pond A12. Measures might include solar aerators, harvesting dead algae, or installing flow diversion baffles to redirect the flow near the area of discharge.

Adaptive management, including slow release of pond water during high tide to ensure mixing and dilution, as was performed during breaching of Ponds A16 and A17 by the SBSP Restoration Project, would be implemented to ensure that construction activities do not result in salinity increases that would impair the beneficial uses of water. For example, salinity would be monitored at the time of breaches of levees around Ponds A12, A13, and A15; if salinity exceeds WDRs, a potential corrective measure would be to slow the release of the more-saline water to minimize this potential effect. Application of the salinity mitigation measure will reduce the impact to less than significant.

Dissolved oxygen measures would be implemented as required by the results of monitoring. Potential actions include installing solar aerators, harvesting dead algae, or installing flow diversion baffles to redirect the flow to improve DO levels near the discharge. Applying the mitigation measure will reduce this impact to less than significant.

4.5.3.1 Residual Impacts and Additional Measures Necessary to Mitigate Significant Impacts

Applying the AMMs included as part of the project would avoid or minimize significant impacts to WQOs, with the possible exception of salinity after breaching of ponds and long-term dissolved oxygen levels. These impacts require mitigation as discussed above. With implementation of measures to monitor and correct DO and salinity levels, this impact will be less than significant. No additional measures are necessary.

4.5.4 Cumulative Effects

The cumulative effects area considered for surface water and sediment quality is the South Bay, defined as that part of the bay that is south of the Dumbarton Bridge. Historic development has substantially altered water and sediment quality in the South Bay, which has resulted in existing cumulative impacts.

Shoreline Phase I Project impacts would be less than significant or can be mitigated to less than significant but still must be considered in combination with other past, present, and reasonably foreseeable future actions that could affect surface water and sediment quality.

4.5.4.1 General Water Quality Effects of Project Construction and Operation and Maintenance

Cumulative water quality effects are significant as evidenced by 303(d) listing of several waterbodies in the region (see Table 4.5-7 *Clean Water Act Section 303(d) Listings for Water Bodies in the Shoreline Phase I Study Area*). Attention and management have improved some conditions; local, State, and Federal water resource managers continue to work to improve water quality in the South Bay. Section 4.5.1.2 *Physical Setting (CEQA Baseline)* provides some background information about legacy water quality effects and the present consequences of these effects.

Construction of the Shoreline Phase I Project would result in less-than-significant turbidity, temperature, DO, salinity, and metals water quality effects in the study area. Other present and reasonably foreseeable future actions in the South Bay area could also result in less-than-significant, short-term water quality effects. All large construction projects that are taking place or are planned in and near the study area (that is, in areas that drain to the South Bay), such as ongoing development in San José and neighboring communities and ongoing facility upgrades, demolition, and new development at the Wastewater Facility in the Coyote Creek and Guadalupe River watersheds, cannot be constructed without demonstrating compliance with Federal and State water quality protection laws. SWPPPs and WDRs apply to most large projects and ensure that construction effects on water quality are minimized; therefore ongoing development in San José and neighboring communities is not likely to substantially contribute to water quality impacts in the project area.

Additionally, activity such as continued operation of industrial facilities and past, present, and future stormwater discharges throughout the cumulative effects study area are conducted consistent with National Pollutant Discharge Elimination System permits, which prevent adverse water quality effects. Other activity, such as restoration activity associated with the SBSP Restoration Project and other local restoration projects, is completed consistent with State and Federal water quality protection laws and applies measures to protect water quality. It is unlikely that construction of the Shoreline Phase I Project elements would coincide with all of these activities and/or cause less-than-significant water quality impacts in the same local area (and thus potentially cause a locally significant impact).

State and Federal water quality protection laws are implemented to ensure that the cumulative effect of all of these types of projects is minimized. Because this regulatory structure is designed to minimize regional water quality effects and because the Shoreline Phase I Project and present and reasonably foreseeable future actions would comply with the regulatory requirements, the cumulative water quality effect of these actions would not be significant.

Operation of construction equipment during construction of proposed water-control structures could result in minor erosional impacts and operation of Pond A12 could result in low DO levels without mitigation. Applying mitigation measure M-WAT-01b to reduce potential DO impacts in Pond A12 would ensure long-term protection of water quality as the Shoreline Phase I Project operates over time. The SBSP Restoration Project, the only other project directly in the project area, would apply similar water quality protection measures as part of long-term management, and local, State, and Federal agencies will continue to monitor and work to improve water quality in the South Bay. Applying required water quality protection measures and protection measures that are part of SBSP Restoration Project and would be part of the Shoreline Phase I Project would ensure that the long-term water quality condition should not deteriorate (and would possibly improve through beneficial water quality effects associated with the SBSP Restoration Project and Shoreline Phase I Project). Operation and maintenance water quality effects associated with the Shoreline Phase I Project would not cause or contribute to long-term adverse water quality.

4.5.4.2 Sediment Dynamics and Mercury

The Shoreline Phase I Project and SBSP Restoration Project occur in an area with historical sediment concerns related to mercury. New development upstream in San José and surrounding communities, and existing industrial facilities, must comply with State and Federal water quality protection laws and applies measures to limit mercury discharge; therefore they are not expected to substantially contribute to cumulative effects. The SBSP Restoration Project addresses that project's potential contribution to cumulative effects associated with sediment dynamics and mercury. For example, it is possible that project-related monitoring of the area of outboard mudflat, tidal shallows, and channel and annual sediment flux at Dumbarton Bridge could show that the proposed action is causing regional impacts on mudflat habitat and sediment dynamics. The Shoreline Phase I project will use information gathered through the SBSP Restoration Project and other ongoing monitoring identify potential problems and remedies. Implementing the Shoreline MAMP to sediment dynamics and mercury would prevent long-term cumulative impacts and contributions to adverse, cumulative water quality effects.

Construction-related mercury effects would be short term and less than significant. Monitoring and management during construction (such as applying and modifying AMMs as needed) would minimize potential adverse effects; similar actions have been taken and will be taken as part of the SBSP Restoration Project activities adjacent to the Shoreline Phase I Study Area. Because both projects would have phased construction (i.e., not all construction would occur at the same time, and construction activity would not be concentrated in a large area) and because phases would be limited in duration, the construction-related effects of the Shoreline Phase I Project are not expected to cause cumulatively considerable incremental effects that would affect the long-term mercury condition.

4.5.4.3 Clean Water Act 303(d) Listed Waters

Table 4.5-8 *Sloughs and Streams in the Shoreline Phase I Study Area* indicates that there is a cumulatively considerable adverse condition in the study area related to several pollutants. Area-wide TMDLs for two of these pollutants address Coyote Creek and Guadalupe River (diazinon) and South San Francisco Bay (mercury).

The Shoreline Phase I Project would not introduce new sources of diazinon, chlordane, DDT, dieldrin, dioxin compounds, furan compounds, PCBs, or selenium to the region and therefore would not contribute to the existing cumulative condition associated with these pollutants. Levee construction and ecosystem restoration could result in the following:

- Recreational use of the study area could result in the introduction of more trash (identified as a pollutant for Coyote Creek and the Guadalupe River).
- Construction could temporarily suspend mercury already in the system but would not add new sources of mercury (identified as a pollutant for the Guadalupe River and South San Francisco Bay).
- Construction-related disturbance and human disturbance associated with recreational use of the area could lead to more areas being adversely affected by invasive species.

The project includes an AMM that would reduce or eliminate adverse impacts associated with trash (AMM-WAT-9: Site Maintenance), so the Shoreline Phase I Project would not contribute to this cumulative condition.

The project would not introduce new sources of mercury. Applying the AMMs and the WDRs during construction activities would minimize impacts associated with suspending mercury-laden sediments, and long-term effects related to MeHg are expected to decrease over time. The project would not contribute to the current cumulatively adverse condition associated with mercury in the Guadalupe River and the South Bay.

Avoidance and minimization measures will be applied during project construction to ensure that no new invasive species are introduced and that existing problem areas are not made worse (AMM-WAT-8). The MAMP includes invasive species monitoring and provides for implementing control measures, if needed. The project is not expected to contribute to the current cumulatively adverse condition associated with invasive species.

The Shoreline Phase I Project would not cause incremental effects that are cumulatively considerable for CWA Section 303(d)-identified pollutants in the study area.

4.5.5 Summary

Table 4.5-14 *Surface Water and Sediment Quality NEPA Impact Conclusions* summarizes the project effects under the NEPA.

Table 4.5-14. Surface Water and Sediment Quality NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
Impact WAT-1: violate any water quality standard or waste discharge requirement	Negative	Minor	Short term	Possible	Limited
• Turbidity around breaches	Negative	Minor	Short term	Possible	Limited
• Increased water temperature	Negative	Minor	Long term	Possible	Limited
• Metals	Negative	Minor	Long term	Possible	Local
• Salinity effects on waters near Ponds A12, A13, and A15	Negative	Moderate	Short term	Possible	Local
• Reduced DO levels in Pond A12	Negative	Moderate	Long term	Possible	Limited
• Long-term suspension and mobilization of mercury-laden sediments and greater levels of MeHg	Negative	Minor	Long term	Possible	Local
• Algae composition	Negative	Minor	Long term	Possible	Local
Impact WAT-2: Substantially alter existing drainage patterns	Beneficial	Major	Long term	Possible	Local

Table 4.5-15 *Surface Water and Sediment Quality CEQA Impact Conclusions* summarizes the project effects under the CEQA.

Table 4.5-15. Surface Water and Sediment Quality CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
WAT-01 violate any water quality standard or waste discharge	AMM-WAT-1: Staging Area AMM-WAT-2: Fuel Management Plan AMM-WAT-4: Pond Construction Timing AMM-WAT-5: Hazardous Spill Plan AMM-WAT-6: Seasonal Restrictions AMM-WAT-7: Minimize Footprint AMM-WAT-8: Clean Equipment AMM-WAT-9: Site Maintenance AMM-WAT-11: Protect Hazardous Sites AMM-WAT-12: Use of On-Site Material AMM-WAT-14: Water Quality Parameters AMM-WAT-15: Water Quality Baseline AMM-WAT-19: Minimize In-water Construction AMM-WAT-20: Turbidity Control AMM-WAT-21: Stormwater Runoff Control AMM-WAT-22: Stormwater Management Plan AMM-WAT-23: Use of Clean Fill AMM-WAT-24: Prepare SWPPP AMM-WAT-25: No Treated Wood AMM-WAT-26: Equipment Staging and Fueling AMM-WAT-27: Hazardous Spill Plan AMM-WAT-28: Prevent Equipment Leaks AMM-WAT-29: Stabilize Construction Areas AMM-WAT-30: Invasive Plant Prevention			
• Turbidity around breaches	AMM-WAT-3: Turbidity Management Plan AMM-WAT-10: In-Stream Sediment Control	LTS	None	LTS
• Increased water temperature		LTS	None	LTS
• Metals		LTS	None	LTS
• Salinity effects on waters near Ponds A12, A13, and A15		S	M-WAT-1a: Salinity Control	LTS
• Reduced DO levels in Pond A12	AMM-WAT-16: Dissolved Oxygen	S	M-WAT-1b: Dissolved Oxygen Control.	LTS

Table 4.5-15. Surface Water and Sediment Quality CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
• Long-term suspension and mobilization of mercury-laden sediments and greater levels of MeHg	AMM-WAT-17: Mercury in Sentinel Species	LTS	None	LTS
• Algae composition	AMM-WAT-18: Control of Nuisance Algae	LTS	None	LTS
Impact WAT-2: Substantially alter existing drainage patterns	AMM-WAT-13: Sediment Accretion Areas	LTS	None	LTS
LTS = less than significant S = significant NA = not applicable				

In summary, none of the action alternatives would result in major, long-term violations of any water quality standard or WDRs with the implementation of mitigation measures below. Construction activities could cause minor, short-term water quality effects from earth moving and construction equipment. Breaching of ponds for restoration to tidal marsh could result in limited exceedance of water quality standards. Applying the measures listed in Section 4.5.3 *Mitigation Measures*, standard BMPs prescribed in the SWPPP, and mitigation measures to address DO and salinity effects would avoid or minimize adverse effects in the case of less-than-significant effects and reduce significant impacts to a less-than-significant level.

All of the action alternatives would alter the existing drainage pattern of the area, but would not result in major or moderate, medium-term or long-term erosion or siltation on or off site and would not affect the upper parts of Coyote Creek or Guadalupe River watersheds. Construction activity could cause minor, short-term, limited and local effects related to erosion but such effects would be avoided or minimized through applying measures listed in Section 4.5.3 *Mitigation Measures* and standard BMPs prescribed in the SWPPP. See Section 4.4 *Hydrology and Flood Risk Management* for a discussion regarding long-term effects related to scour.

The restoration elements of the project would have significant long-term benefits to surface water and sediment quality. Restoration of the ponds would reduce turbidity of waters flowing into the bay, provide energy dissipation that will reduce erosion and flooding, provide higher levels of DO in some ponds in the short term, and sequester water pollutants in the bay.

4.6 Aquatic Biological Resources

4.6.1 Affected Environment

This section describes the regulatory setting for aquatic biological resources and the local and regional conditions (physical setting) for aquatic habitats, aquatic biological resources, and special-status aquatic plants and wildlife. Terrestrial habitats and resources are discussed in Section 4.7 *Terrestrial Biological Resources*. Due to the predominantly terrestrial nature of use in the study area associated with haul-out areas near Coyote Creek, marine mammals, specifically pinnipeds that may be present in the study area (i.e., harbor seals), are discussed in Section 4.7 *Terrestrial Biological Resources*.

The aquatic biological resources discussed in this section are described within the context of the Shoreline Phase I Study Area and the adjacent aquatic habitat (i.e., South San Francisco Bay). Specifically, impacts on aquatic biological resources associated with the No Action Alternative, as well as construction, operation, and maintenance (O&M) activities associated with the action alternatives, would occur within the Shoreline Phase I Study Area. However, because many aquatic organisms are mobile and the long-term effects of restoration activities have ecosystem-level benefits, identifying distinct boundaries within the aquatic ecosystem is imprudent. Therefore, the aquatic communities in South San Francisco Bay are also described and evaluated.

The information presented here is based on scientific literature, SBSP Restoration Project planning documents and monitoring reports, Shoreline Phase I Study planning documents, SCVWD fish and aquatic community monitoring information in Coyote Creek, and other publicly available information. Information regarding aquatic species and their habitats in San Francisco Bay and its tributaries is available from as early as the 1950s, and much of this information is still relevant today. Because biological systems are dynamic and constantly changing, using a snapshot in time to describe the condition that could be affected by the No Action Alternative or the action alternatives is imprudent.

Specifically, the habitat condition and species composition in the study area at any given time are influenced by changes that occur on multiple time scales including daily (e.g., resulting from tidal influence), seasonally (e.g., resulting from species life history such as spawning migration timing), annually, and decadally or longer (e.g., resulting from community succession and other long-term influences such as climate change). Therefore, this section describes the physical setting using relevant information from literature published over several decades with greater emphasis and specific focus placed on studies published in recent years (about the last 15 years).

4.6.1.1 Regulatory Setting

Aquatic biological resources are managed and protected through several Federal, State, and local regulations and programs. Table 4.6-1 *Regulations and Programs That Apply to Aquatic Biological Resources* summarizes the regulations and programs that apply to aquatic biological resources as defined in the Shoreline Phase I Study Area. Regulations that apply to terrestrial species and marine mammals are presented in Section 4.7 *Terrestrial Biological Resources*.

Table 4.6-1. Regulations and Programs That Apply to Aquatic Biological Resources

Regulation or Program	Primary Responsibility and/or Interest	Summary of Regulation or Program
Federal		
FESA of 1973, as amended (16 USC 1531–1543)	USFWS and NMFS	Provides guidance for the conservation of species designated as Endangered and Threatened and their habitats. Section 7 requires that all Federal agencies consult with the USFWS and/or the NMFS to ensure that their actions do not jeopardize the continued existence of a species listed under the FESA. The USFWS and/or the NMFS issue Biological Opinions summarizing findings for activities that could affect a listed species. Section 9 lists those actions that are prohibited under the Act. Note that the USFWS, a co-lead agency under the NEPA, has the same responsibility under Section 7 as any other Federal agency. Even if the USFWS is proposing the action, it must still consult with the NMFS and internally with the Endangered Species Office of the USFWS.
Magnuson-Stevens Fishery Conservation and Management Act (MFCMA) As amended by the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (PL 109-479)	NMFS	The MFCMA requires Federal agencies to consult with the NMFS regarding actions that may affect EFH for Pacific coast groundfish, coastal pelagic species, and Pacific salmon. The MFCMA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." EFH is the habitat (waters and substrate) required to support a sustainable fishery and a managed species' contribution to a healthy ecosystem. Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish. Substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities.
Clean Water Act (33 USC 1251–1376)	USACE, San Francisco Bay RWQCB	Under Section 404(d), the USACE has authority to regulate the discharge of fill material to waters of the United States. The USEPA has oversight authority over USACE administration of the corresponding permit program. Waters of the United States in the study area include wetlands, creeks, and other open waters. Section 401 water quality certification is required for projects authorized under Section 404. See Section 4.5 Surface Water and Sediment Quality for more information about the Section 401 program.
Rivers and Harbors Act (33 USC 403)	USACE	Section 10 of the Rivers and Harbors Act (1899) 33 USC 403 regulates the construction of structures, placement of fill, and introduction of other potential obstructions to navigation in navigable waters. Under Section 10 of the act, the building of any wharfs, piers, jetties, and other structures is prohibited without congressional approval, and excavation or fill within navigable or tidal waters requires the approval of the chief of engineers.
CZMA of 1974	BCDC	Any Federal agency activity within or outside a coastal zone that affects any land or water use or natural resource of the coastal zone must be carried out in a manner that is consistent to the maximum extent practicable with enforceable policies of approved State management programs. A CD must be prepared by the Federal proponent to document this. The CD is reviewed by the State coastal agency, which may or may not concur with the CD. The BCDC manages the CZMA program for the study area and non-Federal actions that are part of the project are subject to CZMA permitting through the BCDC's permitting process.
Fish and Wildlife Coordination Act (16 USC 661–666)	USFWS, CDFW	Applies to any Federal project where the waters of any stream or other body of water are impounded, diverted, deepened, or otherwise modified. Project proponents are required to consult with the USFWS and the appropriate State wildlife agency (the CDFW). The USFWS and the CDFW will make recommendations that identify measures that would prevent loss of or damage to wildlife resources; applies to plants as well as animals.

Table 4.6-1. Regulations and Programs That Apply to Aquatic Biological Resources

Regulation or Program	Primary Responsibility and/or Interest	Summary of Regulation or Program
Executive Order 11990: Protection of Wetlands (May 24, 1977)	USACE, USFWS	Established a national policy to avoid adverse impacts on wetlands whenever there is a practicable alternative.
State		
CESA (Fish and Game Code Section 2050 et seq.)	CDFW	Regulates the "take" of a species listed as Threatened or Endangered under the State act. The CESA does not require formal consultation; however, the CEQA does require that the CDFW act as a reviewing agency for all CEQA documents if the fish and wildlife resources of the State may be affected by the proposed action. If take of a California listed species may occur, the CDFW would require a Fish and Game Code Section 2081 Incidental Take Permit (ITP). An ITP requires that impacts by minimized and fully mitigated in addition to a determination that the species would not be jeopardized by the issuance of the permit.
California Fish and Game Code: Stream Alteration (Fish and Game Code Sections 1601–1603)	CDFW	State and local agencies are required to notify the CDFW prior to any project that would divert, obstruct, or change the natural flow, bed, channel, or bank of any river, stream, or lake. When an existing fish or wildlife resource may be substantially adversely affected, the CDFW is required to propose reasonable project changes to protect the resource. These modifications are formalized in a Streambed Alteration Agreement that becomes part of the plans, specifications, and bid documents for the project.
California Fish and Game Code: Fully Protected Species (Fish and Game Code Sections 3511, 4700, 5050, and 5515)	CDFW	This is the State's effort to identify and provide additional protection to those animals that were rare or faced possible extinction. Fully protected species may not be taken or possessed at any time, and no licenses or permits may be issued for their take. Exceptions are allowed for collecting these species for necessary scientific research and relocating bird species for the protection of livestock. Many fully protected species are also listed under the FESA and/or the CESA.
Porter-Cologne Water Quality Control Act (Porter-Cologne Act)	San Francisco Bay RWQCB	The Porter-Cologne Act authorizes the RWQCB to issue permits to control pollution (i.e., waste discharge requirements [WDRs] and National Pollutant Discharge Elimination System [NPDES] permits) in compliance with implementation of water quality standards as outlined in the region's Basin Plan and taking into consideration beneficial uses to be protected. These regulations limit impacts to aquatic and riparian habitats from a variety of water pollution sources. Per the Basin Plan, developed under the authority of the Porter-Cologne Act, waters and wetlands in South San Francisco Bay have been assigned beneficial uses that include estuarine habitat, fish migration, fish spawning, wildlife habitat, and the preservation of rare and endangered species.
McAteer-Petris Act	BCDC	The McAteer-Petris Act was enacted in 1965 to promote responsible planning and regulation of San Francisco Bay. This law created the San Francisco BCDC, which is responsible for enforcing the McAteer-Petris Act. The act requires that "maximum feasible public access, consistent with a project be included as part of each project to be approved by the BCDC."

Table 4.6-1. Regulations and Programs That Apply to Aquatic Biological Resources

Regulation or Program	Primary Responsibility and/or Interest	Summary of Regulation or Program
Regional Multi-Agency and Local		
Guidelines and Standards for Land Use Near Streams: A Manual of Tools, Standards, and Procedures to Protect Streams and Streamside Resource in Santa Clara County (2007)	Prepared by the Santa Clara Valley Water Resources Protection Collaborative. The City of San José has determined that its existing codes and policies are consistent with the guidelines.	Includes guidelines and standards for land use near streams; intended to protect surface and groundwater quality and quantity in Santa Clara County. Emphasizes riparian corridor protection.
SCVWD Water Resources Protection Ordinance	SCVWD	Project review and permitting process for projects within 50 feet of a creek or waterway or within 50 feet of a SCVWD property or easement. Water Resources Protection Manual provides guidance for complying with ordinance. Compliance necessary if encroachment permit from the SCVWD is required.

BCDC = San Francisco Bay Conservation and Development Commission
CD= Consistency Determination
CDFW = California Department of Fish and Wildlife (formerly CDFG)
CESA = California Endangered Species Act
CZMA=Coastal Zone Management Act of 1974
EFH = Essential Fish Habitat
FESA= Federal Endangered Species Act
NEPA = National Environmental Policy Act
NMFS = National Marine Fisheries Service
NPDES = National Pollutant Discharge Elimination System
RWQCB = San Francisco Bay Regional Water Quality Control Board
SCVWD = Santa Clara Valley Water District
USEPA = U.S. Environmental Protection Agency
USFWS = U.S. Fish and Wildlife Service
WDR = waste discharge requirement

4.6.1.2 Physical Setting (CEQA Baseline)

The San Francisco Bay estuary is a productive, diverse ecosystem. Despite the loss of more than 90 percent of historical tidal wetlands in the San Francisco Bay Area to diking, draining, and filling, aquatic species diversity is high, and more than 120 species of fish regularly use the estuary (Siegel and Bachand 2002). More importantly, San Francisco Bay supports populations of a number of species of regional, hemispheric, or global importance.

Section 4.6 *Aquatic Biological Resources* considers the study area to be the project construction area plus a 100-foot buffer area where disturbance could occur as a result of activities ancillary to construction activity (for detailed information about the area of disturbance, see Section 1.9.1.2 *Area of Impact*) as well as additional 400-foot buffers for biologically important areas adjacent to the expected work area. This biological disturbance buffer extends 400 feet beyond the limit of the Alviso South and WPCP South levee segments, includes a reach of Coyote Creek connecting the construction areas for Ponds A15 and A18 (for possible instream sedimentation impacts), and includes the existing levee between the south side of Pond A16 and the north side of the NCM (Figure 1.9-3 *Shoreline Phase I Area of Impact and Biological Buffer Area* in Chapter 1 *Study Information*). These ancillary activity (100-foot) and biological (400-foot) buffer areas are included to ensure that the impact analyses address potential secondary impacts. Therefore, the total buffer considered in Section 4.6 *Aquatic Biological Resources* and in Section 4.7 *Terrestrial Biological Resources* is 500 feet wide.

Please note that, throughout this section, the terms *12.5-foot NAVD 88 levee* and *15.2-foot NAVD 88 levee* are used to distinguish Alternative 2 levee footprint from the Alternative 3 levee footprint, respectively. Alternatives 2 and 3 run along the same alignment but since the Alternative 3 levee is 2.7 feet higher, the two alternatives will have different impacts (e.g., more filling would be required with Alternative 3 to raise the levee 2.7 feet higher). See Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* for a discussion of how these two levee heights were selected for consideration in the final array of alternative plans.

4.6.1.2.1 Habitats

During mapping of the study area, 16 habitat types were identified based on previous assessments of habitats that occurred along the South Bay (H. T. Harvey & Associates 2007; H.T. Harvey & Associates et al. 2005; Collins and Grossinger 2004; Grossinger et al. 2006). These habitat types include tidal open water, mudflat, circulation ponds, sewage treatment ponds, salt marsh, brackish marsh, muted tidal/diked marsh, freshwater marsh, seasonal wetland, riparian/creek corridor, upland vegetation, parks/upland grasslands, levees, developed areas, and landfills. Aquatic habitats are described in the following paragraphs, while upland habitats are described in Section 4.7 *Terrestrial Biological Resources*. It is important to note that small inclusions of differing habitat types may be present within a mapped section; however, these inclusions do not change the overall value or use of the habitat as described. The discussions following Table 4.6-2 *Habitat Types Mapped in the Study Area* provide only the common names of species (other than when they are referenced to differentiate subspecies as part of a technical discussion or in species tables); scientific names for all species discussed are included in a table in Appendix B5 *Biological Resources: Species Scientific Names, CNDDB Report, and CRPR Report*.

Habitat types and acreages are shown on Figure 4.6-1 *Shoreline Phase I Study Area and Biological Study Area Habitat*, and acreages of each mapped habitat type are summarized in Table 4.6-2 *Habitat Types Mapped in the Study Area*.

Table 4.6-2. Habitat Types Mapped in the Study Area

Habitat Types	Acres
Tidal Open Water (Open Water on Figure 4.6-1 *Shoreline Phase I Study Area and Biological Study Area Habitat*)	357.8
Mudflat	220.4
Ponds	
Batch (high salinity)	826.1
Circulation	2,061.7
Sewage Treatment Ponds	714.3
Legacy Ponds	249.9
Pond/Open Water Subtotal	4,430.2
Salt Marsh	
Tidal	322.0
Non-tidal	85.4
Brackish Marsh	432.2
Muted Tidal/Diked Marsh	340.1
Freshwater Marsh	93.2
Seasonal Wetland	26.2
Riparian/Creek Corridor	17.6
Wetland/Riparian Subtotal	1,316.7
Upland Habitat [a]	829.6
Levee [a]	138.8
Developed [a]	577.0
Landfill [a]	158.5
Upland Subtotal	1,703.9

Sources: H.T. Harvey & Associates 2013; City of San José 2013a

[a] Descriptions of upland habitat types are presented in Section 4.7 *Terrestrial Biological Resources*.

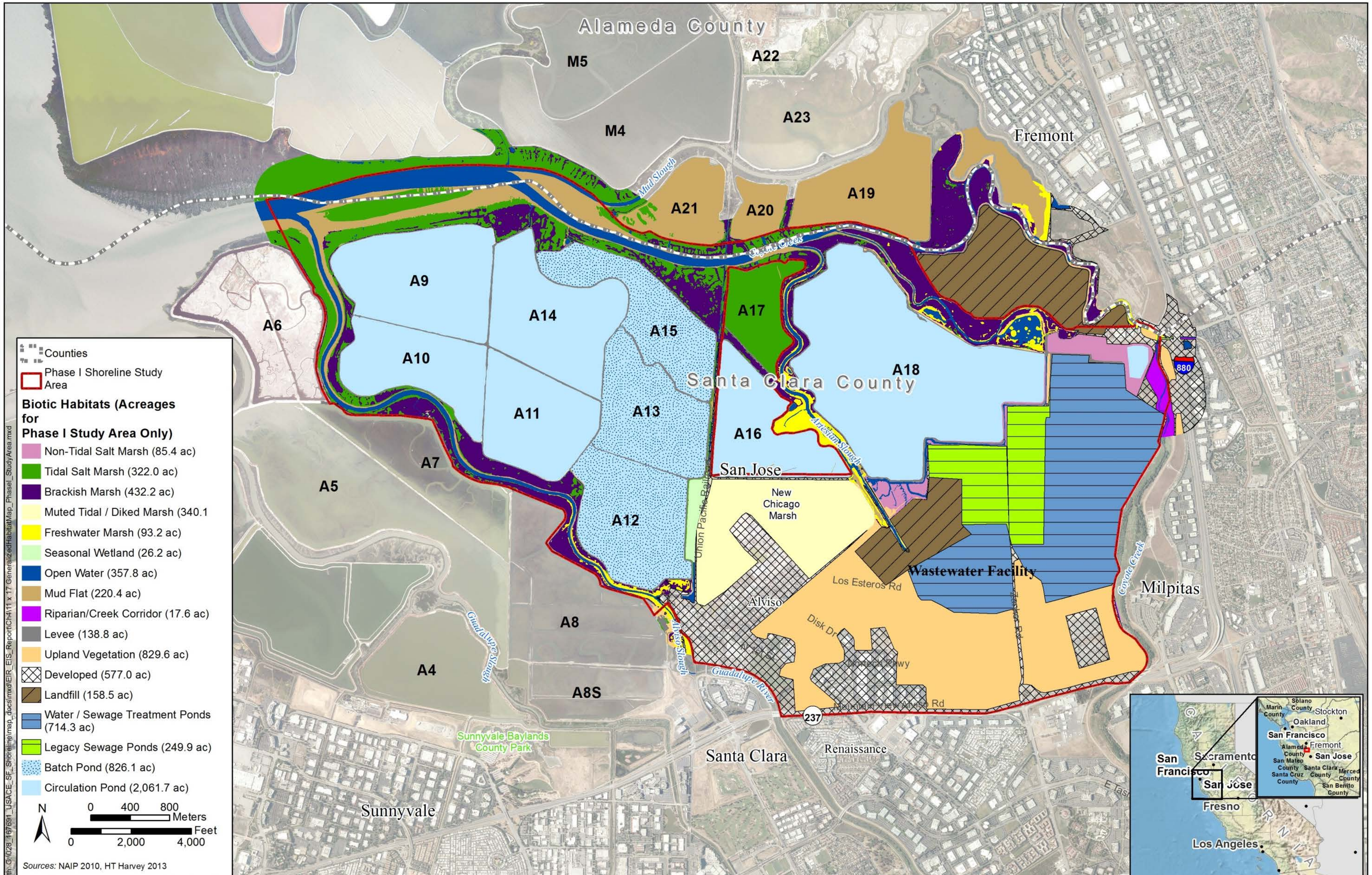

Figure 4.6-1. Shoreline Phase I Study Area and Biological Study Area Habitat

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4.6.1.2.1.1 Tidal Open Water

Approximately 358 acres of open water are found in the study area. The open waters of the South Bay, to the north of the study area, extend from a maximum depth of more than about 26 feet in the channel between the San Mateo and Dumbarton bridges up to the mean lower low water (MLLW) elevation. Within the study area, the open water habitat type is present in Alviso Slough, Artesian Slough, and Coyote Creek and extends upstream into their corresponding drainages. The biological buffer area along Coyote Creek includes this habitat type.

Tidal open waters within the South Bay, including tidal sloughs and channels and areas of open water within and between salt ponds and marshes support a diversity of benthic invertebrates, pelagic invertebrates, and fish species. While not all species reported in the South Bay may occur in the study area, there is potential for occurrence of many of the same species in varying distributions and abundance. During fishery surveys conducted in tidal habitats of the South Bay by the California Department of Fish and Game between 1980 and 2002, 65 fish species were collected. Of those, the most dominant fish included the northern anchovy; shiner perch; longfin smelt; white croaker; Pacific staghorn sculpin; bay goby; plainfin midshipman; English sole; cheekspot goby; and Pacific herring (Life Science 2004 as cited in H.T. Harvey & Associates et al. 2005). The tidal sloughs and channels also serve as important nurseries and feeding areas for estuarine resident fish.

Hobbs (2012) reported three principal species assemblages in the Alviso Slough, including a summer assemblage, a winter assemblage, and a resident assemblage. The winter assemblage is characterized by species that tolerate ranges in salinity, such as longfin smelt, American shad, and Pacific herring. The summer assemblage tends to comprise species that are present in higher-salinity environments. The resident assemblage comprises species that are very tolerant of variable salinities and temperatures, such as the Pacific staghorn sculpin and three-spined stickleback.

Alviso Slough and Coyote Creek provide migratory corridors for adult and juvenile salmonids including the Central California Coast Distinct Population Segment (DPS) steelhead,[1] the fall run of Central Valley Chinook salmon, and green sturgeon, which is infrequently present in the South Bay (EDAW et al. 2007).

Shorebirds, waterfowl, and other waterbirds use the channels and marsh ponds, while the open waters of San Francisco Bay support a high diversity of benthic and pelagic invertebrates. Fish-eating birds, such as terns, fly over open water in search of fish, while diving ducks dive in shallower water for bivalves, crustaceans, and other invertebrates. Large densities of diving ducks are present in some areas where appropriate depths and concentrations of benthic invertebrates, particularly bivalves, provide a rich food source. Terns, pelicans, cormorants, and grebes forage for fish in subtidal habitats. Some wildlife species, such as gulls and ducks, also roost on open waters, especially at night. See Section 4.7 *Terrestrial Biological Resources* for more information about avian species' use of and distribution in the study area.

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[1] See Appendix B5 *Biological Resources: Species Scientific Names, CNDDB Report, and CRPR Report* for a complete listing of species' scientific names.

4.6.1.2.1.2 Mudflat

About 220 acres of intertidal mudflat habitat are found in the study area. Mudflat habitat is present in intertidal areas from below MLLW to mean tide level just beyond the edge of salt marsh habitat within the study area. Intertidal mudflats are expanses of unvegetated mud lying between MLLW and the lower marsh zone. These flats are generally covered by shallow water during high tide but are uncovered at low tide. Narrow mudflats are present along the edges of the tidal sloughs and channels and on the outboard and inboard sides of some former salt pond dikes, while much more extensive flats are present at the mouths of the major sloughs and along the edge of San Francisco Bay.

Large expanses of newly formed mudflat habitat are present along Coyote Creek, especially within and downstream from the Alviso complex's "island ponds" (Ponds A19, A20, and A21, all on the north side of Coyote Creek just outside of the study area). Mudflats in the study area include a large, newly formed mudflat island at the mouth of Alviso Slough adjacent to Pond A9. Additional small areas of mudflat are surrounded by freshwater marsh at the upper end of the reach of Coyote Slough to the south of the island ponds. The biological buffer area along Coyote Creek includes this habitat type.

Mudflats typically support less than 10 percent cover of vascular emergent vegetation, typically in the form of cordgrass (*Spartina* spp.) and annual pickleweed too sparse to map as distinct salt marsh habitat. These same species are more abundant in adjacent areas that are higher in elevation and less subject to regular inundation. The mudflat substrate comprises primarily fine-grained silts and clays that support an extensive community of diatoms and other microalgae, macroalgae, and invertebrates such as worms and shellfish. Mudflats provide important habitat for resident and migratory bird populations in the South Bay as well as foraging habitat for estuarine fishes and invertebrates. Pacific harbor seals and shorebirds, gulls, terns, American white pelicans, and ducks (all species discussed in Section 4.7 *Terrestrial Biological Resources*) often use exposed mudflats as roosting or loafing areas when they are available. During daily high tides, fish school over mudflats to feed on invertebrates. As the tide recedes and the flats emerge, the fish retreat to subtidal areas while large numbers of birds, primarily shorebirds, leave their high-tide roosts to feed on the flats. Although the largest numbers of shorebirds forage on the broad flats along the edge of the bay at low tide, some shorebirds, gulls, and large waders (e.g., herons and egrets) feed on the exposed flats along sloughs and channels. California Ridgway's rails also forage in the exposed channel mudflats and, to a lesser extent, on the edges of the broad mudflats at the edge of the marsh.

4.6.1.2.1.3 Former Salt Ponds (Batch and Circulation Ponds)

About 2,888 acres of the Shoreline Phase I Study Area are occupied by ponds formerly used for salt production. The ponds within the broader Alviso pond complex, referred to as the “Alviso ponds” and numbered A1 through A23, are currently managed as wildlife habitat. Ponds A9 through A15 and A18 are within the study area (Ponds A16 and A17 are surrounded by the study area but are being managed as part of the SBSP Restoration Project). The pond types that are present within the study area are described below:

- **Circulation Ponds.** The circulation ponds encompass about 2,062 acres of the study area. This pond type is managed by circulating bay water through a series of ponds linked by water-control structures, which maintain pond salinities. Management of these ponds focuses primarily on meeting discharge requirements for salinity and dissolved oxygen (DO). However, management for selected habitat conditions (e.g., shallow water for shorebirds, deeper water for waterfowl and diving birds) is feasible when water quality requirements are met. In the study area, Ponds A9, A10, A11, A14, A16, and A18 are currently managed as system ponds and are designated in the maps of existing habitat as “circulation ponds” (Figure 4.6-1 *Shoreline Phase I Study Area and Biological Study Area Habitat*). The biological buffer area along the south side of Pond A16 and north side of the NCM includes this habitat type.
- **Batch (High-Salinity) Ponds.** About 826 acres of high-salinity ponds (A12, A13, and A15) are present within the central portion of the study area between Coyote Creek and Alviso Slough. Batch ponds are ponds managed for higher salinity to support specific wildlife populations, including large numbers of brine shrimp and brine flies that in turn support foraging eared grebes, phalaropes, and shorebirds. These ponds are referred to as “batch ponds” in project maps of existing habitat (Figure 4.6-1 *Shoreline Phase I Study Area and Biological Study Area Habitat*).

Generally, the former salt ponds in the South Bay are characterized by expanses of non-tidal open water, bare mud, or bare salt flats surrounded by mostly barren levees. Vegetation is sparse, and, where it is present, it is limited primarily to levees or along a narrow band on the pondside of the levees (tidal habitats on the outer side of the levees are discussed elsewhere). These higher-salinity ponds provide abundant brine shrimp and brine flies, both of which are food sources for foraging birds.

Some ponds within the Alviso complex contain high levels of mercury in their sediments. Sediment sampling has shown that, overall, Ponds A12 and A13 typically contain the highest mercury concentrations in the study area and exceed the USEPA contaminated sediment criteria (Miles et al. 2005). In addition, several samples from Ponds A15 and A9 had relatively high methyl mercury concentrations in sediments (Miles et al. 2005).

At least 16 species of fish are present in the lower-salinity ponds, where they feed on an abundant supply of benthic and pelagic invertebrate prey. The native topsmelt, longjaw mudsucker, and staghorn sculpin and the nonnative yellowfin goby and rainwater killifish are among the most common fish in these ponds (Takekawa et al. 2005). Northern anchovy, Pacific herring, and bay pipefish have also been found in the ponds (Mejia et al. 2008).

4.6.1.2.1.4 Sewage Treatment Ponds

About 964 acres of the Shoreline Phase I Study Area are occupied by sewage treatment ponds. The study area includes several sewage treatment ponds associated with the Wastewater Facility. Currently, these ponds are part of a biosolids disposal area (approximately 714.3 acres) and a legacy sewage pond area that are no longer used for sewage treatment and have become wetland habitat (approximately 249.9 acres). The ponds are adjacent to muted tidal habitat along Coyote Creek and levees and are not hydraulically connected by surface water flow. The sewage treatment ponds are also adjacent to Pond A18, which is one of the highest waterfowl-use ponds in the South Bay. In general, however, the ponds provide little habitat that is of value to terrestrial wildlife and do not provide habitat for aquatic species such as fish.

4.6.1.2.1.5 Wetlands

Within the South Bay, spatial differences in the wetland plant communities are driven by numerous factors including precipitation, surface and interstitial salinities, relative sea level, and species-specific salinity tolerances (H.T. Harvey &Associates 2010). Collectively, the Alviso Marsh extends east from Guadalupe Slough (not to be confused with the Guadalupe River; Guadalupe Slough is the bayward end of other creeks west of the Guadalupe River, including Calabazas Creek and San Tomas Aquinas Creek (locally known as San Tomas Aquino) to the mouth of Coyote Creek and north to Mud Slough. The marsh contains the estuaries of two of the three largest drainages in South San Francisco Bay (Coyote Creek and Guadalupe River) as well as two sewage treatment plants—the Wastewater Facility and the Sunnyvale Water Pollution Control Plant—which discharge tertiary treated sewage into Artesian Slough and Guadalupe Slough, respectively (Hobbs et al. 2011).

For the purposes of this study, wetlands were divided into tidal salt marsh, non-tidal salt marsh, brackish marsh, and freshwater marsh. Muted tidal habitat and diked marsh habitat that has no tidal influence are also discussed in this section. These habitats collectively account for the greatest acreage of vegetated habitat adjacent to the ponds, occupying about 1,273 acres of the surrounding habitat. Each of these distinct types of wetland habitat is described in further detail below. The wetlands are located mainly in narrow strips between the mudflat and open water habitats and the circulation pond dikes as well as along the landside of the proposed levee adjacent to the Wastewater Facility (known as the WPCP segment). Seasonal wetlands and riparian/creek corridor habitats are discussed separately following the marsh discussions.

Tidal Salt Marsh

About 322 acres of tidal salt marsh are bayward of the outboard (tidal) side of the levees in the study area. Areas of tidal salt marsh in the South Bay are characterized by interstitial soil salinities greater than about 27 ppt, on average (H.T. Harvey & Associates 2002). Salt marsh habitat is primarily along the outboard side of existing levees separating the ponds, primarily

Ponds A9, A10, A14 and A15, from the bay. This habitat type is also present in the biological buffer area along Coyote Creek. The salt marsh habitat in the South Bay consists primarily of low and middle marsh and is dominated by perennial pickleweed and cordgrass. Perennial pickleweed and cordgrass salt marsh habitats are separated by their position relative to tidal inundation; cordgrass typically is present below the mean higher high water (MHHW) mark and perennial pickleweed is present above the mean high water (MHW), often extending up levee banks. Perennial pickleweed and cordgrass salt marshes provide different habitat types in the slough and channels draining into the bay.

Ongoing vegetation studies of the adjacent marsh, Artesian Slough, and Coyote Creek demonstrate the dynamic nature of marshes in the South Bay. Between 2008 and 2010, there was a decrease in the amount of salt marsh habitat and a subsequent increase in the quantity of brackish marsh habitat adjacent to the Alviso pond complex (H.T. Harvey & Associates 2010). More recent evidence suggests that years of lower amounts of rainfall and associated lower streamflows correspond with a die-back of more brackish or freshwater plant communities and an increased distribution of pickleweed salt marsh (H.T. Harvey & Associates 2010). Normal rainfall years appear to reverse this trend and result in the regrowth of vegetation that is more characteristic of brackish marshes, vegetation such as alkali bulrush. The rainfall effect, combined with changes in tidal elevation, appears to drive large-scale changes in the distribution of salt, brackish, and freshwater plant communities.

Current tidal marshes in the South Bay are present as remnants of their former extent but still support high densities, and fairly high diversity, of wildlife species, including several San Francisco Bay endemics (H.T. Harvey & Associates et al. 2005). Terrestrial species, including the State and Federally Endangered salt marsh harvest mouse (SMHM), State and Federally Endangered California Ridgway's rail, and presumably the salt marsh wandering shrew (a California Species of Special Concern), use this habitat type, particularly where pickleweed is present. See Section 4.7 *Terrestrial Biological Resources* for more discussion about terrestrial wildlife species that use tidal salt marshes.

Tidal marshes are nearly as important to the aquatic components of the San Francisco Bay ecosystem as they are to the species that use these marshes directly (i.e., the benthic invertebrates of subtidal areas and mudflats and fishes). Detritus from tidal marshes forms much of the foundation for the food web that ultimately provides sustenance for these species, providing nutrients and carbon for a significant component of the aquatic flora and fauna of the bay (H.T. Harvey & Associates et al. 2005; Harvey et al. 1977; Warwick and Price 1975) as well as cover for fish nursery habitat.

Salt marshes along the outboard side of levees in the study area are an important fringing habitat, providing a physical barrier between the larger waterways (Coyote Creek and Alviso Slough) and adjacent areas. These fringing marshes absorb and break up water and wave action energy, and the plant roots trap sediment and provide shoreline stability (N.C. National Estuarine Research Reserve, no date).

Non-tidal Salt Marsh

About 85 acres of the Shoreline Phase I Study Area are occupied by non-tidal salt marsh. This habitat is located almost entirely in two locations on Wastewater Facility lands: just east of Artesian Slough south of the proposed levee and east of the northernmost stair step of the proposed WPCP levee segment.

An existing condition report for the Wastewater Facility Plant Master Plan (ICF International 2012c) describes non-tidal salt marsh as occurring higher in the marsh than tidal salt marsh, which is not frequently inundated by tidal water. Many areas of non-tidal salt marsh in the South Bay and in the study area have been cut off from tidal action by anthropogenic obstructions, such as levees, dikes, access roads, and other hydrologic impediments. Dominant plant species comprising this habitat include pickleweed, alkali heath, and saltgrass. Other species observed in non-tidal salt marsh habitat in the study area include spearscale perennial pepperweed, five horn bassia, dodder, salt grass, ripgut brome, and soft brome.

Wildlife species that use non-tidal salt marsh are the same as those that are expected to be found in upper, more stable portions of tidal salt marsh because of the similarity of physical habitat characteristics. These species include fossorial mammals (e.g., California ground squirrel, California vole, and salt marsh harvest mouse) and their predators (e.g., red fox, coyote, turkey vulture, western burrowing owl, American kestrel, and red-tailed hawk), various species of shorebirds and wading birds (e.g., killdeer, great egret, and great blue heron), song sparrow, and western fence lizard (ICF International 2012c).

Brackish Marsh

About 432 acres of brackish marsh are present throughout the study area, mostly along Alviso Slough and Coyote Creek. In 2010, vegetation mapping identified widespread increases in brackish marsh areas and of alkali bulrush in particular (H.T. Harvey & Associates 2010). This habitat covers the marsh plain in the transition from salt to freshwater marsh along the entire reach of Coyote Creek being studied and also dominates the outboard sides of levees near the confluence of Mud Slough and Coyote Creek.

Brackish marsh dominates a non-tidal mitigation marsh east of Artesian Slough and south of A18. Water input in this area is largely provided from the outfall weir at the Wastewater Facility. This brackish marsh replaces the salt marsh habitat closer to Coyote Creek moving upstream along Alviso Slough. Brackish marsh habitat typically occurs in the low-to-mid-intertidal reaches of sloughs and creeks draining into the South Bay, where vegetation is subject to tidal inundation diluted by freshwater flows from upstream. For this reason, the average interstitial soil salinity of tidal brackish marsh is lower than in salt marshes, ranging from 15 to 20 ppt in the South Bay (H.T. Harvey & Associates 2002). The water-surface elevation within reaches of brackish marsh in the study area (primarily located in the upper reaches of the study area) can vary by as much as 9 feet, depending on daily tidal activity, seasonal freshwater flows from upstream, and their location within this estuary system. Sloughs fed by freshwater typically exhibit very steep, rapidly fluctuating salinity gradients. Lower Coyote Creek, at the downstream end of this marsh, exhibits salinity fluctuations of 10 ppt or more during each tidal cycle (Hobbs et al. 2011).

Brackish marsh habitat is dominated by emergent, vascular plant species adapted to intermediate (brackish) interstitial soil salinities (H.T. Harvey & Associates et al. 2005), including short bulrushes such as alkali bulrush and saltmarsh bulrush. These species dominate lower brackish marsh habitat where sediment deposits have formed terraced floodplains between the low-flow channels and levees. The middle reaches of these channels are also dominated by shorter bulrushes but, in addition, may have dense stands of tall bulrushes such as California bulrush and hardstem bulrush adjacent to the low-flow channel of creeks and sloughs. Large, dense patches of the invasive, perennial pepperweed may also be present within terraced areas in middle reaches otherwise exclusively dominated by alkali bulrush. Other plants that are in brackish marshes include alkali heath, spearscale, and pickleweed along the high marsh/upland transitional habitats. Higher-order slough channels and upper-creek reaches dominated by these species may also be considered brackish marsh, depending on the extent of intrusion of fresher water in these areas.

Brackish marshes support many of the wildlife species that use salt marsh and freshwater marsh habitats. Species composition and the relative abundance of different species may vary spatially within brackish marshes depending on water salinity, vegetation type, and habitat structure. Black rail (a California Threatened and Fully Protected Species) is known to use this area and may breed here (discussed further in Section 4.7 *Terrestrial Biological Resources*). Variability in salinity within brackish marshes is likely most important for aquatic species, which are directly affected by salinity changes. Brackish marshes are particularly important for juvenile anadromous fish (outmigrating from fresh to saline waters), which use brackish marshes while acclimating to changing salinity on their migrations between freshwater and saline habitats (H.T. Harvey & Associates et al. 2005).

Muted Tidal/Diked Marsh

There are a number of muted tidal/diked marsh areas occupying about 340 acres in total in the study area, including the NCM.

Muted tidal/diked marshes have limited or no tidal exchange because of the presence of levees around the perimeter of bay waters and ponds. Water exchange is limited; therefore, the range in water level in the muted tidal marsh is small (usually a few inches) compared to the range of tidal change in other marsh areas (up to 9 feet). Muted tidal marshes exhibit many of the same features as fully tidal marshes, but they often have lower plant diversity because of the limited range in tidal action. Muted tidal marshes support some of the same types of terrestrial wildlife as tidal salt marshes. As described in Section 4.7 *Terrestrial Biological Resources*, the NCM provides important habitat for SMHM and breeding western snowy plovers, Forster's terns, black-necked stilts, and American avocets.

Freshwater Marsh

About 93 acres of freshwater marsh habitat are present in the study area, mostly in the upper reaches of sloughs and creeks draining into the South Bay. The majority of this habitat type is tidal freshwater marsh found in the upper reaches of Coyote Creek, Artesian Slough, and Alviso Slough. While these reaches may be subject to occasional tidal influence associated with high (usually spring) tides and might have somewhat saline historical sediments, these reaches are otherwise flushed with fresh water on a daily basis and support mostly freshwater emergent vegetation. The water-surface elevation within reaches of freshwater marsh may also vary by as much as 10 feet depending on daily tidal activity and seasonal, freshwater flows from upstream, including discharge from water treatment plants (i.e., outflow from the Wastewater Facility). Juvenile salmonids (species unknown) have been observed in these freshwater marshes.

Broad-leaf cattail and taller bulrushes, including California bulrush and hardstem bulrush, typically dominate the freshwater marsh habitat. Because of regular inundation, these species often form dense stands covering entire floodplain terraces along channels. Patches of perennial pepperweed and thickets of California blackberry are also present in regions of freshwater marsh.

Relatively limited areas of freshwater marsh are present in the South Bay, and wildlife communities of these marshes (relative to brackish and salt marshes) in the South Bay have been little studied. Where freshwater is present along the inland margins of the study area, the Pacific treefrog, bullfrog, and western toad are present. Most wetland-associated birds respond more to food availability and habitat structure than to salinity and therefore may be present in abundance in freshwater, brackish, or salt marsh habitats with suitable habitat structure. See Section 4.7 *Terrestrial Biological Resources* for more discussion regarding terrestrial wildlife.

4.6.1.2.1.6 Seasonal Wetland

About 26 acres of seasonal wetland habitat are present in the study area, mostly along the eastern perimeter of Pond A12 adjacent to the Union Pacific Railroad track. Seasonal wetlands are shallow depressions that typically contain standing water during the rainy season but become drier, or dry out completely, in summer and fall. Seasonal wetland habitats in the study area include both vegetated and unvegetated habitat. Unvegetated flats are found between Pond A12 and the Union Pacific Railroad tracks and in smaller, isolated areas. Vegetated seasonal wetlands are dominated by nonnative species including curly dock, cocklebur, Italian ryegrass, Mediterranean barley, rabbits foot grass, and hyssop loosestrife.

Seasonal wetlands provide foraging areas for upland avian species and some avian species that also use other types of wetlands, such as shorebirds, dabbling ducks, and great blue herons. When seasonal wetlands are dry, they are used for foraging by species such as northern harrier and red-tailed hawk. Western snowy plovers nest in the hypersaline flat area adjacent to Pond A12. American avocets also nest here in some years. Aquatic species that use seasonal wetlands in the study area are probably limited to common species, such as mosquitoes of various species and brine flies (family Ephydridae).

The Shoreline Phase I Study Area does not support any vernal pools, a specific type of seasonal wetland known for supporting several species of aquatic invertebrates.

4.6.1.2.1.7 Riparian/Creek Corridor

About 18 acres of riparian habitat and urban creek corridor are found in the study area. Riparian habitat includes vegetated corridors adjacent to freshwater streams, creeks, and rivers. The historical riparian landscape found in the South Bay was characterized by intermittent and perennial creeks. Most creeks did not reach San Francisco Bay via well-defined channels, and those that were perennial in their lowest reaches had minimal summer flows and likely had little effect on slough salinity during summer months. Coyote Creek was intermittent in its middle reaches but had short perennial sections near San Francisco Bay associated with dense stands of willows (Grossinger et al. 2006), and provided only a small amount of fresh water during the summer months. Currently, flow releases from Anderson Dam and Reservoir and the Anderson Force Main (which supplies water from the Central Valley Project via San Luis Reservoir), and groundwater recharge operations and facilities influence flows from Coyote Creek into San Francisco Bay.

Riparian habitat is not widespread in the study area. Within the study area, riparian habitat is present along the upstream portions of Coyote Creek near the northeastern corner of the study area. Dominant canopy species in South Bay riparian areas such as the one along Coyote Creek include willow and Fremont cottonwood, while common understory species include elderberry and wild rose.

Tidally influenced areas of Coyote Creek downstream of the area dominated by freshwater riparian vegetation support fishes such as staghorn sculpin, northern anchovy, starry flounder, shiner perch, yellowfin goby, threadfin shad, and longfin smelt (H.T. Harvey and Associates et al. 2005). Upstream of the bay, the Coyote Creek watershed is known to support Pacific lamprey, steelhead/resident rainbow trout, Chinook salmon, California roach, hitch, Sacramento blackfish, Sacramento pikeminnow, Sacramento sucker, threespine stickleback, prickly sculpin, riffle sculpin, staghorn sculpin, and tule perch (Santa Clara Valley Urban Runoff Pollution Prevention Program Website April 25, 2013).

4.6.1.2.2 Aquatic Resources

Although surrounded by urban development and highly altered by the diking of wetlands for salt production, the South Bay area supports important remaining habitat in the entire estuary for a number of special-status fish species. In this section, aquatic species in the South Bay are described, specifically species composition and the structure of aquatic invertebrate and fish communities.

The South Bay supports a variety of microhabitat conditions, plant structure, and species assemblages. However, as they pertain to species use of the study area, the previously described aquatic habitat types can generally be divided into several broad categories: tidal sloughs and channels, intertidal mudflats, vegetated tidal wetlands/marsh, ponds, and freshwater tributaries.

The diversity and high productivity of habitat types present within the study area support an assortment of fish and aquatic species. The biology of aquatic species present within the study area is discussed in detail below. A discussion of marine mammals present in the study area is included in Section 4.7 *Terrestrial Biological Resources*.

4.6.1.2.2.1 Invertebrates

South San Francisco Bay is dependent on detritus and phytoplankton as the food web base (Jassby et al. 1993 as cited in Thompson and Parchaso 2009). Invertebrate communities of the South Bay are important consumers, controlling phytoplankton biomass in the bay, and are key prey for fish and birds. They are also important in nutrient and contaminant recycling and the accumulation of contaminants (Thompson and Shouse 2004). Invertebrate communities vary considerably among different habitats in the study area. This section includes a separate description of invertebrates in saline open water, subtidal/intertidal habitats, tidal marshes, ponds, and freshwater habitats. Mosquitoes are discussed in Section 4.1.3.3.3.8 *Public Health and Vector Management*.

Saline Open Water Invertebrate Communities

The epifaunal invertebrate community (more-mobile species on the mud's surface) in the South Bay is dominated by several species of shrimps and crabs. Two native caridean shrimps, the California bay shrimp and blacktail bay shrimp, are common in tidal sloughs and in the bay itself. The California bay shrimp supports the only commercial fishery remaining in the South Bay aside from the limited harvest of brine shrimp. Adult California bay shrimp spawn in the ocean in March and April, and the planktonic larvae are carried into San Francisco Bay by tides and by currents into the South Bay. Juvenile bay shrimp arrive in the South Bay in May and use shallow waters having lower salinities as nurseries. These juveniles migrate up sloughs to brackish water. Thus, they use the Guadalupe River/Alviso Slough and Coyote Creek systems in the study area for feeding and growth through the summer (EDAW et al. 2007).

Other shrimp species, including blackspotted bay shrimp, oriental shrimp, stout coastal shrimp, miniature spinyhead, ridgetail prawn, and visored shrimp, also are present in South Bay waters but are much less abundant than the California bay shrimp (EDAW et al. 2007).

Subtidal/Intertidal Invertebrate Communities

Intertidal mudflats contain three main groups of invertebrates: benthic infauna (less-mobile invertebrates living in or on the mudflats), epifauna, and pelagic fauna (highly mobile species living in the water column). Within the San Francisco estuary, the South Bay contains by far the highest benthic invertebrate biomass, likely due to greater stability of salinity and sediments, large detritus biomass, and the abundance of several introduced bivalve species (Nichols 1979; Nichols and Pamatmat 1988; H.T. Harvey & Associates et al. 2005).

In a recent study, Thompson and Parchaso (2009) identified two exotic species, *Corbula amurensis* and *Nippoleucon hinumensis*, which were introduced since 1985. Like Baltic clams, *Corbula* is likely to be a good source of food for birds and other predators; however, the smaller *Nippoleucon* may not be as valuable to some predators. Some fish species, such as white sturgeon, eat *Corbula*, but the clam passes through the fish undigested. The results of studies by the California Department of Fish and Wildlife (CDFW; formerly CDFG) show that white sturgeon are potential vehicles for transport of adult *Corbula amurensis* clams (and thus could further spread the invasive clam). The results also suggest that the clam can adversely affect the nutrition (and ultimately success) of species such as white sturgeon because nonnutritive food such as the clam provides no benefit to the fish and is a drain on the fish's digestive system (CDFG 2008).

Tidal Marsh Invertebrate Communities

The invertebrates of the vegetated portions of tidal salt and brackish marshes, including benthic infauna, epifauna, and terrestrial species, have not received as much study as those of intertidal habitats, in part because much of the invertebrate biomass within tidal marshes is present within the intertidal and subtidal zones of sloughs and smaller marsh channels. Tidal salt marsh invertebrates provide important forage material for a variety of aquatic and terrestrial species and provide other ecological functions as discussed by Maffei (2000f).Within tidal salt marshes in the South Bay, common invertebrates include the nonnative ribbed mussel, Baltic clam, nonnative mud snail, and yellow shore crab (Niesen and Lyke 1981).

Circulation Pond Invertebrate Communities

Invertebrate communities in South Bay ponds have been extensively studied (Carpelan 1957; Anderson 1970; Swarth et al. 1982; Lonzarich and Smith 1997). In these ponds, invertebrate species richness decreases, and biomass increases (to a point) as salinity increases, primarily because of the increase in brine shrimp (Anderson 1970; Britton and Johnson 1987; Carpelan 1957; Lonzarich 1989; Swarth et al. 1982; Williams et al. 1990). In lower-salinity ponds, numerous nematodes are present in decaying organic matter and mud.

Arthropods are the dominant, and ecologically most important, group of invertebrates inhabiting the former salt ponds in the South Bay. The native brine shrimp, which is consumed by a variety of aquatic species as well as birds, is the predominant animal in higher-salinity ponds.

Two insect groups are also important components of the South Bay invertebrate fauna because of their numerical abundance and importance to foraging birds. Adult reticulate water boatmen inhabit the ponds year-round, and a number of species of brine flies are present within the San Francisco Bay Area.

Freshwater Macroinvertebrate Communities

In the South Bay, studies of freshwater invertebrates have focused primarily on invertebrate assemblages in the middle and upper reaches of streams entering the South Bay. In comparison, relatively few data exist on the downstream reaches of these streams, the reaches that are present within the study area. A 1997 study of stream macroinvertebrates in the Santa Clara Valley identified 261 taxa (groups or ranks in biological classification into which related organisms are classified) at 44 sites along seven streams (Carter and Fend 2000). Taxonomic richness decreased from upstream to downstream sampling locations.

Invasive Invertebrates of the South Bay

According to Cohen and Carlton (2003) and others, the San Francisco estuary is the most invaded aquatic ecosystem in North America. Collectively, these nonnative species have significant impacts on the San Francisco estuary through aggressive predation, highly efficient filter feeding, and competition, which has reduced available habitat and resources for native species.

Cohen and Carlton (2003) noted that at least 212 species, 69 percent of which are invertebrates, have been introduced to San Francisco Bay and the Sacramento–San Joaquin Delta since 1850. The most important species include a number of clams, many of which were introduced into San Francisco Bay via releases of ballast water (Cohen and Carlton 1995), such as the introduced Asian species of *Venerupis* and *Musculista* and the Atlantic clam *Gemma*. With the exception of the Baltic clam, the numerically dominant mollusks of the South Bay are all nonnative species (Nichols and Pamatmat 1988). Collectively, these introduced clam species are capable of filtering the entire volume of the South Bay daily, which has led to dramatic impacts on San Francisco Bay's phytoplankton and zooplankton populations. The Asian clam *Corbula amurensis* is a dominant species in the bay, accounting for 95 percent of the biomass in some areas. This reduces the amount of available space for other species to grow and reproduce (NIMPIS 2002).

The Asian clam, the most abundant clam in San Francisco Bay, was introduced via ballast water around 1986 (Cohen 1998). The gem clam (*Gemma gemma*) occurs throughout the South Bay in both deep subtidal and high intertidal habitats. The Atlantic ribbed marsh mussel was introduced in the late 1800s and is now common throughout much of San Francisco Bay. The soft-shell clam was introduced for commercial purposes and was maintained as an important fishery in the bay in the late 1800s and early 1900s (Skinner 1962). It is an important prey item for California bat rays, flounder, and canvasbacks (Harvey et al. 1982).

The dominant crustaceans of the South Bay are also introduced species. The tube-dwelling amphipod *Ampelisca abdita* was first detected in San Francisco Bay in the 1950s. The other dominant crustaceans in the South Bay include several burrowing amphipods, including *Grandidierella japonica*, and several nonnative *Corophium* species. Both of these genera tolerate poor water quality and readily colonize available habitat throughout the South Bay. These crustaceans are important prey species for shorebirds on intertidal mudflats. The European green crab became established in San Francisco Bay in 1989–1990.

Two nonnative species could physically affect South Bay marshes, levees, streambanks, and other structures. The New Zealand burrowing isopod burrows into mud banks and levees throughout San Francisco Bay, potentially weakening these features and making them prone to erosion (Talley et al. 2001). This isopod is locally pervasive and can be found over a wide range of salinities. The USACE considers it a significant threat to salt marsh restoration (National Park Service 2013). All measures of erosion are higher in infested sites than in uninfested reference sites (Davidson and de Rivera 2008). Another burrowing species that may cause the same problem is the Chinese mitten crab, which has been known to accelerate bank erosions in Germany. First detected in the bay in 1992, the mitten crab has undergone rapid population increases throughout San Francisco Bay and its tributaries (Thompson and Shouse 2004).

4.6.1.2.2.2 Fish

Information on South Bay fish communities is somewhat limited; however, several studies, including recent investigations conducted as part of the overall SBSP Restoration Project, have provided information on fishes of the South Bay's aquatic habitats and ponds (Anderson 1970; Carpelan 1957; Lonzarich 1989; Takekawa et al. 2005; Hobbs 2011; Hobbs 2012). Information on key species is also available in the Goals Project Baylands Ecosystem Species and Community Profiles (Goals Project 2000).

Fish Communities of Tidal Habitats

More than 100 species of fish have been recorded in the tidal habitats of the South Bay. Some species are present year-round, while others are present seasonally. Hobbs (2012) reported three principal species assemblages in the Alviso Slough, including a summer assemblage, a winter assemblage, and a resident assemblage. The winter assemblage is characterized by species that tolerate ranges in salinity, such as longfin smelt, American shad, and Pacific herring. The summer assemblage tends to comprise species that are present in higher-salinity environments. The resident assemblage comprises species that are very tolerant of variable salinities and temperatures, such as the Pacific staghorn sculpin and three-spined stickleback. Hobbs (2012) suggests that these tolerant species are also the fish that could use low-salinity ponds and are the species that most likely would provide the opportunity to associate pond restoration with fish production.

As of the summer 2012, Hobbs (2012) has collected 31 different species by otter trawl, a majority of which were native to the San Francisco estuary. Otter trawling essentially consists of dragging an open trawl net, using boards, to capture fish. The net is held open vertically on an otter trawl by floats attached to a rope that runs along the upper mouth of the net, and weights attached to a rope that runs along the lower mouth of the net. Otter trawls conducted in 2012 in the Alviso Slough captured a variety of fish species (Table 4.6-3 *Otter Trawl Catches within Alviso Slough in 2012*) and indicated that overall fish abundance was greatest during the summer surveys (July and August) and reached a low in February. In February, the winter assemblage of pelagic fish decreased in abundance and remained low into May, suggesting these species have a very short seasonal use of the South Bay, likely using the shallow sloughs for spawning (Hobbs 2012).

Table 4.6-3. Otter Trawl Catches within Alviso Slough in 2012

Common Name	Number of Fish Caught by Month				
	January	March	April	May	June
American shad	26	10	5	1	3
Arrow goby	0	70	9	92	122
Bay goby	0	0	8	2	1
Bay pipefish	6	5	3	1	2
California bat ray	0	1	1	1	3
California halibut	0	0	9	6	7
Chinook salmon	0	0	0	1	0
English sole	65	1,369	270	2	1
Longfin smelt	15	17	0	0	0
Longjaw mudsucker	0	0	0	4	0
Mississippi silverside	0	2	0	0	0
Northern anchovy	1	24	223	78	206
Pacific herring	1	771	296	1	1
Pacific lamprey	18	0	0	0	0
Pacific staghorn sculpin	104	1,038	1,564	292	343
Plainfin midshipman	0	0	0	0	1
Prickly sculpin	11	4	2	2	3
Rainwater killifish	0	0	0	0	2
Sacramento sucker	0	1	1	3	4
Shimofuri goby	0	0	1	0	0
Shiner surfperch	2	11	12	1	1
Shokahaze goby	0	0	0	2	0
Speckled sanddab	3	2	3	0	0
Starry flounder	16	23	12	9	48
Striped bass	0	1	32	20	8
Surf smelt	0	1	0	0	0
Threadfin shad	8	5	0	0	0
Three-spine stickleback	99	119	10	8	76
Topsmelt	11	1	0	1	0
White sturgeon		0	1	0	0
Yellowfin goby	53	28	18	23	220

Source: Hobbs 2012

Alviso Slough yields relatively high fish species diversity due to freshwater inflow. The most commonly captured fish species in Alviso Slough are the northern anchovy, three-spined stickleback, Pacific herring, English sole, Pacific staghorn sculpin, and yellowfin goby. Three-spined sticklebacks are closely associated with restored former salt pond habitats. Although staghorn sculpin and yellowfin goby can complete their lifecycle in the slough, they may immigrate into the slough from adjacent areas for nursery use (Hobbs 2011). During trawling of Alviso Slough from May to November 2011, the seven most abundant species (three-spined stickleback, Pacific staghorn sculpin, Pacific herring, northern anchovy, arrow goby, yellowfin goby, and starry flounder) accounted for 97.5 percent of the total catch, while 17 other species were considered rare (Hobbs et al. 2011). Topsmelt have also been found to be quite ubiquitous and have been collected in many ponds and sloughs of the Alviso pond complex (Mejia et al. 2008).

Hobbs et al. (2011) found a seasonal shift in fish species at the Alviso pond complex, with several pelagic species arriving during winter (e.g., American and threadfin shad, longfin smelt, and Pacific herring) and species such as northern anchovy declining in winter. Populations in mature pickleweed marshes adjacent to restored former salt ponds (Ponds A6 and A8) showed higher catch relative to sites within ponds; however, some months had higher catches within the newly breached ponds, suggesting some species exploited the new habitat in some months.

In the South Bay, circulation ponds support lower diversity of native fishes than tidal habitats, and only a few species are present in circulation ponds in large numbers. Conversely, many of the fish recorded in the South Bay use tidal channels and mudflats at high tide when they are inundated. These tidal habitats are particularly important as nursery habitat for juvenile fish.

The spatial and temporal distribution of different estuarine fish in the South Bay varies widely among species, as does the degree to which different species use San Francisco Bay for breeding and foraging. The South Bay is particularly important to the leopard shark. Pupping (live birth) in San Francisco Bay occurs almost exclusively in the South Bay (CDFG Bay Trawl data cited in McGowan 2000a). This species is present year-round in the bay and appears to be most abundant in the areas on either side of the Dumbarton Bridge, north of the study area, where it forages in shallow mud and sand flats (Compagno 1984). San Francisco Bay is also important for northern anchovies, which spawn in the South Bay, including areas south of the Dumbarton Bridge (McGowan 1986). Spawning occurs in marsh channels; larvae forage over shallow flats after hatching (McGowan 2000b). Adult anchovies generally leave San Francisco Bay for the open ocean in fall, but some late-spawned juveniles remain in San Francisco Bay throughout the winter. Jacksmelt likely spawn in the South Bay from October to early August (Wang 1986) when adults move inshore from marine habitats and lay eggs on aquatic vegetation and other substrates. Apparently preferring more saline waters, the jacksmelt is most common in the Central and South Bays during years of high freshwater flows from the Sacramento–San Joaquin Delta (CDFG 1987 as cited in Saiki 2000b).

Adult topsmelt enter shallow sloughs and mudflats to spawn in late spring and summer; this has been observed in the South Bay near the Dumbarton Bridge (Wang 1986). Eggs are laid on submerged vegetation. Locally, this species is most abundant in the South Bay, where mudflats and sloughs are used for spawning and feeding and as nursery areas for juveniles (Saiki 2000c). The Pacific staghorn sculpin is most abundant in the Central Bay and North Bay, but in some years it is commonly present in the South Bay also (CDFG 1987 as cited in Tasto 2000). This sculpin spawns from November to March in shallow subtidal to intertidal water, and the young gradually shift their foraging areas from shallow intertidal habitats to deeper subtidal habitats as they mature (Tasto 2000). The arrow goby is present on shallow intertidal flats and in salt-marsh channels throughout much of the South Bay, where it is often commensal with burrowing invertebrates (DeLeon and Hieb 2000). This species breeds primarily in spring and early summer, with peak larval occurrence from April through July. The bay goby is present in somewhat deeper water habitats than what is inhabited by the arrow goby and is also a common breeding species in the South Bay (DeLeon and Hieb 2000).

The longjaw mudsucker resides on mudflats and in tidal channels and sloughs. Marshes with complex channels provide the highest-quality habitat, although this species also breeds in lower-salinity ponds (DeLeon and Hieb 2000; DeLeon et al. 1999). The longjaw mudsucker spawns from November through June in the South Bay, constructing burrows for breeding. In the summer of 2011, longjaw mudsucker were most abundant at the Alviso Slough fringing marsh along Pond A6 (Hobbs 2011). The abundance of longjaw mudsuckers is seasonal and declines in October with decreasing water temperatures and the onset of breeding season.

Other species forage in the South Bay but are not known to breed here. Pacific herring are present in the North Bay from November through March, when spawning occurs; larvae and juveniles are present more widely, during which time they are present in the South Bay (although abundance decreases southward). Most individuals depart San Francisco Bay by August (Tasto 2000).

Striped bass were introduced into the San Francisco estuary in the 1800s and are now one of the most important sport fish in San Francisco Bay. Adults congregate in San Pablo and Suisun Bays in fall and move into the Sacramento–San Joaquin Delta to spawn primarily in the Sacramento and San Joaquin Rivers in May and June. Because striped bass are not known to breed in the South Bay, this species is likely subadult fish foraging widely in San Francisco Bay. The California halibut forages to some extent in the South Bay but is not known to breed anywhere inside San Francisco Bay (Saiki 2000a). Juvenile starry flounders are present fairly commonly in South Bay sloughs, tidal marsh channels, and mudflats, although this species is not known to breed in San Francisco Bay (Kline 2000).

Circulation Pond Fish Communities

Fish community composition and abundance within the ponds of the South Bay are primarily a function of salinity, with more diverse communities and greater abundance in lower-salinity ponds, and generally no fish surviving salinities greater than 100 ppt. The primary fish species reported to be present in the Alviso ponds are topsmelt, threespine stickleback, longjaw mudsucker, rainwater killifish, and yellowfin goby (Carpelan 1957; Lonzarich and Smith 1997; Takekawa et al. 2005). Other species recorded in the Alviso ponds include northern anchovy, bay pipefish, staghorn sculpin, chameleon goby, leopard shark, shiner surfperch, and striped bass.

Freshwater Stream Fish Communities

Fishes in the freshwater streams entering the study area consist of a diverse assemblage of native species augmented by a number of nonnatives. Native species recorded along lower Coyote Creek between 1858 and 2000, and thought to be extant as of 2000, include the splittail; Pacific lamprey; steelhead/rainbow trout; California roach; hitch; Sacramento blackfish; Sacramento pikeminnow; Sacramento sucker; threespine stickleback; prickly sculpin; riffle sculpin; and staghorn sculpin (Buchan et al. 2002; Buchan and Randall 2003). Other natives, such as the thicktail chub, Sacramento perch, coho salmon, and speckled dace, were recorded historically in lower Coyote Creek but may have been extirpated. Several anadromous fish species, including steelhead, Chinook salmon, green sturgeon and longfin smelt, also are present in the study area.

A variety of nonnative fish introduced either unintentionally or intentionally for angling or mosquito control are present in South Bay freshwater streams. These nonnatives include the mosquito fish; channel catfish; brown bullhead; yellow bullhead; black bullhead; white crappie; black crappie; red shiner; inland silverside; carp; goldfish; fathead minnow; redear sunfish; bluegill; green sunfish; largemouth bass; golden shiner; and others (Buchan et al. 2002; Buchan and Randall 2003). Many of these nonnatives are widespread in streams throughout Central California and are tolerant of a wide range of water qualities.

In 2006, Saiki and Mejia (2009) found that the fish species assemblage in two upper reaches of Coyote Creek and in one 2-mile reach of Artesian Slough was characterized by freshwater species (e.g., Sacramento sucker) and by an absence of the estuarine/marine species noted in the habitats subject to extensive tidal influence. Salinity appeared to be the factor most associated with spatial distribution of fish species, and water temperature, dissolved oxygen, and pH had little influence on fish distribution. From May to July 2006, common species collected in a reach of Artesian Slough, about 2 miles upstream of Coyote Creek, included Sacramento sucker, American shad, common carp, threespine stickleback, yellowfin goby, and striped bass (Saiki and Mejia 2009).

Recent sediment sampling of the study area indicates that mercury concentrations from sediment in Artesian Slough are higher than those in Alviso Slough. However, preliminary data from 2010 and 2011 on mercury in fish collected in these sloughs do not necessarily show the same trend (SFEI 2012). More information on mercury can be found in Section 4.5 *Surface Water and Sediment Quality*.

4.6.1.2.3 Special-Status Aquatic Species and Habitats

A number of special-status fish species are present within the study area. Special-status fish species that are present in the study area and adjacent habitats are described below. The legal status and likelihood of occurrence of these species are given in Table 4.6-4 *Special-Status Fish Species, Their Status, and Potential Occurrence in the Study Area*. More information on most of these species can be found in the Goals Project Baylands Ecosystem Species and Community Profiles (Goals Project 2000).

Table 4.6-4. Special-Status Fish Species, Their Status, and Potential Occurrence in the Study Area

Name	Status	Habitat	Potential for Occurrence On Site
Central Valley fall-run and late fall-run Chinook salmon (*Oncorhynchus tshawytscha*)	CSSC (fall-run only)	Cool rivers and large streams that reach the ocean and that have shallow, partly shaded pools, riffles, and runs.	Known to be present in several South Bay area creeks (including Coyote Creek, Alameda Creek, and the Guadalupe River) and associated marshes and small channels in the study area, especially as habitat for smolts as they transition to life in a marine environment. Suitable spawning habitat is not present in the study area, but individual strays from the Sacramento and San Joaquin River systems have been observed spawning in Coyote Creek and presumably move through the area in search of suitable spawning habitat in Coyote Creek. However, Coyote Creek provides limited, low-quality spawning habitat and does not support a population of fall- and late-fall-run Chinook salmon. Nonetheless, during certain times of the year, Coyote Creek, Artesian Slough, and Alviso Slough may contain migrating or rearing Chinook salmon.
Steelhead – CCC DPS (*Oncorhynchus mykiss*)	FT	Cool streams with suitable spawning habitat and conditions allowing migration, and marine habitats.	Known to be present in several South Bay area creeks (including Coyote, Stevens, and San Francisquito Creeks, and the Guadalupe River) and associated marshes and small channels in the study area, especially as habitat for smolts as they transition to life in a marine environment. CCC steelhead are not known to be present in Ponds A9–A15 or A18 but are present in Alviso Slough during upstream migration of adults to spawning areas in the Guadalupe River watershed and downstream migration of both adults and smolts heading toward the ocean. Steelhead could potentially move into Artesian Slough adjacent to Pond A18 as well, although, because they do not spawn in Artesian Slough, such presence is expected to be infrequent and limited to a small number of individuals. Suitable spawning habitat is not present in the study area, but this species moves through the area to spawn upstream. The Guadalupe River and Coyote Creek are both designated critical habitat for the CCC DPS.
Green sturgeon – Southern DPS of North American Green Sturgeon (*Acipenser medirostris*)	FT	Adults and subadults live in oceanic waters, bays, and estuaries when not spawning in freshwaters. Green sturgeon is known to forage in estuaries and bays, including San Francisco Bay.	Green sturgeon has been caught infrequently by anglers in the South Bay. The distribution of this species in the study area for Ponds A9–A15 and A18 is poorly known. Although one acoustically tagged green sturgeon was identified by a receiver located on the Dumbarton Railroad Bridge during 2012, it is likely that green sturgeon are present infrequently, and in low numbers, in Alviso and Guadalupe Sloughs and in the portions of the open bay adjacent to Pond A9. The South Bay is in the area considered critical habitat for the green sturgeon – southern DPS.
Longfin smelt San Francisco Bay-Delta DPS (*Spirinchus thaleichthys*)	FC, ST	Rearing and foraging habitat in brackish/ estuarine waters; are present in open water away from the bottom of the water column and away from the shore; spawn in freshwater.	Seasonally documented (winter assemblage) in the tidal sloughs of the Alviso pond complex.

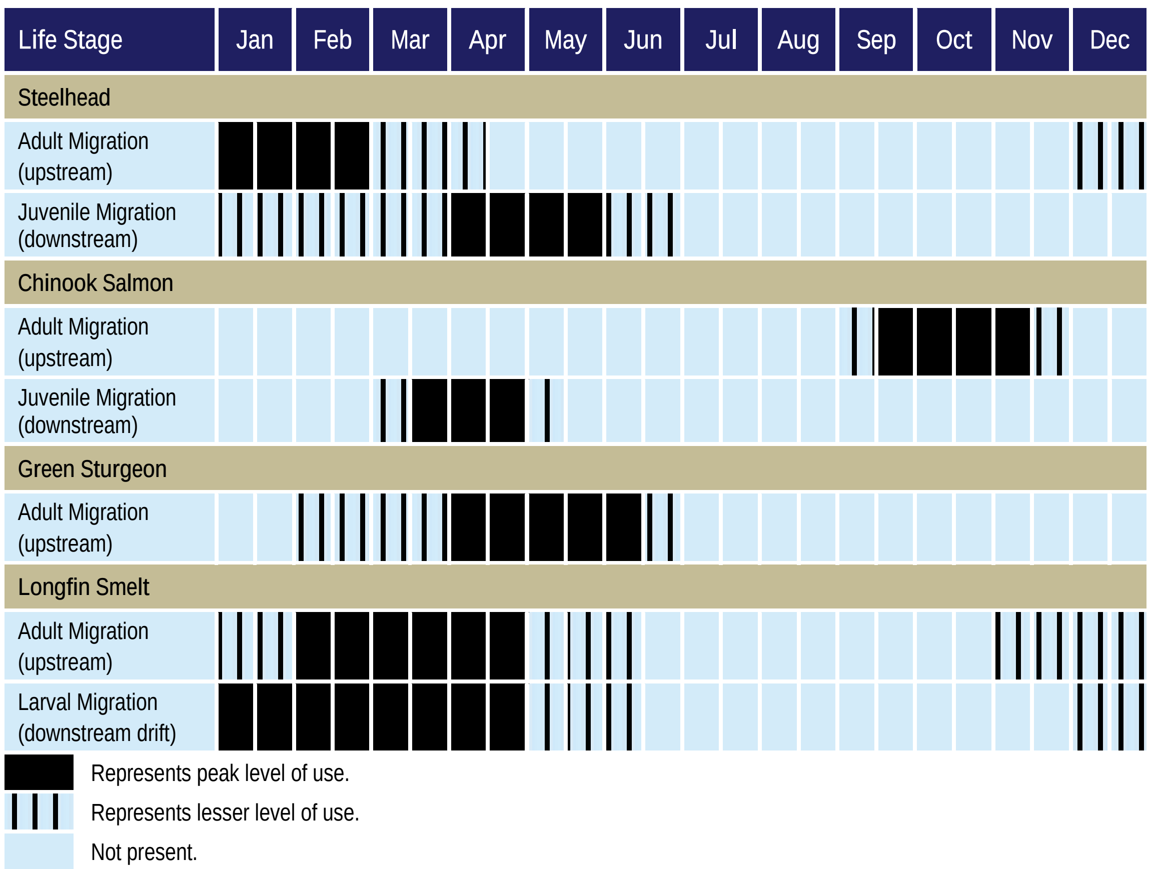
Key: CCC= Central California Coast; CSSC = California Species of Special Concern; DPS = distinct population segment; FT = Federally listed as Threatened; FC = Federal candidate species; ST = State listed as Threatened

4.6.1.2.3.1 Special-Status Anadromous Fish Species

Anadromous fish, such as the Central California Coast (CCC) steelhead and Central Valley Chinook salmon, use the reaches of freshwater streams in the study area primarily during movements between upstream spawning areas and estuarine/oceanic habitats. Coho salmon formerly spawned in the Coyote Creek watershed but were apparently extirpated by the 1970s. In addition to steelhead and Chinook salmon, green sturgeon and longfin smelt are present in the study area. Green sturgeon may be present in the study area year-round, but they do not spawn in freshwater systems in San Francisco Bay.

Table 4.6-5 *Timing of Life Stages of Special-Status Anadromous Fish in the Study Area* illustrates the typical upstream and downstream migration periods of steelhead, Chinook salmon, green sturgeon, and longfin smelt. Juvenile rearing for all stocks could potentially be present from December to June in nearshore habitats bayward of circulation pond dikes.

Table 4.6-5. Timing of Life Stages of Special-Status Anadromous Fish in the Study Area



Sources: NMFS 2009; H.T. Harvey & Associates 2008; SFBRWQCB 2012; Wang 1986 as cited in USACE 2009a

Central California Coast Steelhead. CCC steelhead uses the San Francisco Bay estuary as a migratory route to and from spawning and rearing habitat. In the South Bay, CCC steelhead currently spawn and rear in San Mateo Creek, San Francisquito Creek, Stevens Creek, the Guadalupe River, and Coyote Creek (NMFS 2009).

Relatively few data are available regarding use of South Bay marshes by anadromous salmonids. Steelhead in the South Bay usually migrate upstream to spawning areas from late December through early April, with the greatest activity in January and February (NMFS 2009), when sufficient flows allow them to reach suitable habitat in far upstream areas. The downstream migration of juveniles generally occurs from January through June, with peak emigration in April and May (NMFS 2009). Steelhead are known to be present in several stream systems in the South Bay, and this species could potentially spawn in virtually any reach of a stream offering suitable spawning habitat and lacking downstream barriers to dispersal. Although little is known about juvenile steelhead use of the bay and its estuarine habitats, studies of juvenile salmon and steelhead estuary use suggest that, in general, juvenile steelhead are more likely to use surface current flow, move through estuarine habitats rapidly (thereby having low residence times), and be present in deeper channel habitats (Truelove 2005; Melnychuck et al. 2007).

Within the study area, independent CCC steelhead populations are found in the Guadalupe River and Coyote Creek (CalTrout 2008). Information from the mid-2000s indicated that steelhead individuals were present in the Coyote Creek, Guadalupe River, Stevens Creek, and San Francisquito Creek watersheds at that time (Foxgrover et al. 2004; Leidy et al. 2005). Within the study area, no suitable steelhead spawning habitat exists, and CCC steelhead has not been observed in any of the ponds (Takekawa et al. 2005). However, steelhead spawn in non-tidal portions of Coyote Creek and the Guadalupe River. Alviso Slough is used as a migration corridor to freshwater spawning habitats in the Guadalupe River. Returning adult steelhead navigate their way through the study area as they seek the freshwater upstream spawning grounds of their natal streams (NMFS 2009).

Although information regarding specific use of estuaries by juvenile steelhead is limited (Bond 2006; Hayes et al. 2008), it is likely that steelhead smolts use brackish areas as a transitional environment between freshwater rearing streams and the ocean. It is generally believed that steelhead migrate rapidly as smolts through estuaries to complete their growth to adulthood in the ocean (Quinn 2005; McMichael et al. 2006). Some juvenile steelhead might reside in San Francisco Bay for an extended period prior to ocean entry, while others may choose to never fully enter the ocean and rear to maturity in the estuary (NMFS 2009; Moyle 2002). NMFS (2009) reports that this type of extended or exclusive estuarine residence has been observed in the Russian River estuary; however, it is unknown whether CCC steelhead juveniles exhibit such an extended residence in San Francisco Bay.

Central Valley Fall-Run Chinook Salmon. Adult fall-run Central Valley Chinook salmon migrate from the ocean to the spawning streams, including those in the South Bay, in the late fall. Fall-run Chinook salmon typically arrive in South Bay streams in October or later, although, on rare occasions, adult Chinook salmon have been detected in these streams in summer, and spawning has been reported in Los Gatos Creek (tributary to Guadalupe River) as early as September (Salsbery pers. comm., no date, as cited in H.T. Harvey & Associates et al. 2005). Any adult Chinook salmon found in the South Bay in summer are presumed to be either early fall-run fish or strays from a Central Valley run that are not expected to spawn successfully in these streams (H.T. Harvey & Associates et al. 2005).

In at least some areas, juvenile Chinook salmon extensively use estuarine habitats. Juvenile Chinook salmon may spend a significant amount of time, up to 189 days (Simenstad et al. 1982), foraging in estuarine habitats, showing significant growth in some estuaries (MacDonald et al. 1987) as they adapt physiologically to higher-salinity environments (Maragni 2000). In at least some areas, tidal marshes are important habitats for Chinook salmon. Fry forage throughout shallower tidal sloughs and channels, even foraging within the marsh during flood tides, while larger smolts forage in larger primary and secondary channels and subtidal habitats (Maragni 2000). Chinook salmon use of tidal channels and sloughs within the study area is unknown, though juvenile Chinook salmon have recently been captured in the study area, including tidal sloughs of the marsh (Mejia et al. 2008; Hobbs 2012; Hobbs et al. 2011). Predation pressure may limit the use of larger sloughs as more than transit habitat, as noted above for steelhead, but it is possible that Chinook salmon use tidal marshes in the South Bay as extensively as has been reported in other areas.

Longfin Smelt. The San Francisco Bay–Delta DPS of longfin smelt, a State Threatened species and Federal candidate for listing under the FESA, is present in the study area. Longfin smelt were recently documented in the tidal sloughs of the Alviso pond complex, including Pond A8, located adjacent to and southwest of the study area (Figure 1.5-2 *Alviso Ponds Complex and 2005 Shoreline Study Area* in Chapter 1 *Study Information*) across from Alviso Slough and Ponds A10–A12 (Hobbs et al. 2011). In the San Francisco Bay estuary, high freshwater stream flows appear to be positively correlated with increased smelt abundance (University of California 2012).

Longfin smelt are known to spawn in fresh water in the upper end of Suisun Bay and in the Sacramento–San Joaquin Delta, occurring in the South Bay year-round as pre-spawning adults and yearling juveniles (Wernette 2000). Wang (1986 as cited in USACE 2009a) reported that the downstream extent of longfin smelt spawning occurs in upper Suisun Bay around Pittsburg and Montezuma Slough in Suisun Marsh; however, some spawning may also occur at the southern tip of San Francisco Bay (Baxter 2008, unpublished, as cited in USACE 2009a). Longfin smelt spawn as early as November and as late as June, with a peak from February through April (Wang 1986 as cited in USACE 2009a; University of California 2012). Spawning occurs in freshwater, over sandy-gravel substrates, rocks, and aquatic plants (Moyle 2002). Anadromous populations spawn in the lower reaches of freshwater tributaries near the ocean. Temperature may constrain distribution and abundance in some areas.

Longfin smelt embryos hatch in about 40 days (at 7°C) (Moyle 2002; University of California 2012) and larval development typically occurs from February through May (LFR Levine-Fricke 2004). After hatching, larvae move up into surface waters and are transported downstream into brackish-water nursery areas. Although larvae are reportedly most abundant in the water column from January through April (USACE 2009a), considering the spawning period and the typical incubation period, it is likely that larvae could be present in the estuary as late as July. Larvae morph into juvenile fish 30-60 days after hatching (University of California 2012), and post-larval longfin smelt are reportedly associated with deep-water habitats (Rosenfield and Baxter 2007 as cited in USACE 2009a). Early larval development of a gas bladder likely contributes to their widespread dispersal in the estuary in comparison with other smelt species like Delta smelt (Wernette 2000).

Green Sturgeon. The green sturgeon is the most widely distributed and marine-oriented of the sturgeon species. This species is anadromous and is commonly observed in bays and estuaries along the western coast of North America. Adult green sturgeon migrate into freshwater spawning sites in late February, and spawning occurs from March through July. Confirmed spawning populations in North American are present in the Rogue, Klamath, and Sacramento Rivers (NMFS 2009). The southern DPS of green sturgeon travel through San Francisco Bay to the upper reaches of the Sacramento River to spawn, but they do not spawn in the study area, or in any freshwater tributaries of the study area.

Green sturgeon have been caught infrequently by anglers in the South Bay. Although the distribution of this benthic species in the study area is poorly known, it is possible that green sturgeon are present year-round in San Francisco Bay, though likely infrequently, and in low numbers. For example, despite ongoing tagging studies being conducted by various research efforts, only one acoustically tagged green sturgeon was identified by a receiver located on the Dumbarton Railroad Bridge during 2012.

The southern DPS of green sturgeon may remain in estuarine habitats for several years before entering the ocean to forage, returning every few years to spawn in the mainstem Sacramento River. Although there are no reports of adult or juvenile green sturgeon in the study area, the habitat condition in the South Bay is suitable for sturgeon and it is likely that they are present there (NMFS 2009). Within the project study area, suitable habitat includes estuarine and tidal areas including Alviso, Artesian, and Guadalupe Sloughs, as well as Coyote Creek.

Juvenile green sturgeon in the San Francisco Bay estuary feed on opossum shrimp and amphipods (Moyle 2002), and reportedly may use the tidal channels and sloughs of the study area for foraging throughout the year (NMFS 2009). Adults captured in the Sacramento–San Joaquin Delta feed on invertebrates including shrimp, mollusks, amphipods, and small fish (Adams et al. 2002).

4.6.1.2.3.2 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act requires Federal fisheries management plans (FMP) to describe habitat essential to fish considered commercially valuable, and also describe threats to that habitat from both fishing and non-fishing activities. In addition, to protect this essential fish habitat (EFH), Federal agencies are required to consult with National Marine Fisheries Service (NMFS) on activities that may adversely affect EFH. The Shoreline Phase I Study area includes EFH from three FMPs: the Coastal Pelagic FMP, Pacific Groundfish FMP, and Pacific Coast Salmon FMP. Fish species covered under these plans that are present in the South Bay area are listed in Table 4.6-6 *Fisheries Management Plan Species in the South Bay*.

All subtidal and intertidal habitats within Alviso Slough, Artesian Slough, Coyote Creek, and in the portions of the open bay within the study area are designated as EFH. Northern anchovy, starry flounder, and leopard shark have been collected from several ponds in the Alviso pond complex. These three species and English sole are likely to use tidal channels, mudflats, and marsh edge habitats of the lowermost reaches of Alviso Slough, Guadalupe Slough and Coyote Creek as nursery and foraging habitat. In addition, juvenile and adult Chinook salmon use the lower portion of Coyote Creek and Alviso Slough as migration corridors between estuarine habitats and upstream spawning and rearing habitat in Coyote Creek and Guadalupe River. Juvenile Chinook salmon also use marsh edges, protected tidal channels and creeks for foraging and growth.

The Magnuson-Stevens Act defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” For the Pacific Coast Salmon FMP, EFH includes freshwater and marine habitats, including habitats for estuarine and ocean rearing and juvenile and adult migration. Important features of EFH include “1) adequate water quality; 2) adequate temperature; 3) adequate prey species and forage base (food); and 4) adequate depth, cover, marine vegetation, and algae in estuarine and near-shore habitats.” For the Coastal Pelagic FMP, EFH includes “all marine and estuarine waters from the shoreline along the coasts of California, Oregon and Washington offshore to the limits of the Exclusive Economic Zone and above the thermocline where sea surface temperatures range between ten and 26 degrees Celsius.”

For the Pacific Groundfish FMP, seven “composite” EFH categories are defined. The estuarine composite includes “… those waters substrates and associated biological communities within bays and estuaries of the coasts of Washington, Oregon, and California, seaward from the high tide line (or the MHHW), or extent of upriver saltwater intrusion. These areas are delineated from the USFWS National Wetland Inventory (NWI) and supplemented from the NOAA’s Coastal Assessment Framework for the water portion of the Estuarine Drainage Areas for two small estuaries (Klamath River and Rogue River), the Columbia River, and San Francisco Bay. NWI defines estuaries as areas with water greater than 0.5 ppt ocean-derived salt.” Thus, all marine areas within the study area below MHHW with salinity of 0.5 ppt or greater are considered EFH.

Table 4.6-6. Fisheries Management Plan Species in the South Bay

Name	Occurrence
Coastal Pelagic FMP	
Northern anchovy (*Engraulis mordax*)	Abundant from South to Central Bay; adults and juveniles present in South and South-Central Bay; adults, juveniles, larvae, and eggs present in Central Bay
Pacific sardine (*Sardinops sagax*)	Present in South and South-Central Bay and rare in Central Bay; adults and juveniles present
Jack mackerel (*Trachurus symmetricus*)	Present in Central Bay; eggs and larvae
Pacific Groundfish FMP (Estuarine Composite EFH)	
Leopard shark (*Trikakis semifasciata*)	Present from South Bay to Central Bay; adults and juveniles present
Soupfin shark (*Galeorhinus galeus*)	Present in South-Central and Central Bay and rare in South Bay; adults and juveniles present in Central Bay and rare in South Bay; less known about life stages in South-Central Bay
Spiny dogfish (*Squalus acanthias*)	Present from South Bay to Central Bay; adults and juveniles in South and Central Bay; less known about life stages in South-Central Bay
Big skate (*Raja binoculata*)	Present from South Bay to Central Bay; adults and juveniles present in Central Bay; less known about other life stages present in South and South-Central Bay
California skate (*Raja inornata*)	Present in South Bay (probably rare)
Lingcod (*Ophiodon elongatus*)	Present from South to Central Bay but rare in South-Central Bay; adults and juveniles present in Central Bay; less known about life stages present in South Bay
Kelp greenling (*Hexagrammos decagrammus*)	Present in Central Bay; juveniles and adults
Pacific whiting (hake) (*Merluccius productus*)	Present in Central Bay; eggs and larvae
Brown rockfish (*Sebastes auriculatus*)	Present from South to Central Bay; juveniles present in South and South-Central Bay; adults and juveniles present in Central Bay
Curlfin sole (*Pleuronichthys decurrens*)	Present in Central Bay; juveniles
English sole (*Parophrys vetulus*)	Abundant from South to Central Bay; adults and juveniles present
Pacific sanddab (*Cintharichthys sordidus*)	Present from South to Central Bay; adults, juvenile, larvae, and eggs present in Central Bay; less known about life stages in South Bay
Sand sole (*Psettichthys melanostictus*)	Present in South and Central Bay but rare in South-Central Bay; adults, juveniles, and larvae present
Starry flounder (*Platichthys stellatus*)	Present from South to South-Central Bay and abundant in Central Bay; adults and juveniles present in South Bay and adults juveniles, larvae, and eggs present in Central Bay
Cabezon (*Scorpaenichthys marmoratus*)	Rare to few from South to Central Bay; juveniles present in South and South-Central Bay; adults and juveniles present in Central Bay
Bocaccio (*Sebastes paucispinis*)	Rare in Central Bay; less known about presence and life stages elsewhere in bay
Calico rockfish (*Sebastes dalli*)	Rare in South Bay, life stages unknown
Rex sole (*Glyptocephalus zachirus*)	Rare in South Bay, life stages unknown
Pacific Coast Salmon FMP (Estuarine Composite EFH)	
Chinook salmon (*Oncorhynchus tshawytscha*)	Spawns in several South Bay area streams, including Coyote Creek and the Guadalupe River

Key: EFH = Essential Fish Habitat; FMP = Fisheries Management Plan

4.6.1.3 National environmental Policy Act and Engineer Regulation 1105-2-100: Planning Guidance Notebook Baseline Condition

The NEPA and the Planning Guidance Notebook baseline condition compares effects among alternatives against the effects of the future No Action condition.

For aquatic biological resources, the NEPA and the Planning Guidance Notebook baseline condition is determined by projecting how the resource condition might change between current condition discussed in Section 4.6.1 *Affected Environment* and the start of construction. As described in Section 4.6.1 *Affected Environment*, biological systems are constantly changing on multiple time scales. However, other than stochastic events, which are unpredictable, habitat and species compositions are relatively easily predicted over short periods. Because the NEPA and the Planning Guidance Notebook baseline condition is less than 3 years from the time represented by this affected environment, it is likely that few changes in habitat types, species composition, species distribution and habitat use, and life history periodicities would occur from the physical setting. Therefore, for the purpose of evaluating the effects of the No Action Alternative as well as the action alternatives, the physical setting described above is representative of NEPA and the Planning Guidance Notebook baseline conditions.

4.6.2 Environmental Consequences

4.6.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

Avoidance and minimization measures are those parameters that have been built into the design of the Proposed Project and are committed to as part of project implementation. These measures are generally included in the alternatives description of this report (Section 3.8 *Action Alternatives Component Details*), but, where appropriate, the specific measures related to the impact evaluations are also summarized in the resource chapters.

The project includes several management and conservation measures that would avoid or minimize impacts on aquatic resources. These measures, which are related to construction, operation, and maintenance, are as follows:

- **AMM-ABR-1: Seasonal Restrictions** – Construction activities in or directly adjacent to waters where CCC juvenile steelhead are likely to be present will be performed between June 1 and November 30. To protect juvenile steelhead, levee breaching will not occur between February 1 and May 31.
- **AMM-ABR-2: Biological Monitor –** In-water construction activities will be monitored by a qualified fisheries biologist with the authority to stop work if any special-status species are found during construction and to confirm that all measures are implemented as defined in permits, the SWPPP, and the O&M Manual.
- **AMM-ABR-3: Vibratory Piling** – Pilings for the Artesian Slough pedestrian bridge will be driven using vibratory methods; no impact piles will be utilized.

- **AMM-ABR-4: In Water Sediment Control** – Cofferdams and/or silt curtains will be used to the extent feasible during construction and O&M activities, as well as implementation of any adaptive management actions.
- **AMM-ABR-5: Screen Pumps** – All pumps used for the diversion of water during construction (for in-water dewatering) where salmonids may be present will be screened according to NMFS and CDFW criteria for juvenile salmonids.
- **AMM-ABR-6: Work at Low Tide** – For construction projects that involve structures that extend into the waters where steelhead, Chinook salmon, longfin smelt, and green sturgeon may be present, activities will be performed at low tide or under dewatered conditions, to the extent practicable.
- **AMM-ABR-7: Notification of Mortality Events** – NMFS personnel will be immediately notified of any observed fish mortality events as related to ESA-listed or Candidate species.
- **AMM-ABR-8: Adequate Depth of Channels** – Tidally restored ponds will contain channels that are constructed at an adequate depth and width to allow the ingress and egress of fish with tidal circulation and maintain adequate depths and velocities via scour and deposition to allow continued fish movement in and out of the channels. Inspections will be documented in a record that is available for review on request.
- **AMM-ABR-9: Salvage Natural Materials** – Any appropriate large wood, native vegetation, and weed-free topsoil displaced by construction will be stockpiled for use during site restoration.
- **AMM-ABR-10: Prepare SWPPP** – A stormwater management plan will be developed to ensure that, during rain events, construction activities do not increase the levels of erosion and sedimentation. This plan will include the use of erosion-control materials (e.g., baffles, fiber rolls, or hay bales; temporary containment berms) and erosion-control measures such as straw application or hydroseeding with native grasses on disturbed slopes, and floating sediment booms and/or curtains to minimize any impacts that may occur due to increased mobilization of sediments.
- **AMM-ABR-11: Biological Monitoring –** A long-term marine biological monitoring program will be developed in consultation with the NMFS and will be used to inform the MAMP.
- **AMM-ABR-12: Water Structure Materials** – Treated wood will not be used in structures that may come in contact with water.

4.6.2.2 Methodology for Impact Analysis and Significance Thresholds

Action alternatives associated with the Shoreline Phase I Project would result in a number of effects, both beneficial and adverse, on the aquatic species and habitats in the study area. The project would have a significant effect on an aquatic biological resource if it would:

- **Impact ABR-1:** Have a substantial adverse effect, either directly or through habitat modifications on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW, NMFS, or the USFWS; a substantial adverse effect includes an impact that would jeopardize the continued existence of a species listed under the FESA and/or cause substantial adverse effects to EFH; or substantially interfere with the movement of any native resident or migratory fish.
- **Impact ABR-2:** Conflict with the provisions of the Santa Clara Valley Habitat Plan, an adopted Habitat Conservation Plan/Natural Community Conservation Plan, or the Tidal Marsh Recovery Plan.

4.6.2.3 Alternatives Evaluation

The following sections provide a summary of anticipated effects to aquatic resources under the No Action Alternative and due to the action alternatives. The analysis of anticipated impacts on aquatic resources under each alternative is provided in the following sections. The construction footprint and O&M requirements for the ecosystem restoration activities for each action alternative are nearly identical; therefore, the impact analysis of ecosystem restoration is presented once below.

Each action alternative could result in direct, indirect, and cumulative effects to aquatic habitat and species due to construction, operation and maintenance, and monitoring and adaptive management. This evaluation considers the direct and indirect effects related to construction of the FRM levee, ecosystem restoration activity, and construction of recreation elements and assesses potential effects to aquatic habitat in general and the special-status species and representative fish resources. These representative fish resources include FESA and CESA-listed/candidate species (CCC steelhead, green sturgeon and longfin smelt), Chinook salmon, all estuarine fish, California bay shrimp, and Essential Fish Habitat. Effects to various aquatic habitat types are discussed as related to use by these species. Anticipated effects to aquatic invertebrates in the study area are discussed because they are prey items for estuarine fish. The analysis of effects on the California bay shrimp was selected to represent anticipated alternative effects to subtidal/intertidal invertebrate communities. This species was selected as a community representative due to its year-round presence in the South Bay, and its relative sensitivity to changes in salinity and water quality. A summary comparison of alternatives is presented in Section 4.6.2.3.2.2 *Comparison of Action Alternatives*.

4.6.2.3.1 No Action Alternative

4.6.2.3.1.1 General Effects – Fish and Aquatic Species

Under the No Action Alternative, no modifications to levees would be made in Ponds A9–A15 and A18. As such, no adverse effects on water quality (increased sedimentation and turbidity) would occur due to breaching of levees or excavation of pilot channels. Open-water areas associated with the former salt ponds that are not restored as part of future SBSP Restoration Project actions would remain as currently managed and no additional tidal wetland habitats would be restored in these areas. Existing levees and berms that surround open-water areas would continue to be maintained, and accidental breaches would be repaired consistent with the current management approach for the ponds.

Salmonids

Central California Coast Steelhead

Under the No Action Alternative, steelhead would not be subject to potential negative effects associated with short-term water quality degradation resulting from levee breaches along the perimeter of ponds that are adjacent to estuarine habitats.

In the study area, if levees surrounding Ponds A9–A15 or Pond A18 are not maintained adequately and unintentional breaches are not repaired, eventual levee failure combined with SLC might, over time, reconnect pond habitat to estuarine rearing habitat along Alviso Slough and Coyote Creek, where CCC steelhead are present. However, as described in Section 4.6.1.2.3 *Special-Status Aquatic Species and Habitats*, the quality of habitat in this potentially restored marsh area is likely to be lower under the No Action Alternative than under the action alternatives.

Under the No Action Alternative, the effect determination for CCC steelhead is less than significant/beneficial under the NEPA.

Central Valley Chinook Salmon

Under the No Action Alternative, effects to Central Valley Chinook salmon would be similar to those described above for steelhead. However, the net benefit to Chinook salmon attributed to unintentional breaching of former salt pond dikes, over time, may be greater than that for steelhead. This is because, although no Chinook salmon spawning habitat is located in the immediate vicinity of the Alviso pond complex study area, juvenile fall Chinook salmon are known to use estuarine habitat extensively for rearing (spawning areas are well upstream of the study area). As such, any increase in the quantity of estuarine tidal marsh habitat could benefit rearing juvenile Chinook salmon to a greater degree than juvenile steelhead.

Under the No Action Alternative, the effect determination for Central Valley Chinook salmon is less than significant/beneficial under the NEPA.

Southern DPS of Green Sturgeon

Under the No Action Alternative, green sturgeon in the study area would not be subject to potential negative effects associated with short-term water quality degradation due to levee breaches along the perimeter of ponds that are adjacent to estuarine habitats. If levees are not adequately maintained, they could breach over time, and, if the breaches are not repaired, the ponds could be reconnected to adjacent estuarine habitat. This could result in an overall increase in available shallow water foraging habitat. However, as described in Section 4.6.1.2.3 *Special-Status Aquatic Species and Habitats*, the quality of habitat in this potentially restored marsh area is likely to be lower under the No Action Alternative than under the action alternatives.

Under the No Action Alternative, the effect determination for the southern DPS of green sturgeon is less than significant/beneficial under the NEPA.

Longfin Smelt

Under the No Action Alternative, longfin smelt in the study area would not be subject to potential negative effects associated with short-term water quality degradation or potential entrainment due to excavation associated with levee breaches. If levees are not adequately maintained, they could breach over time, and, if the breaches are not repaired, the ponds could be reconnected to adjacent estuarine habitat. This could result in an overall increase in available habitat. However, as described in Section 4.6.1.2.3 *Special-Status Aquatic Species and Habitats*, the quality of habitat in this potentially restored marsh area is likely to be lower under the No Action Alternative than under the action alternatives.

Under the No Action Alternative, the effect determination for the longfin smelt is less than significant/beneficial under the NEPA.

Estuarine Species

Under the No Action Alternative, estuarine fish would, over time, experience an increase in tidal habitat due to SLC and potential unintentional breaching of ponds if levees were unmanaged. The existing ponds currently support few fish because they are usually dry and inaccessible to estuarine, marine and freshwater aquatic species. If some levees continued to be maintained adequately for FRM purposes, degraded water quality in discharges from ponds that remain managed could locally affect fish or aquatic invertebrates in adjacent estuarine habitats due to discharge of high salinity water with low DO. (However, this effect would not be as great as it is currently, as there would be fewer circulation ponds than currently exist). Impacts to aquatic species that utilize the ponds themselves would be minor, as circulation ponds currently provide habitat for relatively few species. Overall, estuarine fish are expected to benefit from the increase in tidal habitat that would occur due to unintentional breaching of ponds, and water quality would likely reach a suitable equilibrium for most species over a short period of time.

Based on the information presented above, impacts on estuarine species under the No Action Alternative are beneficial under the NEPA.

California Bay Shrimp

Under the No Action Alternative, the levees around Ponds A9–A15 and Pond A18 of the Alviso complex would be maintained, but not raised. For this reason, unintentional breaching of the levees could, eventually, restore tidal connection to estuarine habitats in the vicinity due to SLC, resulting in increased habitat availability. However, the quality of habitat in these restored marshes is likely to be lower under the No Action Alternative than under the action alternatives since intentional restoration under the action alternatives would involve breaches at strategic locations to take advantage of remnant slough networks. Still, California bay shrimp would benefit from the increase in tidal habitat that would occur due to unintentional breaching of ponds, and water quality would likely reach a suitable equilibrium for most species over a short period of time.

Unintentional breaching under the No Action Alternative would not necessarily optimize the subtidal habitats that could be present in restored marshes, in part because the lack of ditch blocks would result in existing borrow ditches capturing much of the tidal prism in breached ponds. Thus, while the net effect on bay shrimp under the No Action Alternative would be beneficial, the benefit would be unknown and potentially limited if unintentional levee breaches occurred in areas where habitat suitability and availability would not be optimized. Therefore, impacts would be less than significant/beneficial under the NEPA.

Essential Fish Habitat

Under the No Action Alternative, effects to designated EFH would be similar to those described above for estuarine fish. Under the No Action Alternative, the effect determination for EFH for all FMPs in the study area (Coastal Pelagic, Pacific Groundfish, and Pacific Coast Salmon) is less than significant/beneficial under the NEPA.

Additionally, under the CEQA, the No Action Alternative would not have a substantial adverse effect on any sensitive natural community identified in local or regional plans, policies, regulations, or by the CDFW, the NMFS, or the USFWS. Therefore, the effect on EFH in the study area would be less than significant.

4.6.2.3.2 Action Alternatives

This section describes the effects to aquatic species and habitats resulting from the common elements of all action alternatives. The analysis of effects presented in this section considers the project elements presented below. All alternatives would be constructed including AMMs designed to lessen impacts as part of the project. General measures to be implemented with all work and phases include AMM-ABR-2: Biological Monitor, AMM-ABR-7: Notification of Mortality Events, AMM-ABR-9: Salvage Natural Materials, and AMM-ABR-11: Biological Monitoring.

Levee Construction. All action alternatives include construction of a FRM levee. As described in Section 3.8 *Action Alternatives Component Details,* although some of the action alternatives differ in the location of the FRM levee, all action alternatives would construct an earthen levee to provide FRM to adjacent urban areas. Three of the alternatives would construct a 15.2-foot

NAVD 88 levee and one alternative would construct a 12.5-foot NAVD 88 levee. The 12.5-foot NAVD 88 levee footprint would be slightly smaller than that associated with the 15.2-foot NAVD 88 levee.

The WPCP levee segment would block the culvert that transfers brackish water to the non-tidal mitigation marsh east of Artesian Slough and south of Pond A18. As part of the project, the culvert will be replaced with some other mechanism to supply brackish water to the mitigation marsh area. The new structure would be designed to provide the same function as the existing culvert.

An existing siphon between Pond A16 (which is not part of the Shoreline Phase I Project) and the NCM would be protected in place for construction activity in the area of the siphon. If protection in place during construction is not possible, the siphon would be replaced in a manner that it would meet the same need and functionality of the current siphon. A replacement siphon would be compatible with USACE levee standards.

Levee construction would also include a tide gate closure system on Artesian Slough, a flood gate at the railroad crossing with a pedestrian bridge over the railroad tracks, and a small breach along the west side of Artesian Slough to restore freshwater input to a freshwater marsh area near the EEC.

Artesian Slough Flood Wall Structure with Tide Gates Construction and Operation. As part of the FRM strategy, all action alternatives include construction of a tide gate closure structure across Artesian Slough to protect the Regional Wastewater Facility from storm waters flooding the slough and backing up into the facility during extreme storm events. The proposed location of the tide gate for all alignment options would be at least 300 feet bayward of the existing Wastewater Facility outfall weir for treated water at Artesian Slough. The gate would only be closed during extreme storm events. When the gate is closed, the Wastewater Facility will need to pump water outputs over the gate, or provide for internal excess water storage during a storm event. With or without the project, the Wastewater Facility would need to develop a plan to pump or store waters during such events given increases in bay water levels that correspond with future SLC scenarios. During these extreme storm events, flooding of the NCM could also occur due to capacity constraints of the interior drainage system; however, the availability of facility pumps or the capacity to store excess waters could lessen the impacts to the marsh areas.

Railroad Flood Gate Construction and Operation. Where the FRM levee would cross the active railroad line that runs parallel to the eastern side of Pond A12, a railroad flood gate would be installed. The location of the flood gate would vary by alternative (see Figure 3.5 1 *Potential Alviso Segment Levee Alignments* in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*). For Alternatives 2 and 3, the flood gate would be installed near the southeast corner of Pond A13 and southwest corner of Pond A16, For Alternative 4, the flood gate would be installed where the levee alignment crosses the tracks after turning east away from Pond A12. For Alternative 5, the flood gate would be near the Alviso Marina. In installing the flood gate, concrete barriers would be installed on either side of the railroad right-of-way and would tie into the earthen levees. Two 60.5-foot-long by 10.25-foot-wide leaf swing gates would be connected to the barrier and would remain open during normal conditions and closed during flood conditions. There would be a 380-foot-long by 10-foot-wide pedestrian bridge over the flood gate. The bridge would be supported on steel pipe columns to provide rail car clearance. The bridge would be metal with a non-slip surface decking and railing and chain link fence on the bridge sides. The bridge would have ADA-compliant approaches on each side.

Artesian Slough Fresh Water Transfer. Construction of any of the Alviso levee options would block a fresh water input from Artesian Slough to a ditch and fresh water marsh area near the EEC. To compensate for the loss of fresh water inflow to the marsh, all of the alternatives include a small breach of an existing berm along the west side of Artesian Slough to allow gravity flow of fresh water from the slough to the unnamed ditch and adjacent marsh. The breach would be sized to provide the same amount of input that occurs under the baseline condition.

Ecosystem Restoration. All action alternatives would restore tidal habitat in Ponds A9 through A15 and in Pond A18 by implementing of the following actions:

- Pond preparation: drain ponds and remove vegetation; commence internal pond preparation, including excavation and internal fill features such as ditch blocks; stabilize pond dikes inboard of ponds being breached
- Complete needed external channel work, such as constructing pilot channels
- Breach outboard levees.

To the extent possible, activities conducted within the ponds (internal side of outboard levees) would occur during the low-water condition following the draining of each pond. Existing pond dikes would provide a level of work-area isolation and therefore minimize impacts on aquatic species. In some cases, cofferdams and dewatering pumps would be used to isolate a work area. All other activities, including portions of outboard pond dike breaching and pilot channel excavation, would be conducted along the bayward side of the perimeter levees, and would therefore require in-water work.

Figure 4.6-2 *Shoreline Phase I Study Area and Aquatic Biological Study Area Habitat Zones* shows the maximum acres of post-restoration habitat in the study area. Table 4.6-7 *Post-Restoration Conditions in the Study Area* summarizes the post-restoration condition by pond and Table 4.6-8 *Post-Construction Tidal Marsh Totals in the Study Area* summarizes the post-construction habitat type totals. Evolution of tidal marsh habitat in breached ponds from subtidal and mudflat habitats would be contingent on initial suspended sediment levels and other environmental conditions during the decades after breaching. Also, since tidal marsh habitat includes such features as channels and pannes, and the percentage of tidal marsh occupied by these features may vary, exact numbers for tidal marsh habitat cannot be predicted. Modeling of the alternatives indicates that tidal marsh acreages by 2057 will be close to the numbers provided in Figure 4.6-2 *Shoreline Phase I Study Area and Aquatic Biological Study Area Habitat Zones*, Table 4.6-7 *Post-Restoration Conditions in the Study Area*, and Table 4.6-8 *Post-Construction Tidal Marsh Totals in the Study Area*.

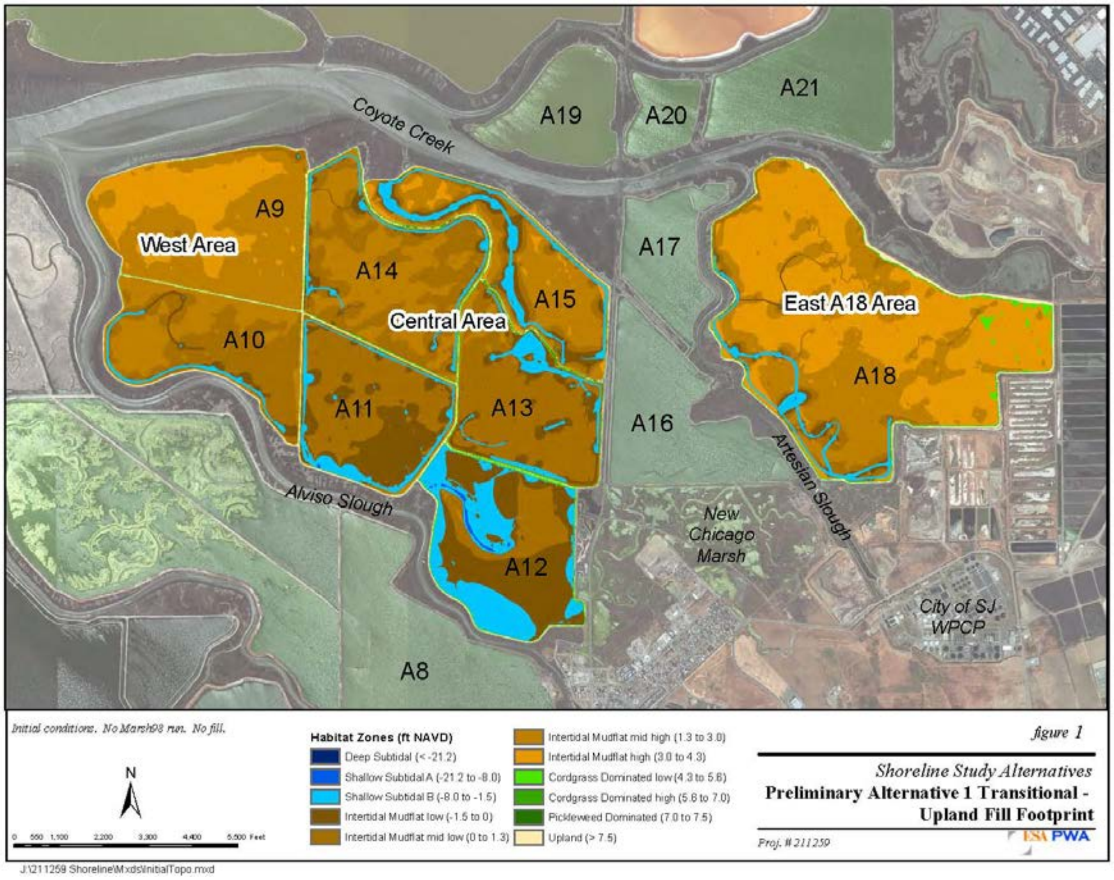


Figure 4.6-2. Shoreline Phase I Study Area and Aquatic Biological Study Area Habitat Zones

Table 4.6-7. Post-Restoration Conditions in the Study Area

Existing Pond Number	Existing Size (acres)	Existing Type	Post-restoration Conditions
A9	365	Circulation pond (open water)	Tidal marsh habitat = maximum of 365 acres Levee footprint = none Transitional habitat = none
A10	250	Circulation pond (open water)	Tidal marsh habitat = maximum of 250 acres Levee footprint = none Transitional habitat = none
A11	260	Circulation pond (open water)	Tidal marsh habitat = maximum of 260 acres Levee footprint = none Transitional habitat = none
A12	310	High salinity (batch pond)	Alternative 2 (Alviso North 12.5-foot levee, bench) Tidal marsh habitat = 300.1 acres Levee footprint = 5.8 acres Transitional habitat = 3.6 acres Alternative 3 (Alviso North 15.2-foot levee, ecotone) Tidal marsh habitat = 280.2 acres Levee footprint = 5.8 acres Transitional habitat = 24.0 acres Alternatives 4 and 5 (Railroad Spur [Alt 4], Alviso South [Alt 5], 15.2-foot levee, bench) Tidal marsh habitat = 299.6 acres (Alternative 4) or 303.3 acres (Alternative 5) Levee footprint = 3.7 acres (Alternative 4) and none (Alternative 5) Transitional habitat = 6.7 acres
A13	270	High salinity (batch pond)	Alternative 2 (Alviso North 12.5-foot levee, bench) Tidal marsh habitat = 268.4 acres Levee footprint = 0.8 acre Transitional habitat = 0.8 acre Alternative 3 (Alviso North 15.2-foot levee, ecotone) Tidal marsh habitat = 263.4 acres Levee footprint = 0.8 acre Transitional habitat = 5.8 acres Alternatives 4 and 5 Tidal marsh habitat = 269.1 acres Levee footprint = none Transitional habitat =0.9 acre
A14	340	Circulation pond (open water)	Tidal marsh habitat = maximum of 340 acres Levee footprint = none Transitional habitat = none
A15	250	High salinity (batch pond)	Tidal marsh habitat = maximum of 250 acres Levee footprint = none Transitional habitat = none

Table 4.6-7. Post-Restoration Conditions in the Study Area

Existing Pond Number	Existing Size (acres)	Existing Type	Post-restoration Conditions
A18	856	Circulation pond (open water)	Alternative 2 (Alviso North 12.5-foot levee, bench) Tidal marsh habitat = 829.8 acres Levee footprint =15.5 acres Transitional habitat = 10.7 acres Alternative 3 (Alviso North 15.2-foot levee, ecotone) Tidal marsh habitat = 774.4 acres Levee footprint =15.5 acres Transitional habitat = 66.6 acres Alternatives 4 and 5 (Railroad Spur [Alt 4], Alviso South [Alt 5], 15.2-foot levee, bench) Tidal marsh habitat = 829.8 acres Levee footprint = 15.5 acres Transitional habitat = 10.7 acres

Table 4.6-8. Post-Construction Tidal Marsh Totals in the Study Area

Alternative	Post-construction Total
2	Maximum of 2,863.3 acres
3	Maximum of 2,783 acres
4	Maximum of 2,863.5 acres
5	Maximum of 2,867.2 acres

All alternatives would construct transitional habitats adjacent to the levees to provide upland transition areas and refugia for species during unusually high tides and flood events. The transitional habitats would be constructed adjacent to levees that abut Ponds A12, A13, and A18. As described in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*, the transitional habitat would either be a bench (Alternatives 2, 4, and 5) or a 30:1 ecotone (Alternative 3). The 30:1 ecotone would have a larger footprint than the bench option.

As discussed in Section 3.6.10 *Monitoring and Adaptive Management*, adaptive management assessments would be performed as restoration actions progress to address key uncertainties. The first and second phases of pond breaches would each be followed by periods of monitoring and adaptive management; following the third and final phase of pond breaching, monitoring and adaptive management would be ongoing (see Section 3.8.3 *Construction Schedule*). It is critical to investigate and address uncertainties during the first restoration phase, since some of the monitoring studies may take decades to generate useful information. Ongoing monitoring would provide additional information for adaptive decision-making by tracking progress toward the project objectives.

For example, if monitoring reveals that water levels inside the breached ponds are not at similar levels to waters just outside the ponds—a restoration target—potential adaptive management actions or O&M measures might include widening breaches to encourage better tidal exchange or beginning a study session to review findings and assess whether further action is needed. At this point, if the suggested adjustments were substantial (i.e., costly), a USACE post-authorization change could be initiated with approval from the Federal sponsor.

In another example, if monitoring reveals that outboard mudflats are decreasing at too high a rate and would not be sufficiently replaced by the creation of inboard mudflats then adaptive management actions might include assessments to determine the causes and/or biological effects of mudflat loss, and/or adjustments to the design to reduce the net loss of mudflats. This example in particular illustrates the value of study in determining the causes and implications of loss in order to apply the appropriate corrective action.

It should be noted that not all of these areas may become tidal in the future. If adaptive management monitoring indicates that pond-dependent species are or could be experiencing adverse impacts, despite management actions to abate the impacts, then conversion of the ponds to tidal habitats would be significantly slowed or halted for the foreseeable future.

Recreation and Public Access. As described in Section 3.8.5 *Features Built into Design to Avoid or Reduce Adverse Environmental Impacts*, all action alternatives would include the construction of two pedestrian bridge crossings (one over railroad, one over Artesian Slough), as well as trail improvements and viewing platforms.

Impact ABR-1: Have an effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW, the NMFS, or the USFWS

The actions proposed under all action alternatives are expected to provide an overall benefit to aquatic species by increasing the amount of tidal and sub-tidal estuarine habitat in the study area. Restoration of circulation ponds to tidal marshes in the South Bay is likely to increase forage production, including export to bay waters, and provide additional foraging and rearing habitats for obligate estuarine species that spawn or give birth in these habitats and for juvenile rearing of anadromous species (West and Zedler 2000).

Regardless of the anticipated long-term beneficial effects of the proposed action alternatives, initial construction activities associated with restoration could result in potentially negative effects that could persist for several years. These potential negative effects are described below, and would primarily result from activities associated with disturbing sediments due to outboard levee breaching, dredging of pilot channels, erosional processes, and sediment disturbance. However, with the implementation of AMMs no significant negative impacts are anticipated to result from the construction.

Because construction of internal pond features would occur during low water or behind isolation structures (i.e., “in the dry”) following pond drainage, little to no effects to aquatic species are anticipated associated with those project elements (e.g., side-cast berms, ditch blocks, internal levee stabilization, replacement of existing water conveyance features) (AMM-ABR-6: Work at Low Tide). Some fish, if present in the ponds in the immediate vicinity of construction actions, could be exposed to increased sedimentation, turbidity, and potential mortality. As explained in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*, dewatering of the ponds would be passive over multiple days, allowing most aquatic organisms to move to the sloughs. Limited numbers of organisms would be stranded in borrow ditches or other low areas in the pond being drained and may not survive in these residual aquatic habitats during the following construction period. Following pond drying or lowering, the pond preparation elements could be isolated from active channel or tidal flows through drawdown of internal ponds, or the use of cofferdams with localized pumping to assist with the removal of seepage water. However, some activities could occur "in the wet," if pond drainage is not feasible in consideration of the construction schedule. Temporary loss of habitat in one or more ponds during construction episodes would have negative but less-than-significant impacts on these species, as described below.

General Aquatic Habitat Effects

Temporary Displacement from Occupied Habitats

During outboard levee breaching, pilot channel excavation, and tide gate construction, aquatic species would be subject to displacement due to a variety of actions. These include the presence of in-water construction equipment, the installation of sedimentation control devices (e.g., cofferdams, silt curtains), temporary loss of habitat in isolation areas, and increased underwater sound-pressure levels due to the in-water operation of equipment. Increased sedimentation and turbidity may result in localized modifications to water temperatures and dissolved oxygen levels, which may also displace aquatic species.

Ecosystem restoration construction activity would be phased over time and thus would limit the physical area affected; construction effects would be limited to specific areas and limited to the maximum amount of time needed to complete each task. Also, construction monitoring and implementing AMMs such as limiting construction periods to times when juvenile steelhead are not likely to be present would help minimize potential adverse effects to occupied habitats (AMM-ABR-1: Seasonal Restrictions).

Though individuals may be affected (consultation under Section 7 of the Endangered Species Act is ongoing for this action), the temporary effects would not be expected to affect population levels of steelhead, Chinook salmon, green sturgeon, longfin smelt, estuarine species, or bay shrimp or result in the substantial loss or degradation of designated EFH.

Because the construction areas would be separated by distance and time, construction-related impacts would be short term, and implementing AMMs would help minimize potential adverse effects, ecosystem restoration construction would not cause significant effects related to temporary displacement from occupied habitats.

Construction of project features and restoration activities would have a less-than-significant impact from the temporary displacement of occupied habitats.

Reduction of Prey Resources

In-water construction associated with excavation of levees, berms, and the tide gate and placement of fill materials for ditch blocks would result in localized displacement, injury, or mortality of aquatic species that cannot or do not readily move away from construction areas. Such species include planktonic larvae, infauna, and bottom-dwelling species that are prey items for many aquatic species.

Recolonization studies for infauna and bottom-dwelling species suggest that recovery depends upon numerous physical factors including particle size distribution, currents, and compaction/stabilization processes following disturbance. The NMFS (2009) reports that rates of recovery range from several months for estuarine muds to two to three years in habitats dominated by sands and gravels. Thus, prey resources for benthic feeders may be locally reduced until foraging opportunities are recovered through benthic recolonization in subsequent months or years. However, the relatively small and localized loss of prey resources would be offset by the eventual gain of prey resources that colonize the newly-restored subtidal and intertidal habitat resulting from implementation of the ecosystem restoration elements of the action alternatives. Thompson and Parchaso (2009) compared benthic communities before and after former salt pond restoration in San Francisco Bay and found that filter feeders were the dominant benthic invertebrates both before and after restoration. Further, they indicated that no changes to the function of filter feeders as the primary plankton consumers could be attributed to restoration activities. Based on this information, it is anticipated that disturbed habitats would be recolonized no more than three years after excavation, and that species from adjacent undisturbed habitats would re-establish in excavated areas since substrates would be similar.

Although the majority of dredged material from adjacent circulation pond dikes would be used to construct hydrologic or habitat features (e.g., ditch blocks), incidental disposal of dredged materials could result in the burial of bottom-dwelling organisms, which may in turn reduce feeding opportunities for fish or macroinvertebrates.

The loss of prey resources would be short term, up to 3 years. In the interim, species that rely on these resources would travel to other locations to feed. This temporary loss would not be expected to cause significant decreases in the numbers of steelhead, Chinook salmon, green sturgeon, longfin smelt, estuarine species, or bay shrimp populations or result in the substantial loss or degradation of designated EFH. The affected areas would be geographically limited and construction would be phased over time.

Because the construction areas would be separated by distance and time, the temporary loss of prey resources would be offset by long-term prey resource gains, and implementing AMMs would help minimize potential adverse effects, ecosystem restoration construction would not cause significant effects related to reduction in prey resources.

Construction of project features and restoration activities would have a less-than-significant impact on prey resources.

Post-Breach Salinity Increase

Following breaching of outboard levees, aquatic species in the immediate area of the breach could be affected by a temporary increase in salinity as internal pond substrates are reconnected to tidal habitats. However, water quality monitoring at similar levee breach sites around San Francisco Bay generally show that salinity does not typically reach levels that would adversely affect fish species, and salinities return to baseline levels within a few days (NMFS 2009).

During a study conducted two months after beaching of earthen levees at the Alviso pond complex island ponds (Ponds A19, A20, and A21), Saiki and Mejia (2009) found that water quality in the ponds was similar to that in adjacent reaches of Coyote Creek. Further, fish species occurring in the ponds were similar to those in the creek. They suggested that salinity reduction within the Alviso island ponds probably occurred during the first few days or weeks following levee breaching as water from Coyote Creek flooded the ponds and diluted the salinity. Still, minor post-breach salinity changes are likely to occur over time due to the leaching of precipitated salts in sediments (Saiki and Mejia 2009), though Ponds A19–A21 were much higher in salinity than the study area ponds.

After several tidal cycles, salinity dilution in the ponds would likely be sufficient to reduce salinities to levels tolerated by most estuarine fishes, including some species commonly found in freshwater (e.g., Mississippi silversides, threadfin shad, common carp, western mosquitofish). Following an unplanned breach of Pond 3 of the Napa-Sonoma salt pond complex in North San Francisco Bay, a rapid decrease in salinity resulted in transformation in fish species assemblages from predominantly salt-tolerant fish to an assemblage that included some freshwater species (Takekawa et al. 2005). Based on these examples, it is anticipated that post-breach salinity levels would reduce rapidly to levels that can accommodate many species of estuarine, and possibly freshwater, fish species. The temporary effects would not be expected to cause significant decreases in the numbers of steelhead, Chinook salmon, green sturgeon, longfin smelt, estuarine species, or bay shrimp populations or result in the substantial loss or degradation of designated EFH.

Impacts related to post-breach salinity would be less than significant.

Elevated Turbidity and Suspended Sediments

Internal pond improvements, including the construction of ditch blocks and side-cast berms, would occur during low water levels, or potentially in the dry using the outboard levees or other materials for work-area isolation. Similarly, the repair and replacement of existing water management structures, including several culverts, should also occur prior to outboard levee breaching, or behind isolation cofferdams after breaching. For this reason, construction-related turbidity associated with those elements is anticipated to be minor and confined to the interior portion of the ponds in the local vicinity of in-water work.

Instream construction activities, particularly dredging associated with pilot channel excavation and levee breaches, would result in elevated levels of fine-grained particles or suspended sediment in and around the activity. The effects of increased turbidity associated with dredging on fish and other aquatic species varies to some degree with the life stage of the species considered. Early life stages are typically more vulnerable to negative effects due to their decreased motility and physiological tolerance of environmental perturbation. For example, increased turbidity can reduce the survival of fish eggs if present in the vicinity of excavated pilot channels. This could result in a localized reduction in recruitment and, ultimately, reduced abundance.

The effects of increased turbidity and suspended sediment on aquatic species behavior are largely dependent upon the magnitude and duration of the stressor. Effects include degradation of water quality, habitat disturbance, barriers to movement, and reduction in prey resources. The associated turbidity plumes of suspended sediments can reduce light penetration and lower the rate of photosynthesis for submerged vegetation (NMFS 2009), and the primary productivity of an aquatic area if subjected to suspended sediments for an extended period of time. If suspended sediments loads remain high, fish may suffer reduced feeding ability and be prone to fish gill injury (Benfield and Minello 1996 as cited in NMFS 2009; Nightingale and Simenstad 2001).

An individual breach takes about an hour or two to complete, but it may be longer between breaches to move the equipment and to prepare any given site. Sedimentation and turbidity would be elevated in the vicinity of each breach until excavated materials are distributed via tidal action, and reach a state of equilibrium. Avoidance and minimization measures included as part of the project (AMM-ABR-4: In Water Sediment Control, AMM-ABR-10: Prepare SWPPP) would be implemented as part of the project to minimize temporary increases in turbidity and suspended sediment.

During construction, SWPPP requirements such as silt fencing would be used to keep construction equipment out of sensitive areas and fiber rolls would be used to prevent construction-related water quality impacts on areas outside of the designated construction zone. Further, outboard levee breaches would be conducted during daily higher tides so that the immediate pulse of sediment associated with breaching is carried into the ponds. Given the number of similar restoration events in the immediate vicinity (Ponds A6, A19, A20, and A21) and throughout the South Bay (Eden Landing, Cooley Landing, Bair Island), it has been the experience that such turbidity effects are localized and extremely temporary in nature and do not result in any significant impacts on aquatic resources. This is effectively a settling mechanism to reduce the amount of sediment that is carried with the flow into the adjacent tidal slough, where aquatic species are present. However, the increase in tidal prism will likely result in increased scour and suspended sediment concentrations in the immediate area, but this is inherent to the restoration process and necessary as natural geomorphic processes are restored.

Finally, outboard levee breaches would be conducted after all internal pond work is completed to ensure that all internal pond work is conducted during low water levels or in the dry using the outboard levees or other materials as the work area isolation features. Internal pond work will be conducted after pond draining, to the extent feasible.

In summary, excavation, dredged material placement, or incidental fallback, depending on the quantity and specific location (e.g., instream habitats occupied by larvae) may create localized sediment plumes. These plumes could expose fish to re-suspended contaminants, sediments that could reduce the ability of a fish's gills to extract DO from the water, and possibly water that has a low DO due to a rise in temperature as a result of turbidity (LFR Levine-Fricke 2004; USEPA Website 2013). These effects, however, would be temporary, and localized to an area within a few hundred feet of the plume. Based on studies cited by LFR Levine-Fricke (2004), levels of suspended sediment are anticipated to return to ambient levels within a few hours of excavation. Application of the project's AMMs restricting construction to the time of year when juvenile steelhead are not present in surrounding waters and requiring a biological monitor during breaching activities would help avoid direct impacts on steelhead and other fish (AMM-ABR-1, AMM-ABR-2). The very short-term construction effects would not be expected to cause significant decreases in the numbers of steelhead, Chinook salmon, green sturgeon, longfin smelt, estuarine species, or bay shrimp populations or result in the substantial loss or degradation of designated EFH.

Because impacts would be short term and AMMs would avoid or minimize effects, impacts related to elevated turbidity and suspended sediments would be less than significant.

Increased Exposure to Mercury

The primary concern with mercury contamination in San Francisco Bay is the accumulation of methylmercury (MeHg) in organisms, particularly at the top of aquatic food webs. Mercury occurs in many forms, but MeHg is the form which poses the highest bioaccumulation risk. The Proposed Project would not affect the rate of mercury deposition into study area but associated with tidal restoration could remobilize mercury-laden sediments already present. The shifting of sediments could expose deeply buried mercury that was previously unavailable for bacterial conversion into MeHg. Excavation in sediment with relatively high concentrations of mercury could cause a short-term increase in the mercury available for MeHg bacterial production and uptake into the food web. But, over the long term, restored tidal marsh would likely produce less organic matter than what is currently produced, providing less fuel for methylating bacteria, and leading to less MeHg production (Grenier et al. 2010). This short-term risk of increased MeHg production is mainly a concern for ponds within the Alviso complex where mercury concentrations are highest (e.g., Ponds A9, A12, A13, and A15; Miles et al. 2005).

Aquatic species in the study area are currently exposed to MeHg when foraging on and in sloughs or other areas with high levels of mercury contamination (for more information about mercury in the study area, see Section 4.5 *Surface Water and Sediment Quality*). Construction activities proposed under this alternative have the potential to increase the exposure of aquatic species to MeHg by re-suspending mercury containing sediments during dredging/excavation of pilot channels and levee breaches that could in turn increase bacterial conversion to MeHg. However, AMMs included as part of the project (AMM-ABR-4, AMM-ABR-10) are provided to avoid and minimize these effects.

With the implementation of AMMs that are part of the project, the potential negative effects associated with suspended mercury exposure are considered to be minor and temporary compared to the long-term benefits associated with restoring tidal estuarine habitat for aquatic species. These minor, temporary effects would not be expected to cause significant long-term impacts to steelhead, Chinook salmon, green sturgeon, longfin smelt, estuarine species, or bay shrimp populations or result in the substantial loss or degradation of designated EFH.

Construction-related impacts related to increased exposure to mercury would be less than significant.

Hazardous Materials Release

Construction-related materials, including petroleum products have the potential to negatively affect aquatic species, if present in the immediate vicinity of in-water work, and work adjacent to aquatic habitats in the study area. Sources of fuel and oil spills or leakage into tidal habitats include heavy equipment, portable water pumps, or from products stored on site for the duration of the project. Specific measures for construction and operation have been established regarding fuel storage, fueling of equipment and spill containment (see Section 4.5.2.1 *Avoidance and Minimization Measures Incorporated into the Alternatives*). These measures should reduce or eliminate the potential for spill events, and thereby reduce or eliminate any direct effects to aquatic species (AMM-ABR-12: Water Structure Materials, AMM-WAT-27: Hazardous Spill Plan, AMM-WAT-28: Prevent Equipment Leaks).

Construction-related impacts related to the release of hazardous materials would be less than significant.

Element-Specific Construction Effects

Construction of the FRM Levee

Although all action alternatives would construct an FRM levee, the alignment and length of the Alviso segment of the levee would differ among the alternatives as described in Section 3.8 *Action Alternatives Component Details*. Anticipated impacts to surface water quality due to construction of the Alviso FRM levee segment are presented in Section 4.5.2.3.2.2 *Comparison of Action Alternatives*. Construction of the WPCP levee segment is not anticipated to require in-water work, and should therefore result in no effect on aquatic species and habitats. Potential construction related effects to water quality resulting from construction in areas adjacent to aquatic habitats would be subject to the stipulations of a Hazardous Spill Plan, discussed in Section 4.5 *Surface Water and Sediment Quality*.

Construction of the FRM levee would have a less-than-significant effect on aquatic species and occupied habitats.

Construction of the Artesian Slough Tide Gate and Railroad Flood Gate

All action alternatives would construct a tide gate across Artesian Slough and a railroad flood gate where the FRM levee crosses the active railroad line east of Pond A12 as described in Section 3.8 *Action Alternatives Component Details*. Anticipated impacts to surface water quality due to construction of the tide gate levee segment are presented in Section 4.5 *Surface Water and Sediment Quality*. Potential construction-related effects on water quality resulting from construction in areas adjacent to aquatic habitats would be subject to the stipulations of a Hazardous Spill Plan, discussed in Section 4.5 *Surface Water and Sediment Quality*.

Construction of the tide gate and flood gate would have a less-than-significant effect on aquatic species and occupied habitats.

Transitional Habitat Construction

Alternatives 2, 4, and 5 include construction of a bench transitional habitat while Alternative 3 includes construction of a 30:1 ecotone transitional habitat (for a complete description of these habitats, see Section 3.8 *Action Alternatives Component Details*). The Alternative 3 transitional habitat would have a larger footprint, but both options would be constructed adjacent to the FRM levee along the east side of Pond A12, the southeast corner of Pond A13, and the south side of Pond A18.

The transitional habitats would be constructed prior to the planned levee breaches for Ponds A12 and A18, so there would not be any in-water work that could affect water quality.

Construction of the transitional habitat would have a less-than-significant effect on aquatic species and occupied habitats.

Construction Access

As presented in Section 3.9 *Evaluation and Comparison of the Final Array of Alternatives,* Ponds A12 through A15 would be accessed from the southeast corner of Pond A12 by the Alviso Marina. Existing levees would be used to gain access to internal pond sites, and trucks would be the primary form of transport. This type of construction access would not affect aquatic resources. It is possible, however, that barges might be necessary to transport equipment at high tide via Coyote Creek or Alviso Slough. Potential effects to the aquatic environment related to barge use include temporary habitat degradation and loss due to anchoring, temporary shading due to the presence of overwater structures, noise associated with operation, and potential loss of habitat due to grounding or blockage of habitat. The use of barges would require close coordination between operators and construction managers to ensure that barges do not run aground, block slough entrances, or negatively affect substrates within the river or tidal sloughs. The presence of such barges would likely result in temporary displacement of aquatic species from occupied habitat in the immediate vicinity of such equipment. Because barge use would be short term and restricted to limited areas, barge-related impacts would be less than significant.

Though some minor displacement of individuals could occur during construction access, this activity would not result in a measurable decrease in the numbers of steelhead, Chinook salmon, green sturgeon, longfin smelt, estuarine species, or bay shrimp populations or result in the substantial loss or degradation of designated EFH.

Construction access would have a less-than-significant effect on aquatic species and occupied habitats.

Construction of Recreation Elements

A proposed pedestrian bridge would span the 500-foot width of Artesian Slough between Ponds A16 and A18 to allow public access through the study area. The bridge would span the slough atop sets of four parallel piles spaced every 50 feet. This would result in a total of forty 12-inch-thick steel piles. A barge-mounted pile driver/crane or an in-water excavator with vibratory hammer would be used to drive the 12-inch-thick steel piles that would form the pedestrian bridge piers (AMM-ABR-3: Vibratory Piling). Because the substrate is primarily silty mud, friction should secure the piles in place. Load tests should be adequate to proof the piles, and impact proofing is not anticipated to be required.

Underwater Noise. Several studies have measured underwater noise levels for installation of piles using a vibratory hammer. Underwater noise generated during vibratory installation of 30-inch-thick steel piles in Hood Canal, Washington, varied between 127 and 158 decibels (dB) and averaged about 145 decibels dB root mean square (RMS; used to describe pressures associated with sound waves; NAVFAC 2012). During the same study, 12-inch-thick steel piles were extracted, and the maximum sound pressure generated was 150 dB RMS. The Washington State Department of Transportation (WSDOT 2010) estimated that vibratory pile driving of plate anchors would generate underwater noise levels of 147 dB RMS. Based on these limited studies, a conservative estimate of 150 dB RMS was used as the estimated maximum underwater noise that would result from vibratory installation of 12-inch-thick steel piles.

Although ambient underwater noise was not measured at the proposed Artesian Slough pedestrian bridge location, ambient levels from other sites can be used to estimate the bridge site condition. Ambient noise levels in deep freshwater lakes or deep slow-moving rivers are about 135 dB RMS (WSDOT 2012). In shallow (1 foot deep or less) fast-moving rivers, the ambient noise levels are louder due to the water moving over rocks and boulders and the wave action at the surface. Ambient levels are approximated to 140 dB RMS in these systems (Laughlin 2005 as cited in WSDOT 2012). Based on this information, a conservative estimate of 135 dB RMS was used as the baseline underwater noise level.

To define the extents of project-related construction noise in the aquatic environment, the Practical Spreading Model was used. This formula, described by Davidson (2004) and Thomsen et al. (2006), is currently used by the NMFS and the USFWS to define the extents of underwater noise on the aquatic environment as well as fish and marine mammals (WSDOT 2013). The Practical Spreading Model estimates the distance at which underwater sound-pressure levels created during vibratory installation (using 150 dB RMS) would attenuate to background levels (135 dB RMS). This formula assumes that sound energy decreases at a rate of 4.5 dB per doubling distance and assumes that sound waves would be absorbed when they reach the nearest land mass. Based on the practical spreading model ($R1 = R2 \times 10[(150–135)/15]$), noises would attenuate to baseline levels about 328 feet from vibratory installation. However, based on the meandering character of Artesian Slough between Ponds A16 and A18, pressure waves are expected to diminish more rapidly as they intersect with land.

Based on the analysis of estimated noise generated during vibratory installation of piles for the pedestrian bridge, underwater sound-pressure levels would not approach injury levels for adult or juvenile salmonids and would not likely be detected beyond 330 feet of the activity given the typically high sound levels in shallow tributary systems. General agreement does not exist on what vibratory sound exposure level threshold value should be used for fish injury, although the likely range is 187 to 220 dB.

Impacts on fishes or other aquatic organisms have not been observed in association with vibratory hammers. This may be due to the slower rise time and the fact that the energy produced is spread out over the time it takes to drive the pile. Vibratory hammers avoid the abrupt over-and-under pressure changes exhibited by impact hammers. As such, vibratory driving of piles is generally considered less harmful to aquatic organisms and is the method of pile installation preferred by the NMFS and the USFWS (WSDOT 2013).

Vibratory installation of steel piles in a river in California resulted in sound pressure levels that were not measurable above the background noise created by the current (Reyff 2006). In a recent FESA consultation involving vibratory driving of piles in the marine environment, the NMFS (2012) stated that "the direct effects of elevated sounds resulting from vibratory pile driving are not known to adversely affect fish or fish habitat." Although these conclusions were made relative to anadromous salmonids under the purview of the NMFS, similar conclusions can be made for other species of fish that possess a swim bladder.

To further attenuate the potential effects of noise during vibratory installation of piles, soft-starts may be used prior to operation of the vibratory hammer. No further attenuation measures (i.e., bubble curtains) are proposed. Underwater noise impacts associated with the Artesian Slough pedestrian bridge construction would be less than significant.

Other Effects due to Instream Work. The presence and operation of in-water construction equipment (e.g., barges, barge-mounted cranes, piles for installation) during installation of pilings to support the pedestrian bridge over Artesian Slough would result in the displacement of species from occupied habitats in the immediate vicinity of the work. The operation of construction equipment and the installation of pilings would increase turbidity and could re-suspend sediments contaminated with mercury. The effects to aquatic species and habitats due to these factors would be similar to those described above for general in-water construction. Since Artesian Slough is occupied primarily by species that are typically less tolerant of saltwater, the effects due to bridge infrastructure installation would likely be greater for freshwater aquatic species than for estuarine or marine species.

Applying AMMs would protect water quality and avoid direct effects to aquatic species would prevent significant instream impacts associated with construction of the pedestrian bridge over Artesian Slough. Though aquatic species would likely be temporarily displaced from habitat during this activity, long-term effects to populations are not anticipated.

Construction of the pedestrian bridge over Artesian Slough would have a less-than-significant effect on aquatic species and occupied habitats.

Other Recreation Elements. The project would also include a pedestrian bridge crossing of the Union Pacific Railroad tracks that run between Ponds A13–A15 and A16 and would modify the existing recreational trail system. These recreational elements do not currently exist in aquatic habitats, and after construction, also would not exist in aquatic habitats. Therefore, because no construction would occur in aquatic habitats, construction of this pedestrian bridge crossing and modifications to the trail system would not affect any aquatic resources.

Operation and Maintenance Effects

Ongoing O&M) activities would be performed periodically at all tidal habitat restoration sites and would continue for the PG&E towers in Pond A18. Such maintenance activities would require construction equipment access (e.g., barges, excavators, trucks), which would displace aquatic species and temporarily alter foraging and rearing behaviors.

Presence of the FRM Levees

As discussed in Section 4.6.2.3.1 *No Action Alternative*, all action alternatives would construct some portion of the proposed FRM levee through or adjacent to a portion of the NCM (see Figure 3.5-1 *Potential Alviso Segment Levee Alignments* in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*). All of the Alviso levee segment alternatives would be constructed on existing berms, including the Alviso Railroad Spur levee segment alignment (associated with Alternative 4) that would travel through the center of the NCM.

The presence of larger berms in or adjacent to the marsh could potentially result in the fragmentation of habitat of aquatic species if they are currently able to access ponded water in the marsh. However, as stated in Section 3.8.5 *Features Built into Design to Avoid or Reduce Adverse Environmental Impacts*, all of the proposed FRM levee alignments would avoid impacts on the hydrology of the marsh by maintaining currently updated hydrologic exchange features, including use of a new siphon between Pond A16 and the NCM. For this reason, aquatic species, if present, would still have access to water during operation of the FRM levee.

However, the potential for habitat fragmentation to occur to a degree that affects aquatic species assemblages is relatively remote, since use of the marsh by fish and other aquatic species is believed to be limited because open water habitat is typically stagnated (Bourgeois pers. comm. 2012) and because berms already exist where the levees would be constructed (so no new barriers would be installed). A small section of the marsh along the railroad tracks where the marsh and Pond A16 connect may be tidally influenced; however, usable habitat is limited (Mruz pers. comm. 2012). The USFWS would continue to manage local hydrology using water control structures. If the current water control structures are determined to be insufficient, further enhancements along the FRM levee may be necessary. Effects to aquatic resources associated with such efforts would likely be similar, though lesser in extent and duration, to those described for initial FRM levee construction.

Overall, operating an FRM levee would not measurably affect populations of steelhead, Chinook salmon, green sturgeon, longfin smelt, estuarine species, or bay shrimp populations or result in the substantial loss or degradation of designated EFH.

FRM levee operation would not result in significant adverse effects on aquatic resources.

Operation of the Artesian Slough Tide Gate

Event-based operation of the Artesian Slough tide gate closure system could interfere with the movement of aquatic species into and out of a short reach of upper Artesian Slough for feeding. Negative effects for fish could be attributed primarily to potential entrainment on the landward side of a partially open gate and exclusion from the uppermost reach of the slough for fish on the bayward side of the gate. However, such effects would occur infrequently (i.e., only during very high tides) and would be of short duration, as the gate would become more opened as the tide subsides at the lower portion of the tidal cycle. Thus, it is unlikely that aquatic species would be entrained landward of the gate, or would be precluded from accessing the uppermost portion of Artesian Slough, for more than a single tide cycle. These effects are therefore not expected to affect survivability or substantially alter migratory patterns, foraging behavior, or the availability of prey. Restoring tidal habitats would provide conditions for improving the health of the estuarine ecosystem and would substantially outweigh potential effects of temporary exclusion from or entrainment in Artesian Slough.

The operation of the Artesian Slough tide gate closure system would have a less-than-significant impact on aquatic resources.

Ecosystem Restoration Maintenance Actions

Maintenance Dredging and Placement of Fill Material

Constructed ditch blocks may require periodic sediment replacement, and, if any levees are lowered, they may require further adjustment if erosional processes are not occurring at the anticipated rates to optimize tidal restoration. Maintenance actions, if required, could occur in the wet, or behind isolation cofferdams with localized pumping. If pumps are used, they would be fitted with appropriate screening as identified in the AMMs adopted as part of this project (AMM-ABR-5: Screen Pumps). Standard BMPs would be used during maintenance to prevent short-term water quality impacts that could affect aquatic resources.

Activities that require dredging would likely require placement of dredge material within the pond, along the sides of the dredged channels, or within the pond itself to redirect water flow to enhance ecological functions. If unintentional breaching or erosion occurs, the berm or levee would be repaired as needed to maintain the connection to adjacent tidal habitats and maintain ecological functions and values. Implementing such activities would require construction access (by land and/or water), staging areas, and material storage areas.

If, during maintenance actions, aquatic species become entrained (temporarily isolated from tidal exchange), poor pond water quality could affect survival and growth, especially during outmigration. Low levels of DO could result in mortality (Kama 2003). However, it is not expected that maintenance would require the isolation of a pond.

Operation and maintenance actions that result in soil disturbance are likely to temporarily increase turbidity and suspended sediment; these activities include placement of dredge material on levee tops, dredging of the ponds and stockpiling of dredge materials, and gaining access to excavation sites. Effects attributed to increased turbidity and suspended sediment on aquatic species behavior may include disruption of normal behavior patterns of breeding, foraging, sheltering, and migration. Further, O&M activities that increase sediment, silt, and pollutants could reduce production of food sources, such as aquatic invertebrates. However, AMMs would be implemented to minimize temporary increases in turbidity and suspended sediment (AMM-ABR-1, AMM-ABR-2, AMM-ABR-4, AMM-ABR-6, AMM-ABR-10), as well as spills or other chemical contamination from construction equipment.

Effects to aquatic species and habitats due to ongoing O&M activities in the study area would be similar to those described above for construction, though likely lesser in extent and duration. Potential direct effects would include risk of entrainment and stranding associated with dewatering canals for maintenance, short-term water quality degradation due to excavation or in-water dredging, temporal loss of habitat due to presence of construction equipment, modification of habitat due to levee maintenance actions, and temporary loss of benthic prey items associated with sediment removal. Further, disturbance and noise associated with dredging, levee repair, and other maintenance activities may startle mobile aquatic species and result in dispersion from the area.

Implementing the AMMs that are part of this project would reduce short-term impacts on steelhead, Chinook salmon, green sturgeon, longfin smelt, estuarine species, bay shrimp populations, or EFH to a less-than-significant level. Long-term negative effects associated with these activities are not anticipated.

Hydraulic Modifications

Over time, shifts in the upstream tidal prism along Alviso Slough may result in increased channel scour and salinity levels in freshwater systems that flow into the Alviso complex. It is possible that the freshwater marsh communities present along portions of Artesian and Alviso Sloughs, and potentially Coyote Creek, might transition to communities dominated by more salt-tolerant species due to increased exposure to tidal waters. This could also result in minor shifts in the composition of local aquatic fauna assemblages but is not expected to significantly affect the number and distribution of species using these types of habitats.

Increased tidal connection might also subject some areas to ongoing channel scour. Layers of sediment with relatively high concentrations of mercury within Alviso Slough could be exposed by chronic tidal scour. This scour could increase the amount of mercury that is available for uptake into the food web, at least in the short term. The period of increased risk and where it would occur, however, is largely unknown (Grenier et al. 2010). However, monitoring of the larger SBSP Restoration Project has indicated that these events are infrequent, localized, and non-persistent, which suggests that impacts on aquatic species would be limited.

Hydraulic modifications than result from the project would have less-than-significant impacts on aquatic resources.

Ongoing Effects Due to Presence of Recreation Features

The proposed pedestrian bridge across Artesian Slough would be incorporated into the tide gate structure. Under this case, the bridge would not affect instream hydraulics or measurably modify microhabitats with regard to flow patterns or sediment transport.

However, should the bridge be an over-water structure, it could have the potential to affect aquatic environments, including changing shading and ambient light in aquatic habitat and, in turn, inducing behavioral responses in fish species and changes in habitat function. Support piles could create hydraulic and physical refuge for piscivorous predators such as striped bass, and this could contribute to increased predation of juvenile fish, including salmonids in Artesian Slough. Shade-producing structures can also introduce changes to fish assemblages and distributions and can potentially reduce or modulate the amount of light required by algae or aquatic macrophytes. The extent and intensity of shading caused by over-water structures are dependent on the physical dimensions and orientation of the over-water structure. Light-penetrating structures with a narrower footprint that are located at higher elevations above the water surface produce the least amount of shading (Chmura and Ross 1978; Mulvihill et al. 1980). Because the proposed bridge would be elevated to levee height, effects on aquatic species and habitat due to shading are anticipated to be minor. In addition to shade impacts, bridge-like structures can create avian predator roosts and increase predation of fish, Ridgway's rails (previously known as California clapper rail), and SMHM. The pedestrian bridge design will meet the Refuge's requirements and will be designed to inhibit avian perching to the extent possible.

Recreation features would have a less-than-significant long-term impact on aquatic resources.

Summary of Effects to Special-Status Species and Selected Aquatic Species and Habitat

California Central Coast Steelhead

As discussed in Section 4.6.1.2.3.1 *Special-Status Anadromous Fish Species*, the FESA-listed CCC DPS of steelhead is known to spawn in non-tidal portions of Coyote Creek. Alviso Slough is used as a migration corridor to freshwater spawning habitats in the Guadalupe River. Juvenile steelhead out-migrate from freshwater rearing habitats to estuarine habitats from February-May and adult steelhead in the South Bay usually migrate upstream to spawning areas from late December through early April.

Levee breaching and pilot channel excavation would not occur between February 1 and May 31 to protect juvenile steelhead migrating from freshwater tributaries to the estuary/ocean. Construction activities in or directly adjacent to water where steelhead are likely to be present (i.e., all aquatic habitats bayward of the outboard levees) would be conducted between June 1 and November 30. These activities would include installing pilings for the pedestrian bridge crossing of Artesian Slough. Based on the proposed timing, construction and O&M actions that increase turbidity and suspended sediment, or increase the risk of entrainment, harassment or stranding, would not occur when juvenile and adult steelhead are most likely to be present

(AMM-ABR-1). However, if present, individuals may be subject to localized, temporary increases in turbidity, which may alter foraging and rearing behavior, and displace individuals from occupied habitat. Juvenile steelhead could be exposed to increased mercury bioaccumulation associated with the suspension of contaminated sediments during in-water work; however, the extent of effects is unknown since data regarding steelhead use of the San Francisco Bay estuary is limited. If steelhead rear for extended periods in the brackish waters of the study area, there is a limited potential for mercury exposure.

Internal pond improvements, including the construction of ditch blocks and side-cast berms, would occur before breaching, using the outboard levees for work-area isolation. Similarly, the repair and replacement of existing water management structures, including several culverts, should also occur prior to outboard levee breaching, or behind isolation cofferdams after breaching. For these reasons, the construction of internal pond habitat elements would result in no effects to steelhead. However, installation of cofferdams could result in potential short-term, localized noise, sediment, or methylmercury mobilization-related effects on steelhead which would be minimized by applying AMMs (such as AMM-ABR-4).

Following restoration, upstream or downstream-migrating adults (kelts) and juveniles could potentially enter the tidally restored habitats of the former ponds. If they enter those areas, they would not be subjected to degraded water quality since full tidal exchange is anticipated. It is possible that steelhead could become temporarily “stranded” in restored areas, following outboard levee breaches, if they enter during high tides, and become trapped in shallow pools within borrow ditches or behind borrow ditch blocks. Such fish could potentially be subject to increased predation by being concentrated in small areas, but they are unlikely to suffer mortality due to low water quality or lack of food before another high tide reconnects those pools with estuarine channels.

The action alternatives would result in temporary minor negative effects on CCC steelhead associated with levee breaches and other in-water ecosystem construction elements; however, the long-term effects of all action alternatives would be largely beneficial. The potential creation of tidal salt marsh in Ponds A9–A15 and A18 could benefit juvenile steelhead that forage and potentially rear in tidal channels in the study area. Any potential negative effects associated with short-term water quality degradation during construction and excavation are considered to be minor and temporary compared to the long-term benefits associated with restoring tidal estuarine habitat along steelhead migratory corridors to nearby spawning streams (Coyote Creek and Guadalupe River). In the long term, the action alternatives are anticipated to contribute to the recovery of CCC steelhead by improving habitat used by both upstream migrating adults and downstream migrating and rearing juveniles.

For these reasons, if any of the action alternatives are implemented, the effect determination for steelhead is less than significant under the CEQA/beneficial under the NEPA.

Central Valley Chinook Salmon

Chinook salmon smolts migrate to the estuary in mid-March to early May. Adult Chinook salmon generally migrate from the ocean to the South Bay tributaries from late September through November. Because in-water construction activities would occur in the summer and fall (June 1 to November 30), migrating adult Chinook salmon, if present, could be subject to increased sedimentation and turbidity associated with in-water work. However, adult Chinook salmon are not known to spawn in the freshwater tributaries that flow into and through the study area (Coyote Creek or Guadalupe River). Therefore, construction-related impacts on spawning adults should not occur.

However, juvenile Chinook salmon may rear in the tidal fringe habitat surrounding the ponds in the study area. If present, juveniles would be subject to increased turbidity and sedimentation due to dredging and excavation of pilot channels along occupied fringes, potential mortality due to excavation of levee breaches, and potential entrainment or stranding if juveniles enter the ponds themselves. Effects would range from temporary loss of benthic foraging habitat and behavioral disruption to mortality due to entrainment in the dredge or burial in erosional areas during dredging. Although these negative effects are possible, they would be minimized, because the majority of construction would occur in the dewatered ponds. Perimeter levee breaches could, however, occur in habitat occupied by juvenile Chinook salmon.

The overall restoration project intent is to increase the availability, quality, and quantity of tidal estuarine habitat. This habitat is known to be used by juvenile Chinook salmon for foraging and rearing prior to ocean entry. For this reason, following the short-term stressors associated with in-water work, the project is anticipated to result in overall beneficial effects to Chinook salmon.

In summary, if any of the action alternatives are implemented, the effect determination for Chinook salmon is less than significant under the CEQA/beneficial under the NEPA.

Southern DPS of Green Sturgeon

Green sturgeon could potentially occur in and adjacent to the study area year round. In-water construction or dredging activities associated with excavation bayward of perimeter levees could potentially result in localized displacement, injury, or mortality of individual green sturgeon that do not readily move away from areas directly affected by the project. Green sturgeon, if present during levee breaching and pilot channel excavation along the perimeter boundaries of each pond, would experience increased turbidity, which would affect prey resources and alter foraging behavior. Following initial construction, increased turbidity is likely to be relatively localized and concentrated near erosional areas along breaches and pond discharge locations. On the basis of their feeding habits, morphology, and bottom orientation, sturgeon likely are more adapted to high turbidity than are other fish species. Most sturgeon species, including green sturgeon, inhabit turbid estuaries where vision is limited (Moser and Lindley 2007). Their general insensitivity to turbidity is reflected in the habitat requirements described by the NMFS (2008), where low turbidity is not included as a biological requirement. Because green sturgeon does not spawn in the study area, project-related sedimentation of potential spawning habitats would not occur.

Following initial construction and eventual attainment of hydrogeomorphological equilibrium, green sturgeon are anticipated to benefit from tidal restoration activities. Benefits would include an anticipated increase in tidal marsh productivity resulting in an increase in organic matter discharge to tidal sloughs, channels, and mudflats, and the bay, thereby increasing benthic invertebrate forage items for juvenile green sturgeon. Following implementation of this alternative, significant increases in the amount of shallow subtidal, mudflat, and tidal marsh habitats are anticipated in the study area.

Operation and maintenance activities may result in short-term increases in turbidity and suspended sediment that may temporarily disrupt feeding and migratory behavior activities of juveniles and adults of the southern DPS of green sturgeon. Because green sturgeon does not use visual cues for feeding, turbidity and sedimentation events are not expected to affect visual feeding success (Sillman et al. 2005).

In summary, if any of the action alternatives are implemented, the effect determination for green sturgeon is less than significant under the CEQA/beneficial under the NEPA.

Longfin Smelt

Longfin smelt spawn in freshwater habitats that are not included in the study area. For this reason, the spawning and incubation life history stages would not be affected by activities proposed under the action alternatives. However, other life stages could potentially be present in the study area, particularly post-hatch larvae that are transported into brackish-water nursery areas from freshwater spawning tributaries. Some longfin smelt spawning may occur in freshwater systems at the southern tip of San Francisco Bay (Baxter 2008 as cited in USACE 2009a). If Coyote Creek or other freshwater systems that flow into the study area are used for spawning, larval longfin smelt would likely be present in the study area and therefore would be affected by instream construction activities.

In-water construction activities, including outboard levee breaches and pilot channel excavation, would be conducted between June 1 and November 30. Based on the proposed timing of instream work, there is potential that out-drifting larvae could be present in aquatic portions of the study area during the first portion of the instream work window (through June 15). However, it is likely that, shortly after the onset of in-water construction activities, longfin smelt larvae, which occupy estuarine habitat similar to that found in the study area, will have metamorphosed into post-larval juvenile fish that reportedly occupy deeper water habitats (Rosenfield and Baxter 2007 as cited in USACE 2009a). Nonetheless, during the first few days of in-water construction, longfin smelt, if present, could be affected by the operation of instream equipment. Effects to individual fish would be similar to those previously described for aquatic species.

Excavation associated with the construction of pilot channels along the pond dikes could entrain larvae, juveniles, and adults, resulting in individual mortality. The likelihood of entrainment varies depending on the vulnerability of the life stage and the type of dredging equipment used. Since excavation is not proposed in freshwater spawning habitats, no entrainment of eggs would occur. Longfin smelt have been observed in hopper dredges during past studies (Larson and Moehl 1990 as cited in USACE 2009a). However, the CDFW's status report on longfin smelt (CDFG 2009) reported that few individual fish were entrained during two separate suction-dredging projects, and those that were entrained were predominantly bottom-dwellers (i.e., not longfin smelt). The longfin smelt life stages that could be present in the study area during instream work (larvae) are not typically associated with the bottom where dredging would occur or would be able are able to move away from the dredge (juveniles and adults).

According to the CDFW, longfin smelt presence data (Baxter 2008 as cited in USACE 2009a) supports allowing dredging between June and October for projects in the Sacramento–San Joaquin Delta and South San Francisco Bay, defined as the area south of a line from Hunter's Point to San Leandro Bay. This timing is similar to the proposed project instream work window, though project activities would continue through the month of November. The project proponents will consult with the CDFW and, if necessary, submit an application for an Incidental Take Permit prior to construction.

Although instream construction could potentially affect longfin smelt, particularly larvae through entrainment during dredging to breach levees, the effects would be minimized by conducting the majority of dredging in the summer and fall, when larvae are least likely to be present. The long-term goal of the restoration portion of the project is to restore tidal habitats in the study area. As a result, larval longfin smelt, if present, would benefit from an increased amount of estuarine nursery rearing habitat in the study area.

In summary, if any of the action alternatives are implemented, the effect determination for longfin smelt is less than significant under the CEQA/beneficial under the NEPA.

Estuarine Species

Potential adverse effects to estuarine fish due to the action alternatives are similar to those described above in the general impact assessment. Negative effects would primarily be attributed to potential entrainment and stranding and short-term water quality degradation associated with levee breaching and pilot channel excavation. These effects could temporarily affect survivability and could alter migratory patterns, foraging behavior, and the availability of prey items. Restoration of tidal habitats should provide conditions for improving the health of the estuarine ecosystem.

If any of the action alternatives are implemented, the effect determination for estuarine species is less than significant under the CEQA/beneficial under the NEPA.

California Bay Shrimp

Although temporary water quality degradation and potential mortality during levee breaching and pilot channel excavation may occur along the outer levees adjacent to estuarine habitat, the elements proposed under the action alternatives are expected to have a net benefit to bay shrimp. If, as anticipated, any of the action alternatives increases salinities in freshwater sloughs and channels adjacent to the breached ponds, the amount of estuarine rearing habitat would increase for bay shrimp.

In summary, if any of the action alternatives are implemented, the effect determination for California bay shrimp is less than significant under the CEQA/beneficial under the NEPA.

Essential Fish Habitat

Restoration activities including breaching outboard levees and excavating pilot channels would result in temporary adverse impacts on EFH associated with increased turbidity or re-suspension of contaminated sediments in the immediate area. Similarly, maintenance and operation activities that result in soil disturbance are likely to temporarily increase turbidity and suspended sediment. Effects of increased turbidity and suspended sediment are likely to disrupt the habitat used for normal patterns of breeding, foraging, sheltering, and migration for all managed species likely to be present in the study area. Avoidance and minimization measures are provided to avoid and minimize temporary increases in turbidity and suspended sediment. Spills or other chemical contamination from construction equipment could also negatively affect managed species; however, AMMs are also provided to minimize these effects (see Section 4.5 *Surface Water and Sediment Quality*).

Following initial construction to breach levees and excavate pilot channels, the quality and quantity of tidal estuary (a FMP Habitat Area of Particular Concern) are expected to improve as a result of activities proposed under the action alternatives. Estuarine habitats, particularly salt and brackish marshes, mudflats, and tidal open channels, are used extensively for rearing, feeding, and growth by a number of species managed under the Pacific Fishery Management Council (PFMC) Fisheries Management Plans. The EFH species most likely to benefit from tidal restoration activities are northern anchovy, starry flounder, leopard shark, English sole, and Chinook salmon.

Pilot channel excavation would also result in the temporary disturbance of possible foraging or spawning habitat for EFH species that may currently utilize the ponds. However, the potential negative effects associated with construction and excavation are considered to be minor and temporary compared to the long-term benefits associated with restoring tidal estuarine habitat for use by various life stages of a number of species managed under PFMC Fisheries Management Plans (AMM-ABR-8: Adequate Depth of Channels). The long-term benefits of restoring tidal estuarine habitat include increasing the food base for FMP species, increasing estuarine habitat and improving habitat quality used by FMP species, and improving water quality throughout the study area.

In summary, if any of the action alternatives are implemented, the effect determination for EFH is less than significant under the CEQA/beneficial under the NEPA.

Impact ABR-2: Conflict with the provisions of the Santa Clara Valley Habitat Plan

The Santa Clara Valley Habitat Plan and Tidal Marsh Recovery Plan do not cover aquatic species, so the project will not conflict with their provisions. *There is no impact under this criterion*.

4.6.2.3.2.2 Comparison of Action Alternatives

This section highlights any differences among the action alternatives relative to effects to aquatic species and habitats. Impacts on aquatic resources due to activities related to ecosystem restoration and recreation access would be similar for all action alternatives. The only substantive difference among the action alternatives is the location and height of the FRM levee in the Alviso segment. Table 4.6-9 *Summary of Impacts on Aquatic Habitats and Species from the Action Alternatives* highlights effects on aquatic species and describes the differences in anticipated effects due to alternative elements.

Table 4.6-9. Summary of Impacts on Aquatic Habitats and Species from the Action Alternatives

Alternative	Impacts on Aquatic Habitats and Species
2 – Alviso North with 12.5-foot Levee and Bench	FRM Levee Element –The Alviso North levee segment would also require some work in aquatic habitat on the edge of Pond A12. An existing culvert between the marsh and Pond A16 would be maintained, so there should be no loss of hydrologic connectivity between the pond and the marsh under this alternative. The WPCP levee segment between Pond A18 and the Wastewater Facility would require some work in aquatic habitat on the edge of Pond A18.This alternative would have the smallest levee footprint and minimal effects on aquatic resources and EFH. Ecosystem Restoration Element and Transitional Habitat – This alternative would cause temporary adverse effects on habitats and species during in-water work along the outboard side of levees and for excavation of pilot channels and temporary stress and handling during estuarine fish sampling. This alternative would result in long-term benefit to aquatic species due to restoration of tidal habitats. Recreation Access Element – Construction of a pedestrian bridge over Artesian Slough would result in temporary displacement of aquatic species from occupied habitat. In-water construction associated with piling installation and associated bridge infrastructure would result in increased levels of underwater sound pressure, which would startle fish and potentially result in injury in the immediate vicinity of pile installation. In the long term, the presence of a new over-water structure would introduce shading in the area beneath the bridge; however, the height of the bridge should minimize any negative effects on species associated with shading. The bridge would be sized to maintain hydraulic capacity and should therefore not affect flow or sediment transport to downstream waterways. The presence of bridge pilings would be minimal enough that refugia for piscivorous fish species should not be a concern.
3 – Alviso North with 15.2-foot Levee and 30:1 Ecotone	FRM Levee Element – Alternative 3 impacts would be similar to Alternative 2 except the levee footprint of Alternative 3 would be larger, potentially resulting in more work in aquatic habitat associated with the edges of Ponds A12, A16, and A18. Ecosystem Restoration Element and Ecotone – Alternative 3 impacts would be similar to Alternative 2 except the larger ecotone could extend farther into aquatic habitats associated with Pond A12 and Pond A18. Construction impacts could be greater than for Alternative 2, but minimization measures would limit such impacts. Recreation Access Element – Same as Alternative 2.
4 – Alviso Railroad with 15.2-foot Levee and Bench	FRM Levee Element – The Alviso Railroad Spur FRM levee segment would bisect the NCM but would use existing berms. This could affect habitat connectivity within the marsh. The hydrologic connectivity of the resulting marsh segments would need to be maintained using culverts under the FRM levee or a new pumping system See discussion in Section 4.7 *Terrestrial Biological Resources*. The WPCP levee segment impacts are the same as those described for Alternative 3. Ecosystem Restoration Element and Bench – Same as Alternative 2. Recreation Access Element – Same as Alternative 2.
5 – Alviso South with 15.2-foot Levee and Bench	FRM Levee Element – Alviso South FRM alignment would avoid impacts on the NCM and therefore should not affect the hydrologic connectivity of the marsh from contributing sources of ground or surface water. WPCP levee segment impacts the same as Alternative 2. Ecosystem Restoration Element and Bench – Same as Alternative 2. Recreation Access Element – Same as Alternative 2.

FRM = flood risk management; WPCP = Water Pollution Control Plant, referred to in text as the Wastewater Facility; EFH = essential fish habitat; NCM = New Chicago Marsh

4.6.2.3.2.3 Monitoring and Adaptive Management Potential for Effects

The Monitoring and Adaptive Management Plan (MAMP) for the Shoreline Phase I Project includes two aquatic species monitoring categories and associated restoration targets and monitoring metrics: estuarine fish and steelhead. Other categories that would apply to aquatic habitats include sedimentation inside ponds and restored tidal marsh habitat inside ponds. The targets and metrics are common to all alternatives and are designed to help guide the planning and implementation of each phase of the project by providing a directed approach to achieving project objectives through lessons learned following implementation of specific actions. Ongoing monitoring associated with the SBSP Restoration Project will also provide information for Shoreline Phase I Study Area managers, since the projects are similar in location and type.

Table 4.6-10 Aquatic *Habitat Restoration Targets, Potential Adaptive Management Actions, and Effects on Aquatic Species and Habitat if Actions Are Implemented* presents a general overview of adaptive management actions that would be implemented under the action alternatives, if monitoring determines that the restoration targets are not being achieved. The table also presents a summary of anticipated effects on aquatic species resulting from implementation of potential adaptive management actions. The complete Shoreline Phase I MAMP is available for review in Appendix F *Shoreline Study Monitoring and Adaptive Management Plan for Ecosystem Restoration*.

Table 4.6-10. Aquatic Habitat Restoration Targets, Potential Adaptive Management Actions, and Effects on Aquatic Species and Habitat if Actions Are Implemented

Restoration Target Category	Monitoring Metric and Method	Potential Management Action	Potential Effect on Aquatic Species and Habitat
Restored Tidal Marsh Habitat inside the Ponds	Tidal marsh habitat acreage in ponds. Total area of tidal salt marsh collected by remote imagery (e.g., satellite data, aerial photographs) with limited "ground-truthing."	If vegetation colonization is compromised and deemed biologically detrimental, widen breaches to encourage better tidal exchange. Adjust to increase pond mudflat accretion. Potential management actions include adding wave breaks, placing fill, or placing in-bay material to "feed" the restored ponds.	Temporary sediment disturbance during management action and potential disturbance of aquatic invertebrates.
Estuarine Fish	Abundance and health of estuarine fish (as measured in permanent monitoring). Fish health parameters, such as abundance, growth, survival, and body condition, of sentinel species are consistent with known values or are similar to parameters in reference locations. Abundance of native fish species in a range of habitats including restored marshes and associated unvegetated shallow water areas, major and minor sloughs, and deep and shallow-water ponds.	If fish health and/or abundance parameters are not met, implement management or adjust design (e.g., remove more levees to increase connectivity in restored ponds) based on study results.	Long-term increase in connectivity and available habitat for estuarine species. However, there would be temporary sedimentation and displacement from habitat in areas in vicinity of levee breaches. Potential effects on aquatic species and habitat would be similar to those described above for outboard levee breaches and levee/berm lowering. Monitoring and sampling to determine the status and abundance of estuarine fish species would result in the use of various seines and nets. The capture and handling of fish species would result in stress to individuals, but they should recover rapidly, and the overall effects of handling would be generally brief if handling is conducted properly. Seining and trapping can result in fish mortality or injury, but sampling would be conducted by qualified biologists to minimize adverse effects on individuals collected.
Steelhead	Monitor steelhead smolt use of the ponds via installation of smolt traps; Counts of upstream-migrating salmonids to monitor spawning populations	None at this time specific to juvenile steelhead use of ponds; however, management actions for general estuarine fish use (i.e., remove more levees to increase connectivity in restored ponds) would benefit rearing and foraging juvenile steelhead that may use the ponds prior to smolt outmigration.	Depending on method of adult counting, could include temporary delay at collection weirs or temporary displacement from habitats during spawning surveys.

4.6.3 Additional Minimization Measures

With implementation of the AMMs, all of the impacts being examined would be less than significant, and thus no additional minimization measures are necessary.

4.6.3.1 Residual Impacts and Additional Measures Necessary to Minimize Significant Impacts

Because the project design and incorporation of AMMs, there are no residual impacts that require minimization.

4.6.4 Cumulative Effects

Historic development in the project area and in the tributaries leading to the south bay has greatly reduced the quantity and quality of habitat which has created a significant cumulative effect to aquatic biological resources.

Within the study area, ongoing and future projects that could affect aquatic biological resources in and near the study area include ongoing implementation of the SBSP Restoration Project and Wastewater Facility Plant Master Plan and FRM activities. Current and future activities include habitat restoration and upgrades to O&M of FRM levees along various tributaries to the South Bay, including the Guadalupe River and Coyote Creek. Past activity associated with the SBSP Restoration Project has contributed beneficially to the habitat condition in parts of the South Bay.

Numerous tidal, wetland, and estuarine restoration projects in the Bay Area would result in temporary negative effects on aquatic habitat during excavation and dredging (associated with habitat modification processes). However, the intent and long-term result of these actions is to benefit aquatic species through the restoration of estuarine habitat and by increasing the extent, quality, and productivity of aquatic habitat. Therefore, these projects would provide net benefits in the long term. Some construction activity associated with the 30-year Wastewater Facility Plant Master Plan might temporarily affect the area around Artesian Slough, but such activity would be conducted in compliance with permits intended to protect water quality and sensitive species and would not significantly affect the aquatic habitat condition. Other present and reasonably foreseeable future construction activity in areas of the South Bay with a stormwater connection to the study area and, ultimately, Coyote Creek, Guadalupe River, or Alviso Slough, includes highway construction and ongoing commercial and residential development. Stormwater regulations would ensure that projects such as these do not cause adverse aquatic habitat effects.

Impacts under the action alternatives are considered less than significant in the short-term and likely beneficial in the long term. Past, present, and reasonably foreseeable future restoration such as that associated with the SBSP Restoration Project is also expected to be beneficial in the long term. The contribution of the Shoreline Phase I Project to cumulative impacts on aquatic species would not be cumulatively considerable and, in the case of restoration activities, would be beneficial.

4.6.5 Waters of the United States Impact Estimates

The impact analyses conducted for the Integrated Document included an evaluation of the potential effects of the four action alternative plans on waters of the United States. The USACE studied the short-term effects and the potential long-term effects associated with three different SLC scenarios on the Recommended Plan. The analyses considered construction-related effects and effects that would occur over the medium term and long term as a result of ecosystem restoration.

Waters of the United States impacts that would occur as a result of FRM implementation would occur at the time of construction. Levee and tide gate construction at Artesian Slough would result in the fill of waters of the United States. Ecosystem restoration impacts would occur in phases as the ecosystem restoration process takes place over time. Most adverse waters of the United States impacts (discharge of fill) would be from levee construction and installing transitional habitat, but lesser amounts of fill would occur due to breaching of ponds. Ecosystem restoration activity would result in beneficial effects by restoring or creating waters of the United States as the restoration process occurs over time. Impacts to wetlands from project construction would be offset over time due to restoration of large areas of tidal marsh.

4.6.5.1 Construction-Related Impacts

Table 4.6-11 *Flood Risk Management and Transitional Habitat Construction-Related Impacts by Type of Wetlands and Other Waters of the United States by Project Alternative* shows the estimated construction-related impacts by type of waters of the United States for each of the action alternatives. The table shows waters impacts associated with levee construction, installing the Artesian Slough tide gate, and building transitional habitat. Levee and transitional habitat construction would occur from 2018 through 2021.

Alternatives 2 and 3 would have similar wetland losses at 17.2 acres (1.13 percent of the total wetland area in the study area) and 17.4 acres (1.15 percent of wetland area in the study area), respectively. Alternative 4 would have the highest wetland loss at 37.1 acres, which is about 2.44 percent of the wetland area in the study area.

Alternative 3 would have the highest loss of other waters of the United States (120.2 acres or about 2.86 percent of the area of all non-wetland waters in the study area) because it would affect more area of circulation pond. Alternative 5 would have the smallest loss of other waters 0.82 percent of the area of all non-wetland waters in the study area.

Table 4.6-11. Flood Risk Management and Transitional Habitat Construction-Related Impacts by Type of Wetlands and Other Waters of the United States by Project Alternative

In acres and percentage of total acreage in the study area

Type of Water	Alternative 2 (NED/NER Plan)	Alternative 3 (Proposed Action and LPP)	Alternative 4	Alternative 5
Vegetated Wetland				
Salt Marsh				
Tidal	1.7 (0.53%)	1.7 (0.53%)	1.1 (0.34%)	0.0 (0.00%)
Non-tidal	8.1 (9.48%)	8.2 (9.60%)	8.3 (9.72%)	8.3 (9.72%)
Brackish Marsh	0.3 (0.07%)	0.3 (0.07%)	0.2 (0.05%)	0.2 (0.05%)
Muted Tidal/Diked Marsh [a]	1.8 (0.53%)	1.8 (0.53%)	22.0 (6.47%)	20.3 (5.97%)
Freshwater Marsh	1.0 (1.07%)	1.1 (1.18%)	0.9 (0.97%)	0.8 (0.86%)
Vegetated Wetland Subtotal	12.9 (1.0%)	13.1 (1.0%)	32.5 (2.6%)	29.6 (2.3%)
Unvegetated Wetland				
Seasonal Wetland	3.7 (14.12%)	3.7 (14.12%)	4.2 (16.03%)	0.0 (0.00%)
Mudflat	0.6 (0.27%)	0.6 (0.27%)	0.4 (0.18%)	0.4 (0.18%)
Unvegetated Wetland Subtotal	4.3 (1.7%)	4.3 (1.7%)	4.6 (1.9%)	0.4 (0.2%)
All Wetlands Total	17.2 (1.13%)	17.4 (1.15%)	37.1 (2.44%)	30.0 (1.97%)
Other Non-wetland Waters				
Open Water	9.4	9.4	9.7	9.6
Ponds				
Batch (high salinity)	7.9	32.6	9.2	7.3
Circulation	22.6	78.2	17.7	17.7
Sewage Treatment Ponds	0.0 (0.00%)	0.0 (0.00%)	0.0 (0.00%)	0.0 (0.00%)
Legacy Ponds	0.0 (0.00%)	0.0 (0.00%)	0.0 (0.00%)	0.0 (0.00%)
Other Water Subtotal	39.9 (0.95%)	120.2 (2.86%)	36.6 (0.87%)	34.6 (0.82%)
Grand Total	57.1 (1.00%)	137.6 (2.40%)	73.7 (1.29%)	64.6 (1.13%)

Note: Alternative 1 is the No Action Alternative and is therefore not included in this table or the following tables.
Key: NED/NER = National Economic Development/National Ecosystem Restoration; LPP = Locally Preferred Plan

4.6.5.2 Ecosystem Restoration Impacts

Ecosystem restoration impacts would occur in phases and in different areas of the study area. Ecosystem restoration is scheduled to occur in three phases, as follows:

- Phase 1: Ponds A12 and A18; breaching begins in 2020
- Phase 2: Ponds A9, A10, and A11; breaching begins in 2025
- Phase 3: Ponds A13, A14, and A15; breaching begins in 2030

Because transitional habitat would be constructed concurrent with levee construction, short-term impacts that result from construction of either a bench or ecotone are included in the Table 4.6-11 *Flood Risk Management and Transitional Habitat Construction-Related Impacts* *by Type of Wetlands and Other Waters of the United States by Project Alternative* totals. For in-pond preparation, each phase would have short-term adverse impacts related to construction activity such as breaching levees. Over time, the affected ponds and adjacent areas would have middle-term and long-term gains in wetlands and enhancement of overall waters of the United States as restoration areas transition.

Project-related impacts are related to changes in topography, changes in jurisdictional area(s), inner levee fill, and project phasing. Impacts would occur in different geographic areas over time as the project progresses.

4.6.5.2.1 Existing Topography

Existing outer levees tend to top out at around 12 feet NAVD 88, while inner levees (between ponds) are often lower. For tidal areas, mean higher high water (MHHW) in the study area is currently at 7.81 feet NAVD 88, and ordinary high water (OHW) is 8.47 feet NAVD 88. Pond A16 is currently managed to be around 3.1 feet NAVD 88. Other ponds may be higher or lower, but they are all managed well below MHHW. All topography that could have a change in jurisdictional status is above current average water levels for MHHW and OHW.

4.6.5.2.2 Changes in Jurisdiction

If a levee is graded (shortened) to the MHHW level, then all parts of the current levee width that are not already jurisdictional would become jurisdictional. An exception would be any nesting islands in the study area ponds that are retained.

For outer levees, the new jurisdictional area would be the part of the existing outer slope above OHW plus the entirety of the remaining levee width. The top of the levee and the inside slope are not currently jurisdictional above the pond water level but would become jurisdictional once the levee top is lowered and tidal action is restored.

For inner levees, the new jurisdictional area would be the entire existing levee width, which would be converted from upland to wetland due to the combination of grading and restored tidal action.

4.6.5.2.3 Inner Levee Fill

Technically, there could be fill associated with raising the inner levees to prepare for ponds being breached, leading to loss of jurisdictional waters. This would be temporary as these levees would be graded down later when remaining ponds are breached. Any islands retained on these inner levees would be only in locations where there is substantial existing levee width, such as some of the levee intersections and the Pond A14/A15 levee. Islands formed in these areas would be on solid, well-established, consolidated fill. Any temporary fill needed to widen an inner levee (should widening be needed in some areas) would be graded down at a later date and would return to being jurisdictional.

4.6.5.2.4 Phasing

Project phasing will result in temporary and medium-term impacts that are physically and temporally separated. The USACE anticipates gains in waters of the United States associated with remnant islands (i.e., sections of the existing non-engineered levees that remain as islands after breaching or levee lowering), the inner faces of outboard levees (i.e., levees that are between the Alviso ponds and the bay), and both faces of inner levees (i.e., levees that are internal to the ponds and do not contact the bay.

Ecosystem restoration actions would offset wetland impacts as follows:

- The ecotone would form a narrow band of marsh quickly after its surface is exposed to pond water after it is constructed within a given pond but prior to breaching.
- Upon breaching, a larger area of the ecotone surface would quickly develop tidal marsh on its own. The portion of the ecotone at the elevation of upper marsh and marsh-upland transition would be planted to accelerate habitat formation. Elevations above that would be planted and seeded with upland vegetation, resulting in buffer and refugial value to marsh wildlife.
- Two breaches are planned for Pond A12 and six for Pond A18. As breaching proceeds starting at the bayward end of Ponds A12 and A18, the existing outboard levees would be lowered to approximately MHHW (which is the average pickleweed plain elevation) progressively to the south and east toward the ecotone. Pickleweed would quickly colonize this lowered levee surface.
- Approximately 20 percent of the existing levee length would be retained to provide high-tide refugia, plus an additional 20 percent of the Pond A18 levee would be retained for powerline access.
- Levees not breached, but adjacent to a pond being breached, would be temporarily raised and strengthened as needed to protect the adjacent pond from premature breaching prior to eventual lowering and breaching as later phases of restoration proceed. These levees would qualify as environmental levees under USACE policy and would not be subject to USACE flood risk management levee construction or maintenance requirements.
- Marsh vegetation would quickly colonize all levee surfaces facing the breached pond at appropriate elevations due to a conversion to intertidal habitat.
- The breached pond would become primarily mudflat habitat at first, with some subtidal areas. Marsh would take many years to establish across most of the pond.
- As additional ponds are breached in later years, additional sections of levee would be graded down to become pickleweed marsh, and additional ponds would be breached to start on the path toward becoming tidal marsh.

The USACE does not consider the increase in jurisdictional waters mitigation but does recognize that, from a regulatory standpoint, they may be classified as mitigation.

4.6.5.2.5 Post-Restoration Conditions (2067)

Long-term impacts take into account the expected amount of jurisdictional waters that would be gained by 2067. Table 4.6-12 *Estimated Post-construction Tidal Marsh (Wetland) Area Restored in the Study Area by Alternative (in 2067)* shows the estimated post-construction total of tidal marsh wetland by alternative. Table 4.6-12 *Estimated Post-construction Tidal Marsh (Wetland) Area Restored in the Study Area by Alternative (in 2067)* does not take into account short-term impacts associated with construction or middle-term impacts that might occur as restored areas transition.

Table 4.6-12. Estimated Post-construction Tidal Marsh (Wetland) Area Restored in the Study Area by Alternative (in 2067)

Alternative	Post-construction Total (acres)
2	Maximum of 2,863.3
3	Maximum of 2,783
4	Maximum of 2,863.5
5	Maximum of 2,867.2

Table 4.6-7 *Post-Restoration Conditions in the Study Area* in Section 4.6.2.3.2 *Action Alternatives* summarizes the changes in and post-restoration conditions of the study area ponds.

4.6.5.3 Change in Jurisdictional Area as a Result of Sea Level Change

Although flood risk management construction would result in immediate loss of jurisdictional waters, different SLC scenarios could affect long-term loss of waters of the United States along the new levees. To understand how sea level change might affect levels of loss with implementation of the Recommended Plan, the USACE compared the potential net jurisdictional loss based on the sea level condition at the time of construction (i.e., the sea level in 2017)[2] with low, medium, and high sea level change scenario losses. The USACE calculations show that the sea level could rise by 0.51 foot with the low scenario, 1.01 feet with the medium scenario, and 2.59 feet with the high scenario by 2067 (USACE 2014).

The net jurisdictional loss without any change in sea level would be 101.41 acres. This loss is different from the construction-related loss for the Recommended Plan (Alternative 3) shown in Table 4.6-11 *Flood Risk Management and Transitional Habitat Construction-Related Impacts by Type of Wetlands and Other Waters of the United States by Project Alternative* because it does not include areas that would be below OHW upon restoration but are not yet due to a pond not being breached. This applies to certain elevation ranges of ecotone in Ponds A12, A13, and A18 until those ponds are breached according to the construction schedule.

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[2] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

The low, medium, and high SLC scenarios take into account areas on the ecotone that would transition to being below OHW during the project's 50-year evaluation period (2017 to 2067). The impacts associated with the Recommended Plan from the three SLC scenarios are:

- Low: 94.82 acres
- Medium: 89.23 acres
- High: 74.14 acres

4.6.5.4 Context for and Summary of Impacts

In the context of the study area, acreage impacts would be relatively modest. In summary, the impact information presented in this section shows that:

- None of the action alternatives would cause losses or more than about 2.4 percent of the **total area of all jurisdictional waters of the United States** in the study area. Alternative 2 would result in the smallest loss at about 1 percent of the total area of all waters of the United States. Alternative 3 would result in the highest loss (2.4 percent of the total area of all waters).
- Impacts to **wetlands** would range from a low of about 1.1 percent for Alternative 2 to a maximum of about 2.4 percent for Alternative 4.
- Impacts to **non-wetland waters of the United States** would range from a low of about 0.8 percent for Alternative 5 to a maximum of about 2.9 percent for Alternative 3.

Nevertheless, given historic losses of wetlands and other waters of the United States in San Francisco Bay, even proportionately small losses can be of concern, in particular for impacts on Threatened and Endangered species. The Recommended Plan is compatible with the Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (USFWS 2013b) and would assist in its implementation by restoring large contiguous blocks of tidal marsh together with substantial adjacent ecotone. A detailed discussion of the compatibility of the Recommended Plan with the recovery plan is included in the response to RWQCB comment number 13 (individual comment 9) in Appendix I *Public Comments and Responses on Draft Integrated Document*. All three species covered by the recovery plan are discussed in Section 4.7 *Terrestrial Biological Resources*.

Consistency with the San Francisco Bay Plan is addressed in the CZMA Consistency Determination. Consistency with the Basin Plan is addressed in the responses to the RWQCB comments.

The alternatives include features to offset Threatened and Endangered species impacts and to reduce temporal severity.

- All the alternatives include restoration of nearly 3,000 acres of tidal habitat. Restoration would generally be a conversion from non-tidal other waters of the United States but would provide enhanced ecological functions to San Francisco Bay by restoring a portion of tidal habitats previously lost.

- All the alternatives include phasing of pond breaching over a 10-year phase period to reduce the severity of temporal impacts.
- The Recommended Plan (Alternative 3) would include an ecotone with 30:1 slopes on the outboard side of the levee. This area would quickly form new marsh upon restoration of tidal action. It also would provide substantial new high-tide refugia for marsh wildlife and would allow these refugia to adapt to sea level change.

Impacts would occur in the short and long term.

Comparative Short-Term Impacts of the Alternatives. Expected short-term waters of the United States impacts of the alternatives are as follows:

- Alternatives 2 and 3 would have lesser wetland impacts than Alternatives 4 and 5 due to the new flood risk management levee following existing dike alignments.
- Alternatives 4 and 5 would have greater wetland losses due new levee alignments through New Chicago Marsh.
- Alternatives 2, 4, and 5 would have lesser impacts to other waters of the United States due to having a relatively narrow bench for transitional habitat instead of an ecotone for transitional habitat.
- Alternative 3 would have greater impacts to other waters of the United States because it requires more fill to establish the ecotone.
- Alternative 3 would result in rapid development of tidal marsh on portions of the ecotone at appropriate elevations within one year of breaching, thereby providing the fastest replacement in any of the alternatives for short-term wetland habitat losses caused by construction of the FRM levee. The bench provided by the other alternatives would provide this short-term benefit to a much lesser extent due to its much steeper slope (3:1 vs. 30:1) within the intertidal elevation range.

Long-Term Impacts of the Alternatives. Expected long-term waters of the United States impacts of the alternatives are as follows:

- Impacts to wetlands and other waters of the United States landward of the crest of the new flood risk management levee would be permanent under all alternatives.
- For alternatives with a bench (Alternatives 2, 4, and 5), a small portion of the impacts bayward of the flood risk management levee crest would be temporary due to re-establishment of waters of the United States on the edge of the bench when tidal action is restored in an adjacent pond.
- All the alternatives would result in nearly 3,000 acres of new tidal habitats being restored bayward of the new flood risk management levee. This would include existing waters of the United States as well as areas that are currently upland (existing levees to be degraded).
- In the long term, nearly all of the tidal habitat acreage created would become tidal marsh.

- Restoration areas would be quite similar between the alternatives, with the only notable difference being the ecotone in Alternative 3.
- Tidal restoration would be subject to adaptive management decisions during the restoration period, and restoration could be halted short of the maximum potential.

Alternatives 2, 4, and 5 would have similar long-term impacts bayward of the new flood risk management levee. Nearly all areas would become tidal habitats, mostly tidal marsh. There would be a narrow transitional habitat area along the edge of the bench.

Alternative 3 would have similar effects, except that the ecotone would provide a broad, gently sloping zone of upper marsh and transitional habitat along the edge of the levee. This would:

- Provide rare and valuable refugial habitat for marsh wildlife.
- Allow marsh and transitional habitat to move upward in response to sea level change without contacting the managed levee surface. This would enable the persistence of upper marsh and transitional habitat despite considerable SLC.

4.6.5.5 Summary of the Short-Term and Long-Term Impacts of the Alternatives

Overall, all of the alternatives would have short-term impacts on wetlands and other waters of the United States, but, over time, marsh restoration activities would result in large increases in tidal wetland area. In summary:

- The four action alternatives would have similar qualitative impacts on habitat types.
- Some areas of pond, seasonal wetland, and non-tidal wetland would be lost due to levee construction and bench or ecotone construction.
- Outside of New Chicago Marsh, losses in habitat would generally be in fragmented, linear areas with low habitat quality and that currently provide a low level of ecological services.
- Marsh habitat losses in New Chicago Marsh, while occurring in an area of greater habitat and functional value, would be more than compensated by long-term marsh habitat gains in restored tidal areas.
- The alternatives would result in very minor impacts to existing tidal habitats, primarily due to pond breaching.

4.6.6 Summary

Table 4.6-13 *Aquatic Biological Resources NEPA Impact Conclusions* summarizes the action alternative effects under the NEPA.

Table 4.6-13. Aquatic Biological Resources NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
ABR-1: Substantial adverse effect on any special-status species	Negative Positive (long term)	Minor Major (long term)	Short term Long term	Possible Possible	Local Local
ABR-2: Conflict with the provisions of the Santa Clara Valley Habitat Plan	Neutral	None	None	None	Limited

Table 4.6-14 *Aquatic Biological Resources CEQA Impact Conclusions* summarizes the project effects under the CEQA. As described earlier in this section, these effects would all be less than significant.

Table 4.6-14. Aquatic Biological Resources CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Additional Measures	Significance After Applying All Measures
ABR-1: Effect on any special-status species	AMM-ABR-1: Seasonal Restrictions AMM-ABR-2: Biological Monitor AMM-ABR-3: Vibratory Piling AMM-ABR-4: In Water Sediment Control AMM-ABR-5: Screen Pumps AMM-ABR-7: Notification of Mortality Events AMM-ABR-8: Adequate Depth of Channels AMM-ABR-9: Salvage Natural Materials AMM-ABR-10: Prepare SWPPP AMM-ABR-11: Biological Monitoring AMM-ABR-12: Water Structure Materials AMM-WAT-27: Hazardous Spill Plan AMM-WAT-28: Prevent Equipment Leaks	LTS	None	LTS
ABR-2: Conflict with the provisions of the Santa Clara Valley Habitat Plan		NI	None	NI

NI = No Impact
LTS = less than significant
S = significant
NA = not applicable

Construction of project features would result in short-term water quality degradation including:

- Temporary increase in sedimentation and turbidity during levee breaching and hydraulic element construction, including placement of fill material and excavation of tidal substrates;
- Temporary increase in underwater noise due to the presence of construction equipment and vibratory installation of piles for the pedestrian bridge;
- Temporary re-suspension of contaminated sediments in excavation areas and in areas subject to scour following breaching;
- Temporary increase in salinity near breach locations immediately following initial breach;
- Temporary displacement from occupied during in-stream work associated with water quality degradation;
- Temporary displacement of aquatic organisms from occupied habitats during in-water work.
- Loss of benthic productivity and associated prey availability due to temporary habitat modification at dredging locations
- Loss of individual aquatic species, primarily immobile fauna that cannot avoid dredging equipment in levee breach and pilot channel locations

Overall, considering the fact that most of the habitat restoration activities would occur isolated from active flow behind existing perimeter levees, the action alternatives would result in less-than-significant impacts on aquatic species and habitats. None of the action alternatives would have a substantial adverse effect on or cause a substantial decrease in the abundance or distribution of steelhead, Chinook salmon, green sturgeon, longfin smelt, estuarine species, or bay shrimp populations. None of the action alternatives would result in the substantial loss or degradation of designated EFH. The action alternatives would not interfere substantially with the movement of any native or migratory fish or impede the use of aquatic nursery sites.

Restrictions related to the timing of in-water actions during the summer and early fall should minimize potential effects on special-status aquatic species, including CCC steelhead and longfin smelt. The long-term positive impact on aquatic species resulting from any of the action alternatives, including increased habitat for rearing and foraging, should ultimately benefit aquatic species in the study area.

4.7 Terrestrial Biological Resources

4.7.1 Affected Environment

This section describes the regulatory setting and the local and physical setting for terrestrial biological resources. Terrestrial biological resources are habitats, wildlife, and plants that are not solely dependent on aquatic environments for survival. Many terrestrial wildlife species use aquatic habitats for breeding, foraging, and resting, but these species spend time on dry land as well as in or near the water. Aquatic habitats and resources, including fish and aquatic invertebrates, are discussed in Section 4.6 *Aquatic Biological Resources*.

The terrestrial biological resources discussed in this section are described within the context of the Shoreline Phase I Project physical disturbance area shown on Figure 1.9-3 *Shoreline Phase I Area of Impact and Biological Buffer Area* in Chapter 1 *Study Information*. This section also includes a description of the regional condition, focusing on the South Bay, since many terrestrial biological species are mobile and use many areas of the South Bay.

Habitat condition and species composition in the study area at any given time are influenced by changes that occur on multiple time scales including daily (e.g., resulting from tidal influence), seasonally (e.g., resulting from species life history such as migration between habitats as the seasons change), annually (such as migration to and from the Bay Area), and decadally or longer (e.g., resulting from community succession and other long-term influences such as climate change). Therefore, this section describes the physical setting using scientific literature, SBSP Restoration Project planning documents and monitoring reports, and Shoreline Phase I Project reports information that has mostly been published over the last 15 years.

Please note that, throughout this section, the terms *12.5-foot NAVD 88 levee* and *15.2-foot NAVD 88 levee* are used to distinguish the Alternative 2 levee footprint from the Alternative 3 levee footprint, respectively. Alternatives 2 and 3 run along the same alignment but since the Alternative 3 levee is 1.7 feet higher, the two Alternatives will have different impacts (e.g., more filling would be required to make the Alternative 3 levee taller). See Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* for a discussion of how these two levee heights were tentatively selected for consideration in the final array of alternative plans.

4.7.1.1 Regulatory Setting

Terrestrial biological resources are managed and protected through several different Federal, State, and local regulations and programs. Table 4.6-1 *Regulations and Programs That Apply to Aquatic Biological Resources* summarizes the regulations and programs that apply to aquatic biological resources; all of the regulations listed in that table also apply to terrestrial biological resources. Table 4.6-1 *Regulations and Programs That Apply to Aquatic Biological Resources* does not include the following two additional regulations that apply to terrestrial resources specifically:

- **Migratory Bird Treaty Act (16 USC 703–711), implemented by the USFWS:** translates the provisions of treaties between the U.S., Canada, Mexico, Russia, Great Britain, and Japan into law. The act makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale any migratory bird, or the parts, nests, or eggs of such a bird, except under the terms of a valid permit issued pursuant to Federal regulations. This act would apply to construction and maintenance activities that could directly affect individual migratory birds.
- **Marine Mammal Protection Act (16 USC 1361–1407), implemented by NOAA Fisheries:** the purpose of this act is to conserve marine mammals. With certain exceptions, the act prohibits the taking and importation of marine mammals as well as products from them. The act also prohibits harassment of marine mammals; it applies to harbor seals that use the project area.

4.7.1.2 Physical Setting (CEQA Baseline)

4.7.1.2.1 Local and Regional Conditions

The San Francisco Bay estuary is a productive, diverse ecosystem. Despite the loss of more than 90 percent of historical tidal wetlands in the San Francisco Bay Area to diking, draining, and filling (Goals Project 1999), fish and wildlife diversity is high, with more than 250 species of birds, 120 species of fish, 81 species of mammals, 30 species of reptiles, and 14 species of amphibians regularly present in the estuary (Siegel and Bachand 2002). More importantly, San Francisco Bay supports populations of a number of species of regional, hemispheric, or global importance. Numerous endemic, Endangered, Threatened, and Rare fish and wildlife species or subspecies reside in or migrate through the San Francisco Bay Area.

The South Bay is a vital component of the larger estuary. The South Bay supports some of the most important habitat remaining in the entire San Francisco Bay Area for a number of wildlife species, even though the surrounding areas are highly urbanized and San Francisco Bay itself has been dramatically altered by the diking and filling of wetlands for salt production and urban development (Goals Project 1999).

The following sections describe the habitats of the Shoreline Phase I Study Area and the general far South Bay area, common terrestrial wildlife that use the area, and special-status species that are present in the area. As described for aquatic resources in Section 4.6.1.2.1 *Habitats*, this terrestrial section provides only the common names of species (other than when they are referenced to differentiate subspecies as part of a technical discussion or in species tables); scientific names for all species discussed are included in a table in Appendix B5 *Biological Resources: Species Scientific Names, CNDDB Report, and CRPR Report*. The California Natural Diversity DataBase (CNDDB) Rare Find 5 and California Rare Plant Rank searches were conducted for the Mountain View and Milpitas 7.5-minute quadrangles, which encompass the study area and surrounding areas with similar habitats for sensitive plant and animal species. (CNDDB 2014; CNPS 2014).

4.7.1.2.2 Habitats

As noted in Section 4.6 *Aquatic Biological Resources*, study area mapping includes 16 different habitat categories (Table 4.6-2 *Habitat Types Mapped in the Study Area* and Figure 4.7-1 *Shoreline Phase I Study Area and Terrestrial Biological Study Area* Habitat). Aquatic habitats, including open water, mudflat, tidal and non-tidal salt marsh, brackish marsh, muted tidal/diked marsh, freshwater marsh, seasonal wetland, and riparian/creek corridor, are described in Section 4.6 *Aquatic Biological Resources*. The following sections describe vegetation in the Shoreline Phase I Study Area in general and the upland, levees, developed areas, and landfill habitats in more detail. It is important to note that small inclusions of differing habitat types may be present within a mapped section but that inclusions do not change the overall value or use of the habitat as described. For example, upland vegetation probably contains areas of annual grassland or other such habitat types.

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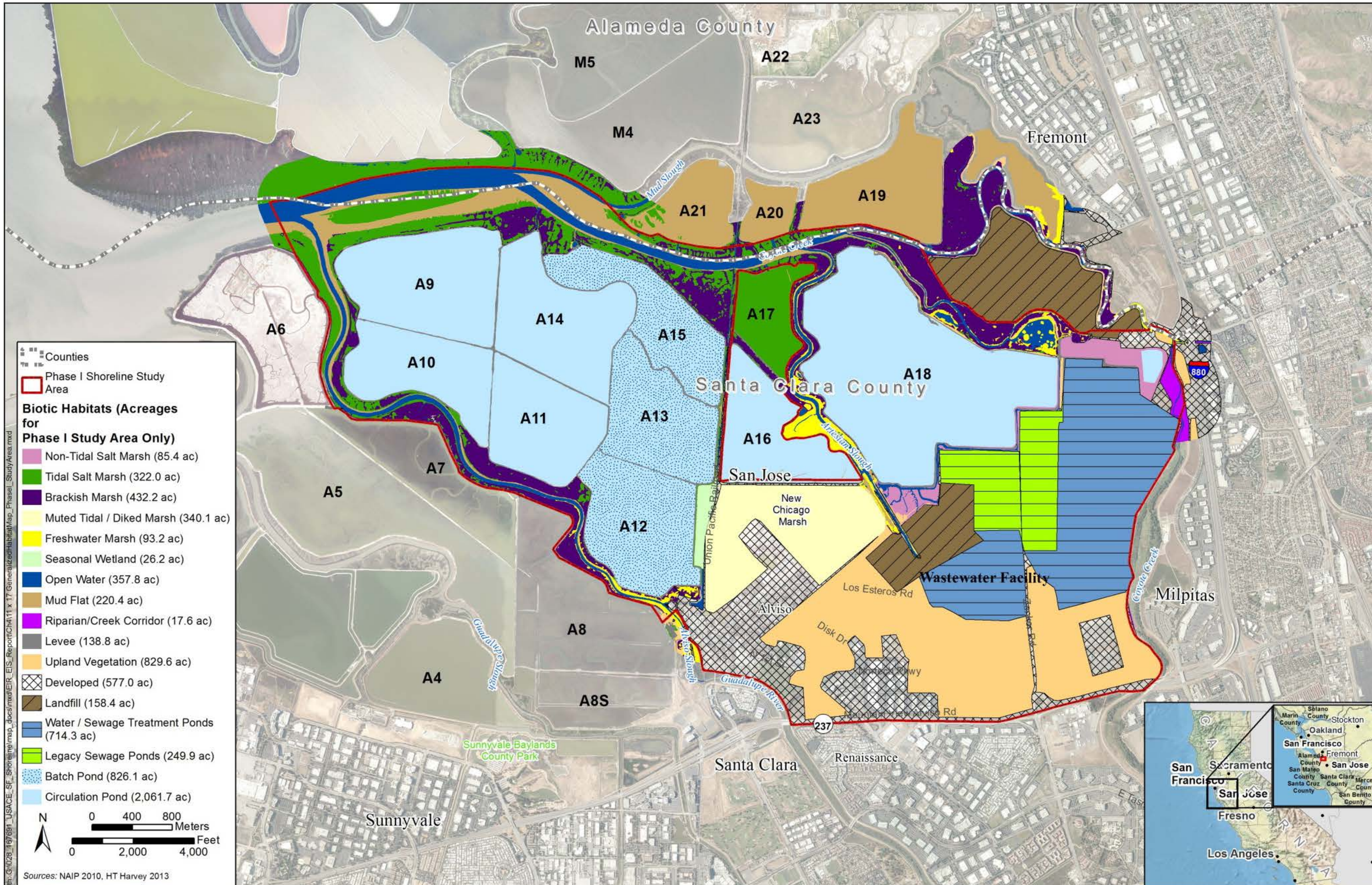

Figure 4.7-1. Shoreline Phase I Study Area and Terrestrial Biological Study Area Habitat

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4.7.1.2.2.1 General Vegetation in and near the Shoreline Phase I Study Area

Figure 4.7-1 *Shoreline Phase I Study Area and Terrestrial Biological Study Area Habitat* provides a general mapping of the project area. Marsh habitat adjacent to ponds in the Shoreline Phase I Study Area includes tidal and non-tidal salt marsh, brackish marsh, and freshwater marsh, as well as areas of salt-tolerant plants. Tidal salt marsh habitat is present on the outboard side of levees along Coyote Creek, Alviso Slough, and parts of the Artesian Slough complex. Salt marsh dominated by cordgrass is found at lower elevations bordering the mudflats and along the fringing lower elevations of Coyote Creek.

In the study area, cordgrass also borders portions of Alviso Slough, and there is a new cordgrass salt marsh island (known as Ogilvie Island) at the mouth of Alviso Slough outboard of Pond A9 (Figure 1.9-1 *Shoreline Phase I Study Area – Alviso Subarea within Santa Clara County* in Chapter 1 *Study Information*). Pickleweed marsh is found at higher elevations just above cordgrass-dominated marsh and extends upstream into Coyote Creek and Alviso Slough.

Brackish marsh covers the marsh plain in the transition from salt to brackish marsh along Coyote Creek and also dominates the marshes on the outboard side of the levees near the junction of Mud Slough and Coyote Creek on the north side of the study area. Brackish marsh replaces salt marsh moving upstream along Alviso Slough. To the east of the mouth of Artesian Slough along Coyote Creek, the brackish marsh contains patches of pickleweed salt marsh within the marsh plain and then more easterly becomes primarily brackish marsh. Brackish marsh dominates Triangle Marsh, which is on the north side of the study area (between Ponds A15 and A17) and extends into the lower reaches of Artesian Slough. Artesian Slough is dominated by freshwater marsh upstream (south) of Pond A17.

Levees separate the individual ponds in the study area, and upland vegetation borders some sections of the freshwater and brackish marshes. Unvegetated islands exist within several of the ponds. Most of the internal levees between ponds are unvegetated.

4.7.1.2.2.2 Upland Vegetation

About 830 acres of the Shoreline Phase I Study Area are dominated by upland vegetation; this includes ruderal (disturbed) grasslands, buffer lands around the Wastewater Facility, and identified parks. Upland vegetation areas are concentrated on the southern end of the study area. There is a small area of upland vegetation on the western edge of the community of Alviso near the Alviso Marina and a larger area east of Zanker Road surrounding the administration buildings for the Wastewater Facility. Vegetation in this type is dominated by nonnative annual species such as ripgut brome,[1] Italian ryegrass, black mustard, wild radish, Mediterranean barley, wild oats, yellow star-thistle, common sow thistle, bull thistle, bristly ox-tongue, rabbits foot grass, and brass buttons, as well as natives such as alkali heath and coyote brush.

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[1] Please see Appendix B5 *Biological Resources: Species Scientific Names, CNDDB Report, and CRPR Report* for a complete listing of species' scientific names.

Most of the wildlife species found in upland areas are common species adapted to urban or ruderal habitats. Reptiles such as the western fence lizard, gopher snake, and southern alligator lizard, and mammals such as the house mouse, California vole, western harvest mouse, California ground squirrel, black-tailed jack rabbit, Audubon's cottontail, brush rabbit, Botta's (valley) pocket gopher, and striped skunk all are present in the upland transitional areas along the edge of the bay.

In most areas, the bird species that are present in the peripheral habitats are also common, widespread species, with the exception of burrowing owls, which have been extirpated from many areas of California. The extent of the upland fields that probably once provided extensive alternate foraging habitat for shorebirds has been reduced considerably by development. Nevertheless, some shorebirds forage in more extensive upland fields during the wet season while others forage around ponded water in such fields in winter.

4.7.1.2.2.3 Levee

The study area includes about 139 acres of non-engineered dikes and berms, most of which were originally built in support of historic salt production in the area. Levees are found along the periphery of the baylands and also separate the individual ponds in the pond complex. In general, these levees are linear, barren, earthen structures that separate the ponds from tidal areas and adjacent ponds. Some levees are armored with rock or other material (riprap), but the levees in the study area are typically constructed from soils excavated from borrow pits in former salt marshes. This material was used to develop the salt production ponds. Currently, the ponds are managed to support wildlife. The levee substrate is primarily saline, silty clay. For the purposes of this project, dirt roadways along the upland perimeters of the ponds or bayfronts are included in the levee category. If levees are dominated by peripheral halophytes or upland vegetation, they are categorized as either of those habitat types rather than as levee habitat. Levees are used as corridors for mammalian predators and as roosting and nesting habitat by shorebirds and waterfowl.

4.7.1.2.2.4 Developed

About 577 acres of the study area are developed areas that support residential uses (community of Alviso), roadways, parking areas, building complexes, pump facilities, and power facilities. Developed areas are concentrated in the southern part of the study area, but there is a small area of developed land west of the I-880/Dixon Landing Road freeway interchange that supports a recycling facility. Developed areas are typically maintained free of vegetation but may occasionally support isolated nonnative upland vegetation. Larger areas of upland or ornamental (landscaping) vegetation in developed settings are categorized as parks/upland grassland (see Table 4.6-1 *Regulations and Programs That Apply to Aquatic Biological Resources*).

4.7.1.2.2.5 Landfill

About 159 acres of the Shoreline Phase I Study Area are active landfill or material recovery sites. These include the Zanker Road Landfill and Zanker Materials Processing Facility along

Los Esteros Road in the southern part of the study area. The Newby Island Resource Recovery Park, which includes a landfill, abuts the northeastern corner of the study area and is not included in the landfill acreage total.

4.7.1.2.3 Invasive Plant Species within the Shoreline Study Area

Many invasive plant species are known to be present or may be present within the study area. These species can out-compete native plants, displacing entire communities of plants and associated wildlife. Recently, the State Coastal Conservancy and the USFWS have focused removal efforts on the invasive cordgrass (*Spartina* spp.). These agencies established the San Francisco Estuary Invasive Spartina Project in 2000 in response to the invasion of hybridized nonnative *Spartina* into the marshes and mudflats of the San Francisco Bay estuary. The Invasive Spartina Project monitors an area within the Shoreline Phase I Study Area called the South Bay Marshes–Santa Clara County site.

Other invasive, nonnative plant species that are located throughout the study area include the following:

- Perennial pepperweed, which has invaded many wetland areas within the study area but is also present in upland areas with ruderal grassland habitat dominated by Italian ryegrass, various nonnative bromes, Mediterranean barley, and wild oats.
- Black mustard and wild radish, which dominate levee banks within much of the study area.
- Pampas grass, which is present in ruderal areas, including areas adjacent to developed areas.
- French broom and Scotch broom, which are present in upland, disturbed areas.
- Giant reed, which is present in freshwater marsh and creeks.
- Sweet fennel, which is common on levees and in ruderal areas.
- Yellow star-thistle, purple star-thistle, and Italian thistle, which are present and can dominate grassland areas.
- Algerian sea lavender, which is present in the area of Pond A6.
- Stinkwort, which is present near the EEC and Pond A12.
- Poison hemlock, which is common on levees in the study area.

4.7.1.2.4 Terrestrial Invertebrates

The San Francisco Bay Area hosts a high diversity of insect species (Myers et al. 2000). Because of the coincidence of a biodiversity hot spot and a major urban center, it is not surprising that the Bay Area is also a center of threatened biodiversity. More than 50 percent of the species of arthropods listed by the Federal government as Endangered are present in the broader Bay Area (Dobson et al. 1997; Connor et al. 2002). However, none of these listed species are known to be present in the Shoreline Phase I Study Area (USFWS ECOS 2012).

The Butterfly and Moths of North America database lists 157 species of butterflies and moths in Santa Clara County (BOMOA 2012). The Bay Area is also home to over 100 native species of ants and 81 native species of bees (sfbaywildlife.info Website 2012).

The CNDDB does not list any special-status insect species within 5 miles of the Mountain View or Milpitas 7.5-minute quadrangles (CNDDB 2014).

4.7.1.2.5 Reptiles and Amphibians

There are few species of reptiles and amphibians in the study area, and the populations have not been studied extensively. Common species known to inhabit the study area include the western fence lizard, garter snake, gopher snake, and southern alligator lizard. The fence lizard is present in a variety of habitats, while the snakes and alligator lizards generally are present along edges of well-vegetated levees, in riparian habitats, and in grassland and ruderal habitats (USFWS 2012).

Western pond turtle, a California Species of Special Concern, is an aquatic turtle that is found west of the Sierra Nevada from the Columbia River south to northern Baja California, Mexico. Western pond turtles have occasionally been recorded along lower Coyote Creek immediately adjacent to the study area (Table 4.7-2 *Special-Status Animal Species, Their Status, and Potential Occurrence in the Study Area*). A small number of western pond turtles also inhabit the ponds west of the study area. Small numbers of several species of nonnative turtles, most likely pets that have been released, are also present in South Bay streams (USFWS 2012).

California tiger salamander, a State and Federally Threatened species, is present in vernal pool habitats in the Warm Springs area northeast of the Shoreline Phase I Study Area. Since there are no vernal pools in the study area, it is unlikely that this species would be present on the project site.

The scarcity of freshwater habitats within the immediate study area limits its use by amphibians. The Pacific chorus frog, western toad, and nonnative bullfrog are present where there is freshwater along the inland margins of the study area. California slender salamander and arboreal salamander are present in moist riparian areas along the margins of the study area, but are much more abundant in higher-elevation, wooded, less-urbanized sites outside the study area.

4.7.1.2.6 Mammals

Because of historical, intense disturbance and habitat conversion, relatively few species of mammals are present in the study area, with the exception of species that do well in urban–wildland interface areas, such as raccoons, Virginia opossums, rats, and skunks. Within the study area, most research attention on mammals has focused on the ecology of special-status species associated with salt marshes (e.g., salt marsh harvest mouse [SMHM] and salt marsh wandering shrew), the use of South Bay waters and tidal habitats by the Pacific harbor seal, and the presence and impacts of nonnative mammals such as the house mouse and Norway rat. Upland habitats within the study area are primarily ruderal, although some nonnative grassland habitat and the riparian corridor of Coyote Creek support a variety of small mammal species in addition to the urban-adapted species.

4.7.1.2.6.1 Small Mammals

Native species that live in or use the study area include two special-status species: the SMHM and the salt marsh wandering shrew. The SMHM and the salt marsh wandering shrew are dependent on dense vegetative cover, usually in the form of pickleweed and other salt-dependent or salt-tolerant vegetation such as alkali bulrush. The SMHM and the salt marsh wandering shrew are discussed in Section 4.7.1.2.8.2 *Special-Status Terrestrial Wildlife*.

Trapping studies for the SMHM in the South Bay have revealed much about the status of other small mammals in marsh habitats of the region. House mice and California voles are common in diked and tidal salt marshes, particularly in the high marsh and the peripheral halophyte zone; the native western harvest mouse also is present. Deer mice, shrews, black rats, and Norway rats have also been recorded in these marshes during SMHM trapping and other studies (H.T. Harvey and Associates et al. 2005).

Several species of bats, such as the Mexican free-tailed bat, Yuma *myotis*, western red bat, and hoary bat forage over the ponds, marshes, and grasslands of the South Bay area. Other small, native mammals such as the Botta's pocket gopher, California ground squirrel, black tailed jack rabbit, Audubon's cottontail, brush rabbit, striped skunk, raccoon, grey fox, common muskrat, and long-tailed weasel are present on pond dikes, at the margins of marshes, and in upland and grassland habitats around the periphery of the study area.

4.7.1.2.6.2 Pacific Harbor Seal

Pacific harbor seals are currently the only marine mammals that are known to be permanent residents of San Francisco Bay. California sea lions enter the Central Bay seasonally, and harbor porpoises are known to be present in the Central Bay. Other marine mammals, such as whales, enter the bay very sporadically.

Although not listed by the State as a Species of Special Concern, harbor seals are protected under the Federal Marine Mammal Protection Act and are sensitive to human disturbance. The NMFS, the agency that oversees the protection of marine mammals, recommends a 100-yard disturbance-free buffer around harbor seals, both in water and while hauled out on coastal beaches. Disturbance can lead to separation of pups from nursing mothers, add physiological stress to adults, and also lead to long-term abandonment of historical haul-out sites (Lidicker and Ainley 2000).

Pacific harbor seals forage in bay waters and sloughs and breed and loaf on the edges of tidal marshes and mudflats. The seals haul out on mudflats far from areas used regularly by humans and near deeper water, where the seals forage. The most extensively used sites in the South Bay are along Mowry Slough and at Calaveras Point, which are north of the Shoreline Phase I Study Area (USFWS 2012), and there is a more local haul-out site at Calaveras Point about 1.5 miles from the study area. Recently, seals and transient (very occasional) California sea lions have been seen in Coyote Creek as far upstream as Pond A18 (Bourgeois pers. comm. 2013; Mruz pers. comm. 2013).

4.7.1.2.6.3 Nonnative Mammals

Several nonnative mammal species are present in the South Bay area, including the red fox, Norway rat, black rat, feral cat, and Virginia opossum. These species affect native wildlife considerably through predation (USFWS 2012). The red fox was first reported in the South Bay area in 1986 (Foerster and Takekawa 1991), but recently its numbers have decreased considerably in the South Bay due to predator management (Strong pers. comm. 2013). It dens in a variety of habitats, including former salt pond dikes (Foerster and Takekawa 1991). The Refuge has an active predator management plan directed at the removal of rats, red foxes, raccoons, skunks, and feral cats from the areas of highest value to Endangered species and nesting birds (USFWS 2012).

4.7.1.2.7 Birds

The birds of the South Bay area have been studied more than any other wildlife group in the Bay Area. This focused attention results from the high diversity of birds in the region; the presence of several San Francisco Bay Area endemics, and Federally listed and State-listed species; the ability of species to adapt to human-caused habitat changes (including historic salt pond development and urbanization) that have occurred in the South Bay; and the intensity of interest in the bird life of the region by professional and amateur ornithologists. The birds using San Francisco Bay and associated ponds, marshes, and tidal flats (also called mudflats) represent the most significant contribution to the South Bay avifauna of the Pacific Flyway (a major north-south route of travel for migratory birds in the Americas).

Birds in the South Bay overlap considerably in habitat preference and resource use, but general groups of species can be distinguished based on their physical adaptations, habitat associations, foraging behavior, dietary requirements, and prey; the ways in which they use the ponds as habitats (e.g., for nesting, foraging, or roosting); and their temporal presence in the study area. For the purposes of describing the bird community in the South Bay, six general groups of species have been identified: (1) shorebirds; (2) waterfowl (ducks and geese); (3) large waders (herons, egrets, and ibis) and other piscivores (fish-eating grebes, cormorants, and pelicans); (4) gulls and terns; (5) other waterbirds (eared grebes, coots, and rails); and (6) terrestrial/riparian birds (including raptors and passerines). This section contains an overview of the South Bay bird communities and then discusses each of these groups.

4.7.1.2.7.1 Overview of South Bay Bird Communities

The San Francisco Bay Area is extremely important to breeding birds and migratory waterbirds using the Pacific Flyway. The bay provides important foraging and roosting habitat for more than one million waterbirds each year (Accurso 1992; Harrington and Perry 1995; Page et al. 1999; Stenzel et al. 1989; Stenzel and Page 1988; Takekawa et al. 2001). With its extensive mudflats, remnant salt marsh, and ponds, the South Bay in particular supports a very high diversity and abundance of waterbirds (Harvey et al. 1992; Takekawa et al. 2000, Warnock

2004). More than 225 bird species are present in the greater South Bay area with some regularity, and many of these are common inhabitants of the study area. More than 75 species of waterbirds use the ponds, tidal marshes, mudflats, subtidal habitats, surrounding managed marshes, water treatment plants, and managed ponds regularly (Athern et al. 2011).

The State of the Birds, San Francisco Bay 2011 (Pitkin and Wood, eds., 2011) notes that most bird populations in San Francisco Bay are currently stable. According to the report, some species, such as western snowy plover and California least tern, are benefitting from conservation and restoration activities, but others, such as the Federal Endangered and State Fully Protected California Ridgway's rail,[2] continue to struggle. The report also recognizes SLC as a threat to tidal flat habitats and marsh habitats such as those in the South Bay and stresses the importance of recognizing how predicted SLC could affect restoration priorities. Concern over SLC is an emerging concept; past concerns have focused more seriously on habitat loss and degradation due to regional development (which is still a concern).

The high waterbird diversity (range of different species) in the South Bay is a function of the diversity of habitats in the region, while high bird abundance (number of total birds regardless of species) is a function of the high productivity of the South Bay estuary and of specialized habitats such as the salt production and managed ponds. Ponds and other alternative habitats (such as artificial ponds and lakes, water treatment plant settling and oxidation ponds, muted tidal and diked marshes, and managed ponds) provide important habitat for waterbirds in the South Bay (Hanson and Kopec 1994; Harvey et al. 1992; Stralberg et al. 2003; Takekawa et al. 2000; Takekawa et al. 2001; Warnock 2004). Birds are very abundant in the ponds during high tide, although most bird activity is concentrated in small areas within the larger managed pond complexes. Ponds close to the edge of the bay have greater bird use than those farther from the bay, and many shorebirds use contiguous or closely located mudflats and ponds (Warnock and Takekawa 1996). Salinity and water depth are key factors in birds' use of ponds.

Several special-status bird species nest and/or forage in the study area. These species are described briefly in Section 4.7.1.2.8 *Terrestrial Special-Status Species*; scientific names are provided in Appendix B5 *Biological Resources: Species Scientific Names, CNDDB Report, and CRPR Report*.

4.7.1.2.7.2 Shorebirds

Because shorebirds rely heavily on the South Bay, no other group of birds using the area has been more studied than shorebirds, which include plovers, sandpipers, stilts, avocets, and phalaropes. Thirty-six species of shorebirds use habitats in the bay (USFWS 2012). The area

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[2] The newly titled (American Ornithologists' Union, July 2014) California Ridgway's rail (previously referred to as the California clapper rail) includes three subspecies: the Bay Area's California Ridgway's rail; the light-footed Ridgway's rail in Los Angeles and San Diego; and the Yuma Ridgway's rail in Arizona, Nevada, and eastern California. All three of them remain on the Endangered species list. It is part of a larger split; two rail species will now be five: king rails in the eastern U.S. and the Caribbean; clapper rails in the eastern U.S. and Cuba; mangrove rails in South America; Aztec rails in the Mexican highlands; and the West Coast Ridgway's rails. However, the new title has not yet been recognized by all USFWS offices; therefore, some appendices to this document continue to use the California clapper rail nomenclature (e.g., Appendix B7 *USFWS Coordination Act Report*).

supports more than 50 percent of the individuals of 11 species recorded in all United States Pacific coast wetlands for at least one season and provides habitat for nearly 1 million shorebirds annually (WHSRN 2009). The bay holds higher proportions of the total wintering and migrating shorebirds in the United States Pacific coast than any other wetland (WHSRN 2009). As a result of these numbers, the Western Hemisphere Shorebird Reserve Network has designated the combined San Francisco and San Pablo Bay areas as a site of hemispheric importance (Harrington and Perry 1995; WHSRN 2009), and the American Bird Conservancy has designated the Refuge a Globally Important Bird Area (ABC 2004; USFWS 2012).

Studies that support data referenced in *The State of the Birds, San Francisco Bay 2011* (Pitkin and Wood, eds., 2011) note that, overall, the shorebird population in the bay has remained stable since the 1990s with some species-specific increases and declines. However, an increase in the North Bay and an apparent decrease in the Central and South Bays seems to indicate a shift of shorebirds from south to north, possibly due to restoration actions in the North Bay providing short-term interim mudflat habitat as tidal marsh develops (Pitkin and Wood, eds., 2011).

The State of the Birds, San Francisco Bay 2011 (Pitkin and Wood, eds., 2011) recognizes that the tidal flats, managed ponds, and tidal marshes of the South Bay are an important part of the larger San Francisco Bay from the perspective of use by breeding, migrating, and wintering shorebirds; however, most of the shorebirds that use the South Bay do so for foraging, roosting during migration, and wintering, and do not breed there (USFWS 2012).

Shorebird abundance in the South Bay is highest in spring and winter. For most species, the spring migration is rapid and compressed to a relatively brief period from early April to mid-May (Recher 1966; Stenzel and Page 1989), resulting in large numbers of individuals using the South Bay simultaneously. In contrast, the fall migration is more protracted for most species because different sexes and age classes migrate at different times. Shorebird abundance is lowest during summer, when breeding individuals of only four species (killdeer, American avocet, black-necked stilt, and western snowy plover) and low numbers of nonbreeders of other species are present.

Most shorebird species in the South Bay are mudflat specialists, foraging primarily on intertidal mudflats when they are available at low tide (Anderson 1970; Kelly and Cogswell 1979; Recher 1966; Stralberg et al. 2003; Swarth et al. 1982; Warnock et al. 2002; Warnock et al. 1995). These birds concentrate at the edge of the receding tideline where their prey is close to the surface (USFWS 2012). How shorebirds use the mudflats varies among species based on bill and leg length. For example, the shorter-billed semipalmated and black-bellied plovers feed on recently exposed mud; small sandpipers, such as western and least sandpipers, forage on recently exposed mud and shallow water; midsized birds, such as dunlin, red knots, long-billed dowitchers, and short-billed dowitchers, forage in slightly deeper water; and larger shorebirds, such as willets, long-billed curlews, and marbled godwits, probe in even deeper water (USFWS 2012). Mudflats are concentrated along Coyote Creek and Alviso Slough in the study area and near the study area within Ponds A6, A17, A19, A20, and A21.

On the other hand, some shorebird species are pond specialists, meaning they are more likely to forage in pond habitats in the study area. More than half of the shorebird use of the San Francisco Bay estuary occurs within the 40,000 acres of former salt ponds that rim the South Bay (Hickey et al. 2003). The extent of foraging habitat within the ponds varies considerably among ponds and seasons, but, at any given time, a relatively small proportion of the managed pond complex provides suitable foraging conditions (i.e., moist soil or shallow water less than 4 inches deep).

The use of ponds for foraging varies considerably among species, and, for some species, it varies among individuals, seasons, and age classes. Because the managed ponds' water levels generally do not change with the tides, shorebirds can feed in shallow ponds throughout the tidal cycle (Stenzel et al. 2001). A few shorebird species remain in these alternative habitats throughout the tidal cycle, using water treatment plants and managed ponds and marshes for foraging, primarily in shallower areas. Phalaropes are one exception, since they forage by spinning in tight circles to create upwellings of food on the surface of the water.

Shorebirds may also use salt marsh, but to a lesser degree than tidal flats (Stralberg et al. 2003), and some species will use tidal marsh for roosting. Shorebirds generally do not use vegetated tidal marsh because of the height and/or density of marsh vegetation. They are more likely to forage on exposed intertidal flats along larger sloughs within the marshes. Shorebirds will also use shallow marsh ponds and pannes (infrequently flooded bare areas) within the marsh and areas where bare mud and shallow water are interspersed with short pickleweed (H.T. Harvey & Associates 2007; USFWS 2012). Some species, such as the willet, whimbrel, long-billed curlew, and yellowlegs, also forage on marsh plains with sparse or low vegetation (less than about 7.8 inches) (Hickey et al. 2003).

Before some initial conversion of tidal marshes to salt ponds in the Bay Area occurred in the mid-1800s, only one shorebird species, the killdeer, likely bred in the South Bay. Conversion continued through the 20^{th} century, with changes in the Alviso Ponds occurring through the 1950's. The presence of American avocet bones in Native American middens indicates that this species was present much earlier than when adults were first recorded in 1884 (Rintoul et al. 2003). The creation of salt ponds in the South Bay has enhanced breeding habitat for several species, including the western snowy plover (Federally listed as Threatened), black-necked stilt, and American avocet. These four species (including killdeer) are the only shorebird species that nest in the study area.

Currently, less than 10 percent of the United States Pacific Coast population of the western snowy plover breeds in South Bay ponds. See Section 4.7.1.2.8.2 *Special-Status Terrestrial Wildlife* for more information about western snowy plover.

American avocet and black-necked stilt were first recorded breeding in the San Francisco Bay Area salt ponds in 1926 and 1927, respectively (Gill 1977; Harvey et al. 1992). Since then, their populations have increased considerably; no other coastal site along the Pacific Coast supports such high abundance of these two species (Rintoul et al. 2003). Rintoul et al. (2003) noted the particularly large concentrations of both species in the NCM in Alviso. In general, population trends for nesting shorebirds that use the South Bay ponds are unknown (Pitkin and

Wood, eds., 2011). Of the shorebirds using the area, American avocets and black-necked stilts are the most abundant breeding shorebirds (estimated at 1,380 pairs of avocets and 590 pairs of stilts in 2003; Rintoul et al. 2003). Within the study area, important nesting sites include the NCM, Pond A12, Pond A13, and the adjacent Pond A16.

Shorebirds in the South Bay eat a wide variety of invertebrates, and occasionally, small fish. Shorebirds have very flexible and opportunistic diets, with considerable dietary overlap among species and foraging guilds (Skagen and Oman 1996). Shorebirds often concentrate where prey is most dense (Goss-Custard 1970; Goss-Custard 1977; Goss-Custard 1979), so the hydrologic regimes and ecosystem processes that maintain abundant invertebrate populations are more important than the specific invertebrate taxa available.

Shorebirds generally roost, resting and preening, when they are not foraging. In the South Bay, the most commonly used high-tide roosts for both pond specialists and mudflat specialists are shallows and bare sediment within ponds, levees surrounding and (especially) between ponds, and islands and artificial structures such as boardwalks within these ponds (Warnock et al. 2002). Shallowly flooded marsh ponds, marsh pannes, managed marshes, and water treatment plant drying ponds are also used for roosting. Isolated roosting habitat, free from disturbance by humans and mammalian predators and adjacent to foraging habitat, is extremely important to maintaining shorebirds in the South Bay.

4.7.1.2.7.3 Waterfowl (Ducks and Geese)

Historical accounts of waterfowl numbers in the San Francisco Bay Area attest to the past abundance of ducks and geese using the Bay Area during migration and winter. Wetland loss, hunting pressures, contamination, and other factors (such as recently improved habitat in the Central Valley) have led to a decline in bay-area waterfowl populations, although this decline is not well documented for the South Bay (Pitkin and Wood, eds., 2011). Currently, the South Bay supports fairly large migrant and wintering populations of ducks, with several breeding species as well. More than 30 species of waterfowl use open water, tidal marsh, ponds, and immediately adjacent habitats of the South Bay. Of these, eight species breed regularly (with populations augmented considerably during the nonbreeding season), nine species are present regularly during migration and winter, and the remaining species are present irregularly and/or in very low numbers as nonbreeders.

In South Bay ponds, ducks tend to dominate the pond bird communities, with northern shovelers accounting for 41 percent to 46 percent of all birds in ponds at low tide (Warnock et al. 2002). Ruddy ducks are the next most abundant duck wintering on South Bay ponds (primarily on low-salinity ponds), accounting for about 40 percent of the Pacific Flyway population, with up to 19,000 recorded on these ponds (Accurso 1992). In contrast to shorebirds, the vast majority of which use managed ponds primarily at high tide (when the tidally influenced shorelines are inundated and unavailable), duck numbers on South Bay ponds are similar at high and low tides (Warnock et al. 2002). Diving ducks (e.g., ruddy ducks, greater and lesser scaups, and buffleheads) and many dabbling ducks (e.g., northern pintails, northern shovelers, teals, and mallards) often roost while swimming in the open bay waters, on sloughs, and in ponds. Dabbling ducks, and diving ducks to a lesser extent, also roost on the edges of mudflats and marshes, on islands and levees within the ponds, and on mud and shallow water within the bottoms of ponds.

The South Bay is an important foraging area for migrant and wintering waterfowl. Duck abundance in the South Bay increases in August and September as migrants arrive in ponds and marshes. Numbers of other dabbling ducks and several species of diving ducks increase through the fall and into winter and remain high into March (Santa Clara County Bird Data, unpublished; Takekawa et al. 2005).

Diving ducks are the most abundant wintering waterfowl in the South Bay. Common species include the lesser scaup, greater scaup, ruddy duck, canvasback, bufflehead, surf scoter, common goldeneye, and red-breasted merganser. Although diving ducks may forage in water up to about 32 feet deep (Miles 2000), these birds forage primarily in water that is usually less than about 7.5 feet deep (USFWS 2012). Because of this, much of the bay is not available or does not provide high-quality foraging conditions for these birds, so foraging flocks of diving ducks tend to congregate over shallows and intertidal flats during high tide. Diving ducks are also common on managed and salt production ponds of low salinity, in larger sloughs, and on some artificial lakes.

Dabbling ducks forage in a variety of habitats in the South Bay, including mudflats, shallow subtidal habitats, tidal sloughs and marsh channels, marsh ponds, managed and muted tidal marsh, seasonal wetlands, managed ponds, salt production ponds, and water treatment plants. In these areas, these non-diving ducks feed on a variety of aquatic plants and invertebrates. Pond salinity is important because the plants on which many dabbling ducks feed cannot tolerate high salinities. Because of this, dabbling duck abundance tends to be highest in lower-salinity ponds (20–63 ppt), with few in ponds greater than 154 ppt (Accurso 1992). The most abundant dabbling ducks wintering in the South Bay are the northern shoveler, American wigeon, northern pintail, mallard, and gadwall (Takekawa et al. 2005). Wintering numbers of dabbling ducks increased in the South Bay ponds between about 2004 and 2011 (Pitkin and Wood, eds., 2011).

The bayland habitats of the South Bay support eight regularly nesting waterfowl species. Mallard, gadwall, and Canada goose (breeding populations of which are introduced) are fairly common breeders, while cinnamon teal, northern pintail, ruddy duck, lesser scaup, and northern shoveler breed in smaller numbers. Important breeding areas for waterfowl in the South Bay combine freshwater or brackish seasonal wetlands with extensive grassy or ruderal vegetation for nesting and fresh, brackish, or low-salinity ponds and marshes for brooding of young. In the study area, such areas are present at the adjacent Wastewater Facility.

4.7.1.2.7.4 Large Waders and Other Fish-Eating Birds

This category includes a diverse group of about 20 species of piscivorous (fish-eating) waterbirds that are present in the South Bay, including pied-billed grebes, western grebes, Clark’s grebes, common loons (which are uncommon-to-rare visitors), double-crested cormorants, American white pelicans, brown pelicans, and large waders (e.g., herons, egrets, and ibis). Several other species, including gulls, terns, mergansers, and belted kingfishers, also forage for fish in the study area.

While a number of fish-eating birds breed in the South Bay, residency by most of these species is highest during the nonbreeding season. Western and Clark's grebes rarely nest in the baylands of the South Bay but may be present in the area year-round, particularly on ponds and in the open bay (being most abundant in winter). Brown pelicans are present in the South Bay during post-breeding dispersal during summer and fall (Ainley 2000). American white pelicans are most abundant in the area from June through December but are present year-round (USFWS 2012).

The piscivorous birds of the South Bay forage in a variety of habitats and locations where prey fish are available. The low-salinity ponds that support fish, tidal sloughs and channels, edges of intertidal mudflats, managed ponds and slough channels, and artificial lakes provide the highest-quality foraging areas. Frenzies of feeding activity may be observed at these locations, presumably when conditions result in large fish concentrations. Brown pelicans usually plunge-dive for fish and therefore require water at least 10 feet deep, but American white pelicans and cormorants swim while feeding and can, therefore, feed in shallower water. Cormorants forage primarily in the open bay, but also forage for fish in the former salt ponds. American white pelicans prefer non-tidal water bodies (Cogswell 2000; Harvey et al. 1988).

The larger piscivores move around the South Bay in search of suitable foraging conditions, allowing them to exploit particularly large concentrations of fish. Cormorants and pelicans exhibit movements between foraging areas at inland reservoirs and the South Bay, although most foraging likely occurs within the bayland habitats (H.T. Harvey & Associates 2007). Several piscivorous species nest in the South Bay. Pied-billed grebes nest in freshwater wetlands, building floating nests of vegetation in scattered areas surrounding the ponds and tidal wetlands in the study area. Double-crested cormorants nest at several locations in the study area. Breeding occurs at undisturbed sites, typically in trees or on human-made structures beside water (such as utility towers over managed ponds), but nesting success has varied considerably over the past 25 years (Pitkin and Wood, eds., 2011). Double-crested cormorants nest during spring and summer (and occasionally into early fall) and are resident in the South Bay year-round. Numbers are augmented considerably in fall and winter by nonbreeding birds from other locations (Ainley 2000).

Large wading birds are constrained by water depth and are usually seen foraging from the edges of a body of water or wading within the shallows. Pied-billed grebes and most of the herons and egrets often forage along freshwater streams and along the edges of ponds in the South Bay, and great blue herons and great egrets also occasionally forage for small mammals in upland fields and ruderal areas. The white-faced ibis, a medium-sized wading bird that is an uncommon breeder in California, is a State Species of Special Concern only at nesting colonies. There are recent (2012) records of white-faced ibis using Artesian Slough (Cornell Lab of Ornithology 2013), but the only record of nesting by this species in the South Bay was at Artesian Slough between Ponds A16 and A18 in the 1980s. Breeding success is unknown, and there has been no subsequent evidence of breeding since then. White-faced ibises are present irregularly throughout the San Francisco Bay Area during the nonbreeding season.

Herons and egrets nest in or adjacent to the study area as well. Numbers of nests in the Bay Area tend to show dramatic variation from year to year, but data show an apparent decrease over the last 5 to 10 years (Pitkin and Wood, eds., 2011). Currently, heron rookeries near the Shoreline Phase I Study Area include a colony of snowy egrets and black-crowned night-herons at the Palo Alto Baylands duck pond (west of the study area); small numbers of great blue herons nesting on transmission towers in ponds near the study area (Ponds A2W, A2E, A3N, and A19; see Figure 1.5-4 *Alviso Pond Complex and Shoreline Phase I Study Area* in Section 1.5 *Project Background and General Study Area Setting*); great egrets, snowy egrets, and black-crowned night-herons nesting in California bulrush at the west end of the Coyote Creek Lagoon near Newby Island landfill (northeast of the study area; first noted in 2000); and great egrets, snowy egrets, black-crowned night-herons, and little blue herons in Guadalupe Slough between Ponds A4 and A5 (southwest of the study area) and in Artesian Slough between Ponds A16 and A18 (Santa Clara County Bird Data, unpublished; Strong 2004a; Figure 1.5-4 *Alviso Pond Complex and Shoreline Phase I Study Area* in Section 1.5 *Project Background and General Study Area Setting*). Green herons nest at low densities in scattered locations throughout the South Bay, including mixed-species heronries but also as isolated pairs or in small monospecific groups along sloughs and in trees and brush (Robinson-Nilsen et al. 2009).

4.7.1.2.7.5 Gulls and Terns

Although larids (birds in the family *Laridae*, such as gulls, terns, and skimmers) have historically used the South Bay area for foraging during winter and migration, the use of this area has increased as a result of pond creation and other landscape changes. The provision of food at landfills and other anthropogenic sources has led California gulls to begin nesting in the South Bay over the last few decades. Currently, larid populations in San Francisco Bay are highest in winter because of the presence of tens of thousands of (if not more than 100,000) wintering gulls. However, terns are generally more abundant in the South Bay during the breeding season.

Gulls. The Newby Island Landfill north of Coyote Creek and the study area and other local landfills immediately adjacent to the east of the study area provide food for tens of thousands of wintering gulls. Gull abundance is much higher in the vicinity of these landfills than elsewhere in or near the study area. Most of the gulls in the greater South Bay area roost on the bay or Alviso complex and Fremont ponds and levees north of the study area at night, and large numbers also roost in these areas during the day.

California gulls historically bred primarily on saline inland lakes. The State declared this species one of special concern at nesting colonies because of concern over impacts on inland breeding colonies in 1978. In 1980, a small group colonized the abandoned salt Pond A6, which is adjacent to the Shoreline Phase I Study Area. The California gull population in the South Bay has since increased dramatically, with over 52,000 individuals estimated to nest in the South Bay, including a large colony within the study area on the levee between Ponds A9 and A14 (Donehower and Tokatlian 2012). The State moved this species to the "watch list" in 2008.

Western gulls nest in very low numbers near the Shoreline Phase I Study Area but have not been recorded in the study area. Records show one to three pairs nesting in Pond A6 and on the levee between Mowry Ponds M4 and M5 (which are on the north side of Coyote Creek), both within large California gull colonies (Strong 2004a; Strong 2006). The western gull breeds much more commonly near the mouth of San Francisco Bay and along the coast.

During the nonbreeding season, nesting populations of western and California gulls within the South Bay are augmented not only by nonbreeders of those species (likely including more than 10,000 more California gulls and hundreds to more than 1,000 western gulls), but also by large numbers of herring gulls (tens of thousands), Thayer's gulls (thousands), ring-billed gulls (thousands to more than 10,000), mew gulls (thousands), glaucous-winged gulls (hundreds to more than 1,000), and Bonaparte's gulls (thousands). With the exception of the Bonaparte's gull, which forages primarily on invertebrates in ponds and sewage treatment plants, these gulls are opportunistic foragers. They eat a wide variety of animal matter, including invertebrates, fish, small mammals and birds, and carrion, as well as processed food in landfills. Many gulls forage or roost on intertidal mudflats at low tide (Warnock et al. 2002).

Recently, SBSP Restoration Project actions included breaching the levee that impounds Pond A6 to restore tidal action and create tidal marsh habitat; this levee was breached in 2010. Because the largest gull colony existed in Pond A6, the gulls have since been forced to relocate to roost and nest elsewhere. When the levee was first breached, Refuge managers feared that the relocation could lead to increases in harassment, encroachment, and predation on other nesting waterbirds (Ackerman et al. 2009; Luongo 2009). Predictive modeling completed in 2009 indicated that interference competition by California gulls taking over prime breeding space, rather than predation, would likely be the more serious problem in the near term, particularly as Pond A6 transitions back to tidal marsh (Luongo 2009). In 2011, the bay-wide number of California gulls decreased 17 percent from 2010 to 2011 and that, after the levee of Pond A6 was breached, the total number of nests at that site dropped by 50 percent (Robinson-Nilsen et al. 2011). However, by 2012, the number of gulls using the South Bay had increased to about 52,000 (Donehower and Tokatlian 2012). Predation and encroachment by this species, then, continues to be a concern in and near the study area.

Terns and Skimmers. Terns and skimmers in the South Bay include Caspian tern, Forster's tern, California least tern (identified as Federal and State Endangered and Fully Protected under State law; discussed in Section 4.7.1.2.8.2 *Special-Status Terrestrial Wildlife*), elegant tern, common tern, and black skimmer (California Species of Special Concern at nesting sites; discussed in Section 4.7.1.2.8.2 *Special-Status Terrestrial Wildlife*). Terns and skimmers feed primarily on small fish. Foraging occurs commonly within the open waters of the bay and in low-salinity ponds as well as tidal sloughs and freshwater and brackish channels and ponds. Caspian and Forster's terns also often forage at inland ponds and lakes, even during the breeding season. Terns may roost on intertidal mudflats at low tide, whereas at high tide and at night, they roost primarily on isolated levees, islands, and exposed mud surrounded by water within shallow ponds.

Recently, the Pacific Coast population of Caspian terns has shifted away from the Bay Area, in particular to one location in the Columbia River estuary where a large proportion (about 67 percent) of the Pacific Coast population of Caspian terns now breeds (Wires and Cuthbert 2000; Roby et al. 2003). The history of Caspian tern breeding colonies in the Bay Area has been dynamic, with frequent changes in both the location and size of colonies (Collis et al. 2012). Although South Bay populations have declined precipitously since the early 1980s, the establishment of a large colony on Brooks Island in the North Bay has allowed San Francisco Bay Area populations to remain fairly constant, with approximately 2,300 individuals breeding in the San Francisco Bay Area in 2003 (Strong 2004a). Currently, a small colony of Caspian terns nests in the study area on the levees between Ponds A11 and A14.

Forster's terns were first reported to be nesting in the San Francisco Bay Area in 1948 (Sibley 1952). Since then, Forster's tern colonies have appeared at scattered locations throughout the South Bay, with populations peaking at 4,386 birds in 1992. These colonies are located on small islands having little or no vegetation (and no tall vegetation) within the ponds. The number of Forster's tern nests in the South Bay varies annually but is declining bay-wide (Pitkin and Wood, eds., 2011). Between 2005 and 2011, the nest numbers ranged from a low of 771 in 2005 to a high of 1,214 nests in 2006 (Robinson-Nilsen et al. 2011). Tern nest abundance within specific ponds tends to be variable, but some of the most important and consistent breeding locations for Forster's terns in the bay are in Ponds A1, A2W, AB1, AB2, A7, A8, and A16, none of which are in the Shoreline Phase I Study Area. These ponds contain nearly 60 percent of all the monitored breeding Forster's terns in the South Bay (Ackerman and Herzog 2012). Within the study area, the NCM provides important nesting habitat for Forster's terns.

Predation by red foxes and by avian predators such as California gulls and common ravens may be affecting tern populations to some extent. In addition, encroachment on Forster's tern nesting sites by breeding California gulls has taken its toll on nesting terns. For example, islands in Alviso Pond AB2 west of the Shoreline Phase I Study Area that were formerly used by nesting Forster's terns have been mostly or entirely taken over by nesting gulls (Strong 2004a). Some nesting habitat has also been lost due to tidal marsh restoration efforts, particularly at Pond A8.

4.7.1.2.7.6 Other Waterbirds (Eared Grebes, Coots, and Rails)

The eared grebe is a small diving bird that breeds only occasionally and in small numbers in the South Bay but is present much more abundantly as a nonbreeding forager from October to April. In the South Bay, breeding has occurred only in a flooded, diked pickleweed marsh in the Crittenden Marsh area, where nesting occurred in 1983, 1986, 1993, and 1995 (Cogswell 2000; Santa Clara County Bird Data, unpublished). Recent surveys of South Bay ponds by the USGS (Takekawa et al. 2005) found eared grebe abundance highest on Alviso Ponds A8 (outside of but adjacent to the study area) and Ponds A11–A17 (some of which are present in the study area).

American coots and common moorhens breed in freshwater wetlands, channels, and ponds in and around emergent vegetation in a number of locations throughout the South Bay. Coot populations are augmented substantially during winter, when this species is present by the hundreds or low thousands on lower-salinity ponds (Anderson 1970), sewage treatment plant ponds, and other open-water locations.

The California Ridgway's rail is a Federal and State Endangered species and a State Fully Protected species that is endemic to the marshes of San Francisco Bay. Ridgway's rails are discussed in Section 4.7.1.2.8.2 *Special-Status Terrestrial Wildlife*.

Recent surveys indicate that the population of California black rail is increasing (Pitkin and Wood, eds., 2011). This State Threatened species, which is discussed in Section 4.7.1.2.8.2 *Special-Status Terrestrial Wildlife*, is a small rail that inhabits tidal salt, brackish, and freshwater marshes.

Two other rails are present regularly in the South Bay. Both the sora and Virginia rail may breed in very small numbers in freshwater wetlands around the South Bay, although they are present much more commonly as nonbreeders from August to May. During the nonbreeding season, these secretive species are present in a wide variety of tidal and non-tidal salt, brackish, and freshwater marsh habitats, being most abundant in freshwater and brackish areas.

4.7.1.2.7.7 Terrestrial, Tidal Marsh, and Riparian Birds

Although riparian habitats in the study area have been highly degraded by vegetation removal, stream channelization, and encroachment by agriculture and urbanization, these riparian habitats still support a high abundance and diversity of terrestrial birds. In particular, the remnant mature riparian woodland along lower Coyote Creek (just east of the study area), augmented by the habitat restoration efforts of the SCVWD, provides important breeding and foraging habitat for birds. The reach of Coyote Creek that is within the Shoreline Phase I Study Area supports limited riparian habitat.

Bird communities are dominated by insectivorous passerines (insect-eating birds characterized by perching or resting on branches or twigs, fences, etc.) during summer; representative breeding species include permanent residents such as the song sparrow, San Francisco common yellowthroat (California Species of Special Concern), bushtit, chestnut-backed chickadee, downy woodpecker, and Anna's hummingbird, and summer residents such as the California yellow warbler (California Species of Special Concern), Pacific-slope flycatcher, and black-chinned hummingbird. The Alameda song sparrow, a California Species of Special Concern, is one of three subspecies of song sparrow that breeds only in salt marsh habitats in the Bay Area, including such habitats in and near the Shoreline Phase I Study Area. This species is present throughout the South Bay and is particularly abundant along tidal sloughs as long as taller herbaceous vegetation is present (Chan and Spautz 2008). During spring and fall migration, large numbers of insectivores such as the Swainson's thrush, orange-crowned warbler, Wilson's warbler, and warbling vireo forage in the riparian trees and shrubs. Seed-eating birds that frequent more open habitats during migration and winter include the white-crowned sparrow, golden-crowned sparrow, Lincoln's sparrow, and fox sparrow in addition to resident American goldfinch and house finch.

Only a few passerines breed commonly in tidal salt, brackish, and freshwater marsh in the South Bay. Within most tidal salt marsh, the only nesting passerines are the Alameda song sparrow and marsh wren (in the lower marsh dominated by cordgrass and gumplant) and the savannah sparrow, which nests in pickleweed and peripheral halophytes in the upper portions of tidal and diked saltmarsh, along vegetated levees, and in adjacent upland transitional zones. The San Francisco common yellowthroat (a California Species of Special Concern) may also nest in South Bay salt marshes in small numbers (Ray 1919; H.T. Harvey & Associates 2007), although it nests primarily in brackish and freshwater marsh.

Breeding raptors in the project study area include the northern harrier (a California Species of Special Concern), red-tailed hawk, red-shouldered hawk, Cooper's hawk, peregrine falcon, white-tailed kite, and American kestrel. Transmission towers within the marshes and ponds in the South Bay provide nesting sites for red-tailed hawks, peregrine falcons, and common ravens. Red-tailed hawks and peregrine falcons may prey on small mammals, rails, waterfowl, and shorebirds in the South Bay, and common ravens are particularly notorious predators of the eggs and young of a variety of birds. Populations of ravens and American crows have increased markedly in recent decades throughout the San Francisco Bay Area, and the birds feed heavily at the landfills and other human-based food sources around the South Bay but also prey on other wildlife species. Few data are available on the impact of ravens and crows on breeding populations of other species, but it is likely that ravens nesting on towers within tidal marshes and ponds have at least some impact on populations of California Ridgway's rails, western snowy plovers, and other breeding bird species. During the nonbreeding season, additional landbirds are present in the baylands, including large numbers of sparrows of several species and several raptors. Short-eared owls (a California Species of Special Concern) are present regularly in small numbers in the more extensive marshes in winter, foraging on small mammals and birds. Merlins, peregrine falcons, and other raptors forage for waterfowl and shorebirds throughout the South Bay area.

A variety of birds use annual grasslands such as those near the Wastewater Facility in the study area as foraging habitat. Species that use this habitat include savannah sparrows, horned larks, American pipits, western meadowlarks, lesser goldfinches, barn swallows, and various raptors, including burrowing owls (a California Species of Special Concern; discussed in more detail in Section 4.7.1.2.8.2 *Special-Status Terrestrial Wildlife*). Western meadowlarks and mourning doves may nest in this habitat as well. Birds in developed areas face not only regular human disturbance but also unique foraging and nesting opportunities. Those that are well adapted to such habitats commonly breed here. These species include the house finch, mourning dove, barn swallow, cliff swallow, and black phoebe and nonnative European starling, rock pigeon, and house sparrow.

4.7.1.2.8 Terrestrial Special-Status Species

Special-status species are plant and animal species that have been given special status under Federal and/or State law.

The Biological Opinions (BOs) for the SBSP Restoration Project (Document 81420-08-F-0621 from the USFWS dated August 12, 2008, and Document 2007/08128- 2008/02283 from the NMFS dated January 14, 2009) include several conservation measures related to disturbance, water level changes, trail closures during the breeding season, and proximity of interpretive facilities (e.g., boardwalks and viewing platforms) near nesting areas for listed species (USFWS 2008b). Because the Shoreline Phase I Project BOs had not been issued at the time the draft Integrated Document was released, the draft contained measures from the SBSP Restoration Project BOs. Overall, the special-status species protection measures that are in the BOs for the Shoreline Phase I Study are similar to those listed in the SBSP Restoration Project BOs. Special-status species protection measures that are included in the Shoreline Phase I Project BO (Appendix B8 *Endangered Species Act Compliance*) will be adopted as part of the Final Shoreline Phase I Study.

4.7.1.2.8.1 Special-Status Plants

Special-status plant species are not commonly present within the upper zones of the tidal salt marsh and brackish marshes of San Francisco Bay. However, some special-status plant species with broad soil tolerances were historically, and are currently, locally common. Those special-status plants that are extremely rare in the estuary have highly restrictive growth requirements, such as coarse substrates on high-energy shorelines, salt panne edges, or channel edges within tidal brackish marsh. These plants are scarce because of the limited acreage and distribution of these habitat types. The continued persistence of these plants is further threatened by nonnative, invasive plant species, particularly perennial pepperweed, which generally thrive under disturbed conditions with increased urban runoff. The status, habitat preferences, and potential for occurrence of special-status plant species in the study area are summarized in Table 4.7-1 *Special-Status Plants, Their Status, and Potential Occurrence in the Study Area*.

Three special-status plants have been recently recorded in the study area. These are small spikerush, Congdon's tarplant, and Hall's bush-mallow, all of which are listed in the California Rare Plant Rank (CRPR) system. None of the other plants listed in Table 4.7-1 *Special-Status Plants, Their Status, and Potential Occurrence in the Study Area* are likely to be present in the Shoreline Phase I Study Area.

Small spikerush was identified in small patches along the mudflat/marsh adjacent to the borrow ditch in Pond A19. Small spikerush has been found in the Refuge near the South Bay Yacht Club along Alviso Slough growing in disturbed habitat.

Congdon's tarplant was recorded on the Wastewater Facility property in 1998 and more recently in seasonal wetlands in the vicinity of Warm Springs north of the study area The CNDDB lists 20 records of the plant in the Refuge (some plants may be outside the study area) and many other records within 5 miles of the Refuge. Congdon's tarplant may currently be present in the study area in California annual grassland habitat (with alkaline substrates), particularly near seasonal wetland, brackish marsh, and muted tidal marsh habitat. These types of habitat and transition zones are present on and adjacent to the Wastewater Facility property.

Table 4.7-1. Special-Status Plants, Their Status, and Potential Occurrence in the Study Area

Name	Status	Habitat/Description	Potential for Occurrence On Site
Federal or State-Listed as Threatened or Endangered Species			
Palmate-bracted bird's-beak (*Chloropyron palmatum*)	FE, SE, CRPR 1B.1	Chenopod scrub, valley and foothill grassland/alkaline. Known from Alameda, Colusa, Fresno, Glenn, Madera, and Yolo Counties. Believed to be extirpated from San Joaquin County. Annual herb that blooms May through October.	Unlikely. Alkaline flats in the study area are generally degraded or absent.
Mason's lilaeopsis (*Lilaeopsis masonii*)	SR, CRPR 1B.1	Exposed banks of tidal meanders and channels within brackish to freshwater marsh. Locally common in Suisun Marsh. Perennial; blooms April through November.	Absent. Not known to be present in the South Bay area; historical and current records in Suisun Bay only.
Contra Costa goldfields (*Lasthenia conjugens*)	FE, CRPR 1B.1	Saline/alkaline vernal pools, mesic areas within grasslands. Known from Alameda, Solano, Monterey, Contra Costa, and Napa Counties. Annual; blooms March through June.	Unlikely. Two large colonies associated with grassy seasonal wetlands in Fremont vicinity; otherwise, is present in disjunct populations in Monterey County and the North Bay. The Warm Springs portion of the Refuge north of the study area provides suitable habitat, but there is no habitat in the Shoreline Phase I Study Area.
State Rare and California Rare Plant Rank Species			
Coastal marsh milk-vetch (*Astragalus pycnostachyus* var. *pycnostachyus*)	CRPR 1B.2	Coastal salt marshes, stream sides, and mesic coastal dunes in Marin and San Mateo Counties. Perennial; blooms April to October.	Absent. Not known to be present in the South Bay area; no suitable habitat in Shoreline Phase I Study Area (extant populations associated with maritime salt marsh).
Alkali milk-vetch (*Astragalus tener* var. *tener*)	CRPR 1B.2	Alkaline soils in playas, vernal pools, and adobe clay areas within grasslands. Alameda, Merced, Solano, and Yolo Counties. Annual; blooms March to June.	Unlikely. Recently rediscovered in seasonal wetlands near Fremont, on Pacific Commons Preserve, which is north of the Shoreline Phase I Study Area. Considered extirpated from Santa Clara County, but there are historical records in the Shoreline Phase I Study Area (1905). Currently, closest suitable vernal pool habitat is present within the Warm Springs unit of the Refuge, which is north of the study area.
San Joaquin spearscale (*Atriplex joaquiniana*)	CRPR 1B.2	Alkaline soils within chenopod scrub, meadows, playas, and grasslands in 14 central California counties. Annual; blooms April through October.	Unlikely. Is present in seasonal wetlands in Warm Springs vicinity north of the Shoreline Phase I Study Area. No vernal pool habitat in the study area.
Congdon's tarplant (*Centromadia parryi* ssp. *congdonii*)	CRPR 1B.2	Moist, alkaline soils within grasslands. Tolerates disturbance. Annual; blooms June through November. Known from Alameda, Monterey, San Luis Obispo, and Santa Clara Counties.	Present. Recorded on the Wastewater Facility property in 1998. Is present in seasonal wetlands in Warm Springs vicinity north of the study area The CNDDB lists 20 records of the plant in the Refuge (some plants may be outside the study area) and many other records within 5 miles of the Refuge. May be present in peripheral halophyte or disturbed upland zones in Shoreline Phase I Study Area, but not currently associated with salt marsh.

Table 4.7-1. Special-Status Plants, Their Status, and Potential Occurrence in the Study Area

Name	Status	Habitat/Description	Potential for Occurrence On Site
Hispid bird's-beak (*Chloropyron molle* ssp. *hispidum*)	CRPR 1B.1	Meadows and seeps, playas, valley and foothill grasslands/alkaline. Known from Alameda, Fresno, Kern, Merced, Placer, and Solano Counties. Annual hemiparasitic herb that blooms June through September.	**Unlikely.** Saline flats in the study area are generally degraded or absent.
Pt. Reyes bird's-beak (*Chloropyron maritimum* ssp. *palustre*)	CRPR 1B.2	Annual herb that blooms from June to October. Historically found in coastal salt marshes in Alameda, Humboldt, Marin, Santa Clara, San Francisco, San Mateo, and Sonoma Counties.	**Unlikely.** Historical records in the Shoreline Phase I Study Area (1905). Species is presumed to be extirpated from the Santa Clara County but was found in La Riviere Marsh in Alameda County in 2010.
Recurved larkspur (*Delphinium recurvatum*)	CRPR 1B.2	Chenopod scrub, cismontane woodland, valley and foothill grassland/alkaline. Known from Alameda, Contra Costa, Fresno, Glenn, Kings, Kern, Madera, Merced, Monterey, San Joaquin, San Luis Obispo, Solano, and Tulare Counties. It is believed to be extirpated from Butte and Colusa Counties. Perennial herb that blooms from March through June.	**Unlikely.** Grassland habitat with alkaline soils within the study area is generally degraded or absent.
Small spikerush (*Eleocharis parvula*)	CRPR 4.3	Perennial herb that blooms April through September. Habitats include marshes and swamps.	**Present.** Species was recently identified in small patches along the mudflat/marsh adjacent to the borrow ditch in Pond A19.
Hoover's button celery (*Eryngium aristulatum* var. *hooveri*)	CRPR 1B.1	Annual or perennial herb that blooms in July. Observed in vernal pool habitats from 10 to 148 feet in elevation. Known from Alameda, San Benito, Santa Clara, San Diego, and San Luis Obispo Counties.	**Unlikely.** Historical records in the Shoreline Phase I Study Area (1902), but these populations are thought to have been lost to development. An extant population is present north of the Shoreline Phase I Study Area in a disturbed alkaline wetland of the Warm Springs Area. There are no vernal pools in the Shoreline Phase I Study Area.
Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*)	CRPR 1B.2	High marsh zone in brackish and freshwater marshes. Known from Suisun Marsh (Sacramento, San Joaquin, Solano, and Contra Costa Counties) and Napa marshes. Perennial; blooms May through September.	**Unlikely.** Historical and current records are from the North Bay only. Marginal habitat is present within the study area, but the CNDDB does not list any occurrences in the study area.
Hall's bush-mallow (*Malacothamnus halli*)	CRPR 1B.2	Chaparral and coastal scrub habitats. Perennial; blooms from May to September and sometimes into October.	**Present.** The CNDDB lists two records of the species in 2008. Found in the Refuge near the South Bay Yacht Club along Alviso Slough growing in disturbed habitat.
Prostrate vernal pool navarretia (*Navarretia prostrata*)	CRPR 1B.1	Seasonal wetlands and vernal pools within grasslands and coastal scrub. Ranges from Monterey County south to San Diego. Annual; blooms April through July.	**Unlikely.** In the South Bay area, known only from Pacific Commons Preserve and the Warm Springs unit of the Refuge north of the study area. No vernal pool habitat in the study area.
Delta woolly-marbles (*Psilocarphus brevissimus* var. *multiflorus*)	CRPR 4.2	Dried beds of vernal pools and flats, especially in grasslands, in Alameda and Santa Clara Counties north to Yolo County. Annual; blooms April to June.	**Unlikely.** Known from the Warm Springs area of the Refuge north of the study area. No vernal pool habitat in the study area.

Table 4.7-1. Special-Status Plants, Their Status, and Potential Occurrence in the Study Area

Name	Status	Habitat/Description	Potential for Occurrence On Site
Saline clover (*Trifolium hydrophilum*)	CRPR 1B.2	Edges of salt marshes, alkali meadows, and vernal pools along the coast from Sonoma County south to San Luis Obispo, as well as in the inland counties of Solano and Colusa. Annual; blooms April through June.	**Unlikely.** Several historical records in the Shoreline Phase I Study Area (1892), but habitat is no longer present. Currently, the Warm Springs area of the Refuge to the north has the only suitable habitat near the study area, but the species is not known to be present there.
Special Habitats			
Northern Coastal Salt Marsh	N/A	Tidally influenced wetlands that are dominated by plants that are tolerant of wet, saline soils; found in low-lying coastal habitats that are periodically wet and usually saline to hypersaline.	**Present.** Several recorded occurrences in the study area.

Key:
CRPR= California Rare Plant Rank
1B – Plants Rare, Threatened, or Endangered in California and elsewhere
4 – Plants of limited distribution – a watch list
N/A – not applicable

Threat Code Extensions:
.1 – Seriously threatened in California
.2 – Fairly Endangered in California

FEDERAL/STATE LISTING STATUS:
FE = Federally listed as Endangered
SE = State listed as Endangered
SR = State listed as Rare

Note: In March 2010, the CDFW changed the name of “California Native Plant Society (CNPS) List” or “CNPS Ranks” to “California Rare Plant Rank” (or CRPR). This was done to reduce confusion over the fact that the CNPS and the CDFW jointly manage the Rare Plant Status Review groups and that the rank assignments are the product of a collaborative effort and not solely a CNPS assignment.

4.7.1.2.8.2 Special-Status Terrestrial Wildlife

Special-status wildlife species that are present within or near the study area are listed in Table 4.7-2 *Special-Status Animal Species, Their Status, and Potential Occurrence in the Study Area*. Special-status wildlife species that are known to breed in or regularly use the study area or areas near the study area are briefly described in the text below Table 4.7-2 *Special-Status Animal Species, Their Status, and Potential* Occurrence in the Study Area. Refer to Appendix B6 *South San Francisco Bay Shoreline Study Existing Biological Conditions Report* (H.T. Harvey & Associates 2007) for expanded descriptions of species that are known to breed in or regularly use the study area, for which potentially suitable habitat is present in the study area, or for which the resource agencies have expressed particular concern. More information on most of these species can also be found in the Goals Project Baylands Ecosystem Species and Community Profiles (Goals Project 2000).

A number of special-status species are present in the study area as rare or occasional visitors, migrants, or foragers, but are not known or expected to breed in the immediate area. The following text does not include expanded species accounts for these species. The following text also does not describe species that might have historically used the area but have not been recently observed. Please see Appendix B6 *South San Francisco Bay Shoreline Study Existing Biological Conditions Report* for more details about these species.

Table 4.7-2. Special-Status Animal Species, Their Status, and Potential Occurrence in the Study Area

Name	Status	Habitat	Potential for Occurrence On Site
Mammals			
Salt marsh harvest mouse (*Reithrodontomys raviventris raviventris*)	FE, SE, SP	Salt marsh habitat dominated by pickleweed.	**Present (breeding).** Is present in pickleweed marshes within the study area. Also is present in brackish marshes.
Salt marsh wandering shrew (*Sorex vagrans halicoetes*)	CSSC	Medium-high marsh with abundant driftwood and pickleweed.	**Potential (breeding).** May be present in salt marshes throughout the study area, although numbers have declined, and current status is unknown. The CNDDB lists several occurrences in or near the study area.
Birds			
Alameda song sparrow (*Melospiza melodia pusillula*)	CSSC	Breeds in salt marsh, primarily in marsh gumplant and cordgrass along channels.	**Present (breeding).** Uncommon resident, breeding and foraging in tidal salt marsh.
American peregrine falcon (*Falco peregrinus anatum*)	SP (nesting)	Forages in many habitats; nests on cliffs and similar human-made structures.	**Present (breeding).** Regular predator (on other birds) in the study area, primarily during migration and winter. Nested in 2006 and 2007 (two nests) in old raven nests on transmission towers in the Alviso pond complex. Nests yearly in ponds that are adjacent to the study area.
American white pelican (*Pelecanus erythrorhnchos*)	CSSC (nesting)	Forages in freshwater lakes and rivers; nests on islands in lakes.	**Present (nonbreeding).** Common forager primarily on ponds in the study area. Regular visitor from late summer to spring. Not known to breed in the study area.
Ashy storm-petrel (*Oceanodroma homochroa*)	CSSC (nesting)	Nests in islands off the California coast. Forages in ocean.	**Present (nonbreeding).** Occasional winter visitor; does not breed in the study area.
Bald eagle (*Haliaeetus leucocephalus*)	SE, SP	Is present mainly along seacoasts, rivers, and lakes; nests in tall trees or in cliffs. Feeds mostly on fish.	**Potential (nonbreeding).** Present in small numbers all year. May occasionally forage, but does not nest, in the study area.
Bank swallow (*Riparia riparia*)	ST	Colonial nester on vertical banks or cliffs with fine-textured soils, near water.	**Unlikely (nonbreeding).** Observed in the study area as rare transient. No suitable breeding habitat in the study area.
Barrow's goldeneye (*Bucephala islandica*)	CSSC (nesting)	Nests in freshwater marshes; winters in coastal marine habitats.	**Potential (nonbreeding).** Occasional winter visitor; does not breed in the study area.
Black skimmer (*Rynchops niger*)	CSSC (nesting)	Nests on abandoned levees and islands in ponds and marshes.	**Potential (breeding).** A few pairs have bred and foraged on islands in ponds near the study area, including Pond A16, which is surrounded by the study area.
Black tern (*Chlidonias niger*)	CSSC (nesting)	Forages in freshwater marshes and marshy lakes in summer; sandy coasts on migration and in winter. Nests in shallow water.	**Present (nonbreeding).** Common winter visitor; does not breed in the study area.
Bryant's savannah sparrow (*Passerculus sandwichensis alaudinus*)	CSSC (nesting)	Nests in salt marsh. Forages in low, tidally influenced habitats, adjacent ruderal areas, and moist grasslands.	**Present (breeding).** Common breeder in salt marsh (including diked, muted tidal, and tidal) and adjacent ruderal/grassland habitat in the study area.

Table 4.7-2. Special-Status Animal Species, Their Status, and Potential Occurrence in the Study Area

Name	Status	Habitat	Potential for Occurrence On Site
California black rail (*Laterallus jamaicensis coturniculus*)	ST, SP	Breeds in fresh, brackish, and tidal salt marsh.	Present (breeding). Individuals winter in small numbers in tidal marsh within the study area, and, due to recent detections of calling birds in multiple areas in the study area, this species is now a likely breeder (Bourgeois pers. comm. 2014). Fourteen individuals were captured adjacent to Pond A15 in 2012 during the breeding season.
California brown pelican (*Pelecanus occidentalis californicus*)	SP (nesting and communal roosts)	Is present in nearshore marine habitats and coastal bays. Nests on islands in Mexico and southern California.	Present (nonbreeding). Regular during nonbreeding season (summer and fall) in the study area. Roosts on levees in the interiors of pond complexes; forages in ponds and in San Francisco Bay.
California Ridgway's rail (*Rallus longirostris obsoletus*)	FE, SE, SP	Salt and brackish marsh habitat usually dominated by pickleweed and cordgrass.	Present (breeding). Recorded using tidal marsh habitats along Coyote Creek and Alviso Slough.
California least tern (*Sterna antillarum browni*)	FE, SE, SP	Nests along the coast on bare or sparsely vegetated flat substrates.	Present (nonbreeding). The South Bay is an important post-breeding staging area for least terns, though species does not currently breed within the study area. Forages and roosts in a number of South Bay ponds, especially Alviso ponds farther west in the vicinity of the Moffett Federal Airfield.
California yellow warbler (*Dendroica petechia brewsteri*)	CSSC (nesting)	Breeds in riparian woodlands, particularly those dominated by willows and cottonwoods.	Present (breeding). Confirmed nesting activity in 2014 in riparian habitat along Coyote Creek (Bourgeois pers. comm. 2014) in the study area.
Common loon (*Gavia immer*)	CSSC (nesting)	Nests in freshwater marshes; winters in coastal marine habitats.	Present (nonbreeding). Occasional winter visitor; does not breed in the study area.
Golden eagle (*Aquila chrysaetos*)	FP (nesting and wintering)	Breeds on cliffs or in large trees or electrical towers; forages in open areas.	Present (nonbreeding). Occasional forager, primarily during the nonbreeding season. No nesting records within the study area.
Grasshopper sparrow (*Ammodramus savannarum*)	CSSC (nesting)	Forages and breeds in open grasslands and prairies with patches of bare ground. Ground nester.	Present (nonbreeding). Occasional winter visitor; does not breed in the study area.
Least bittern (*Ixobrychus exilis*)	CSSC (nesting)	Forages and breeds in freshwater or brackish marshes with tall emergent vegetation. Ground nester in dense stands of vegetation.	Present (nonbreeding). Occasional winter visitor; does not breed in the study area.
Loggerhead shrike (*Lanius ludovicianus*)	CSSC (nesting)	Nests in dense shrubs and trees; forages in grasslands, marshes, and ruderal habitats.	Present (breeding). Resident in low numbers within the study area.
Northern harrier (*Circus cyaneus*)	CSSC (nesting)	Nests and forages in marshes, grasslands, and ruderal habitats.	Present (breeding). Breeds in small numbers in marsh habitats in the study area; forages in a variety of habitats.
Purple martin (*Progne subis*)	CSSC (nesting)	Forages over towns, cities, parks, open fields, streams, wet meadows, and other open areas.	Present (nonbreeding). Occasional winter visitor; does not breed in the study area.
Redhead (*Aythya americana*)	CSSC (nesting)	Forages and breeds in ponds and lakes. Nests are floating.	Present (nonbreeding). Common winter visitor; does not breed in the study area.

Table 4.7-2. Special-Status Animal Species, Their Status, and Potential Occurrence in the Study Area

Name	Status	Habitat	Potential for Occurrence On Site
San Francisco common yellowthroat (*Geothlypis trichas sinuosa*)	CSSC	Breeds primarily in fresh and brackish marshes in tall grass, tules, and willows; uses salt marshes more in winter.	**Present (breeding).** Common resident, breeding in freshwater and brackish marshes (and possibly to a limited extent in salt marshes), and foraging in all marsh types during the nonbreeding season.
Short-eared owl (*Asio flammeus*)	CSSC (nesting)	Nests on ground in tall emergent vegetation or grasses; forages over a variety of open habitats.	**Potential (nonbreeding) and Unlikely (breeding).** Uncommon. Has bred in small numbers near the study area, although current breeding status unknown. Most numerous in the study area during migration and winter.
Tricolored blackbird (*Agelaius tricolor*)	CSSC (nesting)	Breeds near freshwater in dense emergent vegetation.	**Present (nonbreeding); Potential (breeding).** Has bred in the study area at the Wastewater Facility; is present in the study area primarily as a nonbreeding forager, but potential for nesting in freshwater marsh vegetation associated with Artesian Slough and eastern areas of Coyote Creek.
Vaux's swift (*Chaetura vauxi*)	CSSC (nesting)	Nests in snags in coastal coniferous forests or, occasionally, in chimneys; forages aerially.	**Present (nonbreeding).** Forages over the study area. No nesting habitat within the area.
Western burrowing owl (*Athene cunicularia hypugea*)	CSSC (nesting)	Flat grasslands and ruderal habitats.	**Present (breeding).** Breeds in the NCM and at several upland sites adjacent to the study area on Wastewater Facility property.
Western snowy plover (*Charadrius alexandrinus nivosus*)	FT, CSSC (nesting)	Nests on sandy beaches and salt panne habitats.	**Present (breeding).** Breeds and forages at sites in and near the study area, including Ponds A16, A17, and A23 outside of the study area and Pond A13 in the study area. Additional birds are present in the study area during winter.
White-tailed kite (*Elanus caeruleus*)	SP (nesting)	Nests in tall shrubs and trees; forages in grasslands, marshes, and ruderal habitats.	**Present (breeding).** Common resident species; breeds within the study area where suitable nesting habitat occurs.
Yellow-headed blackbird (*Xanthocephalus xanthocephalus*)	CSSC (nesting)	Breeds and roosts in freshwater wetlands with dense, emergent vegetation, such as cattails. Often forages in fields, typically wintering in large, open agricultural areas.	**Present (nonbreeding).** Common winter visitor; does not breed in the study area.
Yellow rail (*Coturnicops noveboracensis*)	CSSC (nesting)	Nests and forages in shallow marshes and wet meadows; in winter, drier freshwater and brackish marshes, as well as dense, deep grass, and rice fields.	**Present (nonbreeding).** Occasional winter visitor; does not breed in the study area.
Yellow-breasted chat (*Icteria virens*)	CSSC (nesting)	Riparian brush and woodlands.	**Unlikely.** Rare nonbreeding visitor to riparian habitats near the study area during migration.

Table 4.7-2. Special-Status Animal Species, Their Status, and Potential Occurrence in the Study Area

Name	Status	Habitat	Potential for Occurrence On Site
Reptiles and Amphibians			
California tiger salamander (*Ambystoma californiense*)	FT, ST, CSSC	Vernal or temporary pools in annual grasslands, or open stages of woodlands.	**Unlikely.** No records of this species in the study area. A population is present nearby on Refuge lands in the Fremont/Warm Springs area, but there are no vernal pools within the study area.
Western pond turtle (*Emys marmorata*)	CSSC	Permanent or nearly permanent fresh or brackish water in a variety of habitats.	**Unlikely.** Uncommon along the inshore side of Pond A3W, which is west of the study area; a few are occasionally recorded along lower Coyote Creek and the Guadalupe River in or near the study area. May be present rarely in freshwater and brackish creeks and sloughs elsewhere in the study area.

Source: Cornell Lab of Ornithology: All About Birds Website 2014; NAS 2014; Shuford and Gardali eds. 2008; Bourgeois pers. comm. 2014; Collins 1988.

Key:
CSSC = California species of special concern
NCM = New Chicago Marsh

FEDERAL/STATE LISTING STATUS:
FE = Federally listed as Endangered
FT = Federally listed as Threatened
FP = protected under Federal law (Bald and Golden Eagle Protection Act)
SE = State listed as Endangered
SP = State Fully Protected species
ST = State listed as Threatened

Special-Status Mammals

Salt Marsh Harvest Mouse

The SMHM, a Federally- and State-listed Endangered and State Fully Protected species, is endemic to the salt marshes of the greater San Francisco Bay.

The SMHM is normally inventoried via trapping, but trapping yields tend to be very low and are generally used to indicate presence or absence rather than population numbers. Recent trapping conducted in the North Bay detected SMHM in brackish marshes dominated by alkali bulrush and in both tidal and diked salt marshes (Fisler 1965; Shellhammer 1982; Shellhammer 2000a; Shellhammer et al. 1988; Shellhammer et al. 1982; H.T. Harvey & Associates 2007; Sustaita et al. 2011). The study area has been part of numerous trapping surveys conducted from the late 1970s through 2012 in the NCM; 1976, 1990, and 2006 in Triangle Marsh; and 1977 in Alviso. Recent trapping surveys for SMHM in the study area detected SMHM in brackish marshes dominated by pickleweed (Harvey et al. 2006, USFWS 2010a). The extent of the species' distribution in and use of brackish marsh habitat is not fully known, and its use of tidal brackish marsh is likely limited to marsh with very dense bulrush thatch. The species may also use grasslands adjacent to pickleweed marshes in the spring when new growth affords suitable cover and possible forage (Johnson and Shellhammer 1988) and to avoid high tide events, but only a small percentage of the edge of the South Bay has much escape cover adjacent to it. Because of this, small mammals have difficulty finding safe refuge during very high tides.

In the study area, SMHM has been recorded in the NCM and in marsh habitats along Coyote Creek (CNDDB 2014), although populations are small as a result of habitat loss, degradation, and fragmentation. Despite the species' small populations, SMHM is known to rapidly colonize restored areas and quickly moves into areas of appropriate habitat, including many habitats in the South Bay from nearby inhabited areas, as has been shown in numerous trapping project reports (H.T. Harvey & Associates 1984, 1985a, 1985b, 1985c, 1987, 1996, 1997, 2006).

The USFWS completed a recovery plan for SMHM in 2013, but has not designated critical habitat for the species (USFWS 2008b). The 2013 Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California further addresses recovery of SMHM (USFWS 2013b).

Salt Marsh Wandering Shrew

Salt marsh wandering shrew, a California Species of Special Concern, is present primarily in fairly tall pickleweed-dominated salt marshes, in which it builds nests. Historically, the salt marsh wandering shrew occupied pickleweed-dominated tidal salt marshes in South San Francisco Bay. Currently, it occupies small remnant patches of tidal salt marsh in the study area and this species is likely present, albeit probably in low numbers, in extensive tidal salt marshes such as the NCM. It primarily nests and forages in the middle marsh, although it will also forage in low marsh at low tide and will retreat into high marsh at high tide (Collins 1998). The CNDDB lists an old occurrence (1985) of salt marsh wandering shrew in the NCM or near the study area (CNDDB 2014).

Special-Status Birds

Alameda Song Sparrow

The Alameda song sparrow, a California Species of Special Concern, is one of three subspecies of song sparrow that breeds only in salt marsh habitats in the San Francisco Bay Area. Locally, it is most abundant in the taller vegetation found along tidal sloughs, including salt marsh cordgrass and marsh gumplant. Alameda song sparrows are present in suitable habitat throughout the South Bay, including the study area, being particularly abundant in more extensive marshes but also present fairly commonly in narrower marshes along tidal sloughs such as Alviso Slough as long as taller herbaceous vegetation for nesting is present (USFWS 2012). The CNDDB lists records of Alameda song sparrow in the NCM, along Alviso Slough, and near the Wastewater Facility (CNDDB 2014).

American Peregrine Falcon

The American peregrine falcon was formerly listed as Endangered pursuant to both the FESA and the CESA. However, the species recovered sufficiently to be delisted under both programs. This species remains Fully Protected under State law. The CNDDB lists several occurrences of American peregrine falcon within 5 miles of the study area (CNDDB 2014). This species uses old hawk and raven nests on transmission towers in the Refuge, and one or two pairs have nested on transmission towers near the study area since 2006 (USFWS 2012).

Black Skimmer

The black skimmer, a California Species of Special Concern, is a unique species with an extended lower mandible (beak) that allows these birds to fly over the surface of the water, skimming for small fish. Until the mid-1990s, the black skimmer was considered a very rare nonbreeding visitor to the San Francisco Bay Area. However, this species was documented nesting in San Francisco Bay in 1994, when one pair nested in Pond AB2 west of the study area and one pair nested at Hayward Regional Shoreline in Alameda County north of the study area (Layne et al. 1996). Since the species was first detected, skimmer populations in the South Bay area have slowly but steadily increased. However, because nesting success in the South Bay has apparently been low (judging by the low number of chicks surviving to fledging age), this population increase has likely been primarily the result of immigration from the increasing southern California population.

Skimmers nest in colonies with Forster's terns in various sites in and near the study area, including Ponds AB1, AB2, A2W, A1, A8, and A16 (Strong 2004b). In these areas, black skimmers have usually nested among Forster's terns on small dredge-spoil islands (including both bare islands and islands vegetated, sometimes heavily, with pickleweed) in the former salt ponds. Exact nesting locations vary from year to year. The CNDDB does not list any black skimmer occurrences in the study area (CNDDB 2014).

California Black Rail

The California black rail is listed as Threatened under the CESA and is a Fully Protected species in California. This small bird is secretive and is most often seen during high tides when it is forced into high marshes. Black rails are most abundant in tidal marshes with some freshwater input (Evens et al. 1991) and nest on the ground, primarily in pickleweed-dominated marshes with patches or borders of bulrush, often near the mouths of creeks. Prime black rail habitat is salt marsh vegetation that is present between the high tideline and the upland shore, a gently sloping plain with very little elevational rise (Evens 1999).

The California black rail reportedly bred in the Alviso area in the early 1900s (Wheelock 1916). The current scarcity of breeding California black rails in the South Bay is presumably a result of habitat loss. In the greater San Francisco Bay Area, this small rail currently breeds primarily in marshes in the north San Francisco Bay Area (i.e., San Pablo Bay and Suisun Bay). After breeding, some California black rails disperse into the South Bay (USFWS 2012). In 2012 through 2014, California black rails were detected summering in Triangle Marsh and calling during the breeding season along Alviso and Artesian Sloughs in the study area. Breeding-season occurrences of black terns have also been recorded in LaRiviere Marsh, the Alameda County Flood Control Channel, and in Triangle Marsh between Ponds A20 and A 21. This colonization of the study area appears to have been recent and rapid, as Ridgway's rail surveys conducted by San Francisco Estuary Invasive Spartina Project personnel did not detect any California black rails in the study area prior to 2012. California black rails are presumed to be breeding in the study area (S. Rottenborn, pers. comm. 2014).

California Least Tern

The California least tern is listed as an Endangered species under the FESA and the CESA and is a Fully Protected species in California. California least terns are small fish-eating birds that nest primarily on beaches from Baja California north to San Francisco Bay during the summer. Least terns are migratory and spend winter months in coastal areas of Mexico and Central America. The Bay Area supports one large breeding colony at the former Naval Air Station, Alameda Point, and several other smaller colonies (Pitkin and Wood, eds., 2011). Currently, the breeding colony at Alameda Point (about 27 miles north of the study area) is one of the most important breeding colonies in the State. In 2005, this colony had 424 breeding pairs (USFWS 2008b; Marschalek 2006). Least terns forage in managed ponds in and near the study area. The USFWS completed a final recovery plan (USFWS 1985). However, the USFWS has not identified critical habitat for this species.

Adult and juvenile least terns roost on former salt pond dikes (both outboard levees and interior levees between ponds) and on boardwalks; they forage in the ponds and over the open waters of the bay. Least terns have been recorded at a number of ponds in or near the study area, including Ponds A1, A2E, A3N, A3W, A4, A5, and A7 west of the study area and Ponds A9, A10, A11, and A14 in the study area (Hurt 2004).

California Ridgway's Rail

The California Ridgway's rail is listed as Endangered under the FESA and the CESA. The resilience of Ridgway's rail populations depends on large, contiguous, high-quality tidal marsh habitat with extensive channel systems, cover for foraging, and high-tide refugia (USFWS 2010 as cited in Olofson Environmental 2012). This species does not migrate, and adults are territorial year-round. Juveniles disperse around the bay during late summer and fall (USFWS 2012). This species breeds from February through August, nests in salt and brackish marshes along the edge of the bay, and is most abundant in extensive salt marshes and brackish marshes that are dominated by cordgrass, pickleweed, and marsh gumplant and that contain complex networks of tidal channels (H.T. Harvey et al. 1980).

The California Ridgway's rail population has decreased dramatically in the last 200 years due primarily to development that diked, filled, and converted its habitat, pushing the species into smaller marshes separated by urban landscapes (USFWS 2012; Pitkin and Wood, eds., 2011). *The State of the Birds, San Francisco Bay, 2011* (Pitkin and Wood, eds., 2011) reports that this species continues to decline because of continued habitat loss, predator pressure, pollution and contaminants, and invasive species, and that increasing sea levels will likely pose further challenges to this species in the future. The USFWS completed a recovery plan for California Ridgway's rail in 2013 but has not designated critical habitat for the species (USFWS 2013b).

The USFWS reports that Ridgway's rail is a resident of Triangle Marsh between Ponds A15 and A17 in the study area, and the CNDDB lists several occurrences of California Ridgway's rail along Coyote Creek and along Alviso Slough in the study area (USFWS 2012; CNDDB 2014).

Loggerhead Shrike

Loggerhead shrikes are a California Species of Special Concern during nesting. This species is a resident of the study area and presumably breeds in shrublands and along urban edges that have a fair amount of shrubs, grass cover, and areas of bare ground. Upland habitats around the Wastewater Facility likely provide suitable nesting habitat for this species.

Northern Harrier

Northern harriers, a California Species of Special Concern during nesting, nest within tidal salt marshes in broad, vegetated marsh plains. This species is a common forager over San Francisco Bay marshes and extensive areas of ruderal habitat immediately surrounding San Francisco Bay, particularly during the nonbreeding season (winter) when migrant and wintering birds augment the local resident population. Northern harriers breed in low numbers within the South Bay, nesting in the larger expanses of tidal marsh that remain, such as Triangle Marsh (which is on the north side of Pond A15 in the study area), the Warm Springs marshes east of the study area, and the Palo Alto/East Palo Alto marshes west of the study area.

San Francisco Common Yellowthroat

The San Francisco common yellowthroat, a California Species of Special Concern, is a fairly common breeder in South Bay freshwater and brackish marshes and riparian habitats. This species is present in brackish and freshwater marshes in the study area, particularly along the middle and upper reaches of Alviso Slough. San Francisco common yellowthroats also breed in the riparian corridor of Coyote Creek within or adjacent to the study area.

Short-Eared Owl

Potential breeding habitat for the short-eared owl, a California Species of Special Concern during nesting, is present in the study area, but the status of this species as a breeder in the study area is unknown. If short-eared owls currently breed in the South Bay, they are likely to nest only in larger tracts of suitable habitat. During winter, the species is more widespread, although low in numbers, with many records from bayside locations throughout the study area. Locations of more regular observations in winter include Byxbee Park and the Palo Alto Flood Basin, both of which are west of the study area. The CNDDB does not list any occurrences of short-eared owls in the study area (CNDDB 2014).

Tricolored Blackbird

Tricolored blackbird is a permanent resident of California's Central Valley but does breed in scattered coastal locations. Tricolored blackbirds nest colonially, with a minimum colony size of 50 pairs (ICF International 2012a), and require habitat areas large enough to support the colony. The CNDDB shows records for this species in 1985 in the area of Agua Caliente Creek, which is northeast of the study area (CNDDB 2014). The species was also observed in the Alameda Pacific Commons Stormwater Treatment Wetland north of the study area in 2011 (Cornell Lab of Ornithology 2013).

Surveys of the Wastewater Facility property indicate that there is suitable tricolored blackbird nesting habitat in the study area along Artesian Slough and Coyote Creek (ICF International 2012a).

Western Burrowing Owl

Grasslands in the South Bay area support limited and declining populations of western burrowing owl, a California Species of Special Concern. Burrowing owl populations in the South Bay have been decreasing rapidly and significantly in recent decades. As of 1990, the South Bay burrowing owl population was thought to have declined at least 50 percent since 1981 (Barclay et al. 1998). A statewide census in the mid-1990s, the first large census and most comprehensive undertaken to that date or since, suggested that the rate of disappearance of South Bay burrowing owls was greater than the rate found for owls in the Central Valley and that the rate of decline for both regions was accelerating (DeSante et al. 1993; DeSante et al. 1997). As reported in the Final Santa Clara Valley Habitat Plan, the population of burrowing owls in the South Bay was estimated at 70 adults in 2012 (County of Santa Clara et al. 2012).

Burrowing owls use annual grassland and non-serpentine native grassland; grain, row-crop, hay and pasture, disked/short-term fallowed land; and rural residential, golf courses and urban parks, and barren land habitats for foraging and breeding in the Santa Clara Valley. This species will also forage in serpentine bunchgrass grassland habitat and grain, row-crop, hay and pasture, disked/short-term fallowed land and will forage in and move through valley oak woodland, orchards, and develop agricultural land (County of Santa Clara et al. 2012).

Burrowing owls have been observed in many places around and in the study area, including the Wastewater Facility buffer lands, areas in and around the NCM, areas near the Alviso Marina, and berms in the existing ponds (Ponds A9 and A10) (CNDDB 2014). Surveys performed in support of the Santa Clara Valley Habitat Plan in 2008 found seven owl pairs and three single adult birds in the Alviso area, including the Wastewater Facility buffer lands. When 2008 survey results for the city of San José (which include the Alviso area survey results) were compared to 1998 and 2000 surveys, results showed that the numbers of pairs of owls in 1997, 2000, and 2008 can be used to suggest a regional trend across this time period.

Based on a citywide estimate of 43–47 pairs in 1997, 39–40 pairs in 2000, and 20–21 pairs in 2008, the burrowing owl population in San José has declined about 50 percent since 1997 (Albion Environmental, Inc. 2000a, 2000b, 2008a in Santa Clara County et al. 2012).The Wastewater Facility Plant Master Plan includes a 180-acre western burrowing owl habitat restoration area (City of San José 2013d).

Western Snowy Plover

On the Pacific Coast, snowy plovers nest on sandy beaches and salt panne habitat from Washington to Baja California, Mexico. Because they nest during the summer, primarily on beaches in a temperate climate, western snowy plovers are susceptible to nest disturbance and other negative interactions with humans. In response to severe population declines, the USFWS listed the Pacific Coast population of the western snowy plover as Threatened in 1993, released a final recovery plan in 2007, and designated critical habitat for the population in 2012 (USFWS 2007; 77 FR 36728–36869). The study area does not include any identified critical habitat. The State identifies the species as one of special concern when nesting (March 1 through September 30).

In the South Bay, western snowy plovers are likely to forage anywhere prey is available, including mudflats and shallow ponds. Plovers use dry pond bottoms, isolated islands, and levees in salt production and managed ponds for nesting (Pitkin and Wood, eds., 2011). Brine flies, a primary food, are usually found in greatest densities at the shallow margins of ponds or puddles. The western snowy plover population in the bay has recently shown an increasing trend, but reproductive success is low. Primary threats to this species are predation by both native and nonnative species, habitat loss, SLC, and human disturbance (Pitkin and Wood, eds., 2011). Current nesting sites for this species in the study area include Pond A12, the impoundment between Pond A12 and the railroad tracks, Pond A16, and the NCM.

During the winter and breeding seasons, the greatest concentration of western snowy plovers in the San Francisco Bay Area has consistently been in the Eden Landing/Hayward area north of the study area, with a lower but moderate level of use at the Alviso pond complex, within which lies the study area. Western snowy plovers are present in the study area year-round, and are protected under the FESA year-round. Western snowy plovers were observed regularly during SBSP Restoration Project construction in 2011–2012 at Ponds A16 and A17, which are surrounded by the Shoreline Phase I Study Area. Snowy plovers are known to winter

The results of a 2011 survey of six nests in a dry panne area of the NCM (within the study area) showed a 41 percent nest success rate; this was less than the bay-wide success rate of about 48 percent. Monitoring activity in 2011 in the South Bay included banding of 36 chicks; of the 36, only five survived to fledging (14 percent) as of September 30, 2011. Low nest success continues to be a limiting factor for western snowy plover recovery in the South Bay (Robinson-Nilsen and Demers 2011). The CNDDB includes occurrences of this species in ponds that abut Alviso Slough both in and adjacent to the study area (CNDDB 2014). Current nesting sites for this species in the study area include Pond A12, the impoundment between Pond A12 and the railroad tracks, Pond A16, and the NCM.

White-Tailed Kite

The CNDDB lists several occurrences of white-tailed kite in and near the study area (CNDDB 2014). A Fully Protected species in California, white-tailed kites have recovered from near-extinction in the 1930s to being common throughout most of California today (UC Davis 2012). This small raptor forages for small mammals over open habitats, including grassland, salt marsh, and agricultural fields. During surveys for the Wastewater Facility master planning effort, biologists observed white-tailed kites foraging over grassland and salt marsh habitats similar to those in the adjacent study area (ICF International 2012a). White-tailed kites nest in shrubs and trees in upland habitats adjacent to the study area, including along slough channels.

Special-Status Reptiles and Amphibians

Western Pond Turtle

Western pond turtle, a California Species of Special Concern, is absent from most of the study area because of a lack of suitable freshwater habitat. However, a small, isolated population inhabits brackish habitats in the vicinity of Pond A3W, which is west of the study area (Alderete et al. 2003; see Figure 1.5-4 *Alviso Pond Complex and Shoreline Phase 1 Study Area* in Section 1.5 *Project Background and General Study Area Setting*). This species could inhabit similar habitats in the study area, such as upstream areas in Artesian Slough and Coyote Creek (ICF International 2012a).

4.7.1.2.9 National Environmental Policy Act and Engineer Regulation 1105-2-100: Planning Guidance Notebook Baseline Condition

The NEPA and the Planning Guidance Notebook baseline condition is used to compare effects among alternatives against the effects of the future No Action condition.

For terrestrial biological resources, the NEPA and the Planning Guidance Notebook baseline condition is determined by projecting how the resource condition might change between the current condition discussed in the Affected Environment section above and the start of construction. As described in Section 4.7.1 *Affected Environment*, biological systems are constantly changing on multiple time scales. However, other than stochastic events, which are unpredictable, habitat and species compositions are relatively easily predicted over short periods. Because the NEPA and the Planning Guidance Notebook baseline condition is less than 5 years from the time represented by this affected environment, it is likely that few changes in habitat types, species composition, species distribution and habitat use, and life history periodicities would occur from the physical setting. Therefore, for the purpose of evaluating the effects of the No Action Alternative as well as the action alternatives, the physical setting described above is representative of the NEPA and the Planning Guidance Notebook baseline condition.

4.7.2 Environmental Consequences

4.7.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

Avoidance and minimization measures (AMM) are those parameters that have been built into the design of the Proposed Project and are committed to as part of project implementation. These measures are generally included in the alternatives description of this report (Section 3.8 *Action Alternatives Component Details*), but, where appropriate, the specific measures related to the impact evaluations are also summarized in the resource chapters.

The BOs for the SBSP Restoration Project (Document 81420-08-F-0621 from the USFWS dated August 12, 2008, and Document 2007/08128- 2008/02283 from the NMFS dated January 14, 2009) include several conservation measures that would apply to terrestrial habitats and species and were included in the Draft Integrated Document as examples of measures that were anticipated to be applied to the Shoreline Phase I Project. The USFWS BOs for the Shoreline Phase I Project were issued following the release of the Draft Integrated Document, so conservation measures that are listed in those opinions were not included in the draft, but have been added in this final version, and the full BOs from the USFWS have been attached as part of Appendix B8 *Endangered Species Act Compliance*.

As part of the project, the lead agencies have agreed to a number of conservation measures intended to avoid or minimize potential effects on terrestrial biological resources. These measures, which would be adopted as part of the project, include the following:

- **AMM-TBR-1: Reporting Requirements** – Notify the USFWS, the NMFS, and the CDFW within 1 working day of the finding of any injured or dead listed species or any unanticipated damage to its habitat associated with the proposed project. In addition, the USACE and/or USFWS Refuge staff will provide annual updates and interim progress reports to the USFWS as outlined in the USFWS BO (Appendix B8 *Endangered Species Act Compliance*).
- **AMM-TBR-2: Seasonal Restrictions** – Implement wet-season restrictions on construction for wildlife protection. To the extent feasible (i.e., if water quality protection can be provided), construction will be conducted outside the nesting season for birds (February 1 through August 31) generally, and in compliance with the specific

guidelines outlined in the USFWS BO for listed species (Appendix B8 *Endangered Species Act Compliance*).

- **AMM-TBR-3: Conduct Preconstruction Surveys** – If construction cannot take place entirely during the wet (nonbreeding) season (September 1 through January 31), then preconstruction surveys and establishment of buffers around active nests will be conducted to avoid or minimize impacts on wildlife species. Specific buffer requirements for listed species are included in the USFWS BO (Appendix B8 *Endangered Species Act Compliance*).
- **AMM-TBR-4: Stage Outside Sensitive Habitats** – Locate staging, access, and parking areas outside of sensitive habitats.
- **AMM-TBR-5: Minimize Footprint** – Avoid and minimize areas of disturbance to the smallest footprint necessary.
- **AMM-TBR-6: Install Exclusionary Fencing** – Install exclusionary fencing for environmentally sensitive areas. Any fencing near habitat for the SMHM, California Ridgway's rail, or western snowy plover will incorporate raptor perch deterrents to minimize raptor predation on listed species. In addition, all ingress and egress points will be clearly identified in the field using orange construction fence, and work will not be conducted outside the designated work area.
- **AMM-TBR-7: Biological Monitor** – A USFWS-approved biological monitor will be present during all work activities in or immediately adjacent to habitat that could be occupied by Federally listed species (further guidance provided in Appendix B8 *Endangered Species Act Compliance*).
- **AMM-TBR-8: Site Stabilization and Restoration** – All disturbed areas will be stabilized within 12 hours of any break in work unless construction will resume work within 7 days. Earthwork will be completed as quickly as possible, and site restoration to preconstruction (or better) conditions will occur immediately following use.
- **AMM-TBR-9: Pond Levels for Snowy Plover** – Water-level manipulation (e.g., for management) within ponds that contain suitable western snowy plover habitat will not be performed unless surveys are conducted to determine whether they are present during the breeding season (March 1 through September 14). If western snowy plovers are present, any addition of water to the pond will be monitored closely to ensure that no nests are flooded.
- **AMM-TBR-10: Least Tern Breeding Buffer** – No activities will be performed within 300 feet of an active least tern nest during the least tern breeding season, which is April 15 to August 15 (or as determined through surveys). *Exception*: Only inspection, maintenance, research, or monitoring activities may be performed during the least tern breeding season in areas within or adjacent to least tern breeding habitat with approval of the USFWS and the CDFW under the supervision of a qualified biologist.

- **AMM-TBR-11: Pond Levels for Least Tern –** Water-level manipulation (e.g., for management) within ponds known to contain nesting least terns will be monitored closely to ensure that no nests are flooded during the least tern breeding season (April 15 to August 15) unless surveys demonstrate that nesting least terns are absent.
- **AMM-TBR-12: Worker Awareness** – At the start of construction, the supervising construction personnel will participate in a USFWS-approved worker environmental awareness program. Under this program, construction personnel will be informed about the presence of listed species and habitats associated with the species and that unlawful take of the animal or destruction of its habitat is a violation of the FESA. Prior to construction activities, a qualified biologist approved by the USFWS will instruct all construction personnel about (1) the description and status of the species; (2) the importance of their associated habitats; and (3) a list of measures being taken to reduce impacts on these species during project construction and implementation. The awareness program will apply to construction occurring within or adjacent to tidal marsh or slough habitat and within or adjacent to managed pond habitat. A fact sheet conveying this information will be prepared for distribution to the construction crew and anyone else who enters the project site. A USFWS representative will be appointed as the point of contact for any employee or contractor who encounters a listed species. The representative will be identified during the environmental awareness program. The representative name and telephone number will be provided to the USFWS and the CDFW prior to the initiation of any activities.
- **AMM-TBR-13: Closure of Trails for Bird Species** – To avoid or minimize potential adverse effects from public access and recreation features constructed near tidal marsh, trails adjacent to some nesting areas for sensitive bird species will be closed during the breeding season. Public trails within 300 feet of suitable western snowy plover or least tern nesting habitat will be closed during the breeding season. In addition, if trails are to be open during the breeding season of these species, viewing platforms, kiosks, benches, boat ramps, interpretive displays, restrooms, and other focal areas for public use will be located a minimum of 600 feet from suitable nesting habitat. The locations of trail segments to be closed, and the periods of closure will depend on whether sensitive bird species, such as western snowy plovers or least terns, are nesting in certain areas in a given year and whether nesting areas are located in close proximity to the trails. Decisions about whether to close a particular trail segment will be made early in the breeding season (and possibly later in the season as conditions change) following surveys for nesting birds within a given pond adjacent to a trail.
- **AMM-TBR-14: Interpretive Signs** – Interpretive signs prohibiting access to areas that are closed to the public, and indicating the importance of protection of sensitive biological resources, will be placed in key locations, such as along trails near sensitive habitats, at boat launches, and near the mouths of sloughs that are closed to boating access. Interpretive signs at boat launches will describe areas that are closed to boating access and will describe measures to be implemented to avoid impacts on harbor seals, Ridgway's rails, and other sensitive wildlife.

- **AMM-TBR-15: No Dogs in Refuge** – Dogs are not allowed on Refuge land in the Alviso Pond Complex. If the City of San José allows dogs in the area around Pond A18, dogs will be restricted to designated trails (must be leashed) and designated hunting areas during the waterfowl season. Dogs not actively used for hunting in the area around Pond A18 must be on a leash at all times.
- **AMM-TBR-16: Cleaning of Equipment** – To reduce potential impacts from infestation by nonnative *Spartina*, pepperweed, and other invasive, nonnative plant species, all equipment (including personal gear) will be cleaned of soil, seeds, and plant material prior to arriving on site to prevent introduction of undesirable plant species. Equipment and personal gear will be subject to inspection. All infestations occurring within the wetlands will be controlled and removed to the extent feasible without substantially hindering or harming the establishment of native vegetation in the restored wetlands.
- **AMM-TBR-17: Hazardous Materials Management/Fuel Spill Containment Plan** – A hazardous materials management and fuel spill containment plan will be developed prior to construction and given to all contractors and biological monitors working on the project. The plan will describe what actions will be taken in the event of a spill. The plan will also incorporate preventative measures to be implemented, such as vehicle and equipment staging, cleaning, maintenance, and refueling; and contaminant (including fuel) management and storage. In the event of a contaminant spill, work at the site will immediately cease until the contractor has contained and mitigated the spill. The contractor will immediately prevent further contamination, notify appropriate authorities, and mitigate damage as appropriate. Containers for storage, transportation, and disposal of contaminated absorbent materials will be provided on the project site. Details of the plan elements can be found in the USFWS BO (Appendix B8 *Endangered Species Act Compliance*).
- **AMM-TBR-18: Construction Site Maintenance** – Project sites will be maintained trash-free, and food refuse will be contained in secure bins and removed daily.
- **AMM-TBR-19: Speed Limit** – Prior to construction, all high-quality habitat for listed species will be mapped and provided to the USFWS. Vehicles driving on levees adjacent to such habitat for construction or monitoring activities will then travel at speeds no greater than 10 mph to minimize noise and dust disturbance.
- **AMM-TBR-20: Vehicle Staging and Fueling** – Vehicle staging, cleaning, maintenance, refueling, and fuel storage will be located 150 feet or more from any stream, body of water, or wetland.
- **AMM-TBR-21: Vehicle and Equipment Maintenance** – All equipment will be maintained free of petroleum leaks. No equipment will enter live water except for aquatic equipment or amphibious equipment designed specifically for aquatic or amphibious use. All vehicles operated within 150 feet of any body of water will be

inspected daily for leaks and, if necessary, repaired before leaving the staging area. Inspections will be documented in a record that is available for review on request.

- **AMM-TBR-22: Stormwater Management Plan** – A stormwater management plan will be developed to ensure that, during rain events, construction activities do not increase the levels of erosion and sedimentation. This plan will include the use of erosion-control materials (e.g., baffles, fiber rolls, or hay bales; temporary containment berms) and erosion-control measures such as straw application or hydroseeding with native grasses on disturbed slopes; and floating sediment booms and/or curtains to minimize any impacts that may occur due to increased mobilization of sediments.
- **AMM-TBR-23: Use of Clean Fill** – All clean fill material proposed for upland and wetland placement will meet the qualifications set forth in the San Francisco Bay Regional Water Quality Control Board's waste discharge requirements (Tentative Order), approved with respect to chemical and biological suitability for uplands and wetlands by the USACE Dredged Material Management Office. If the above-mentioned thresholds are not attained and the material is approved for use by the San Francisco Bay Regional Water Quality Control Board, consultation will be reinitiated to analyze the potential effects of the contaminated material to listed species.
- **AMM-TBR-24: Invasive Plant Species Monitoring** – The restored tidal marsh wetlands will be monitored for possible infestation by nonnative cordgrass, perennial pepperweed, and other invasive, nonnative plant species that could result in a substantial reduction in the ecological value of the tidal restoration and ecotone construction. It is expected that some nonnatives that are not particularly invasive will colonize the ecotones, but, if any particularly invasive, nonnative plant species are found, a qualified botanist will recommend specific measures to control the spread of nonnative plant species. All infestations of nonnative cordgrass within the restored tidal marsh wetlands will be controlled and removed in coordination with the San Francisco Estuary Invasive Spartina Project without substantially hindering prepared or harming the establishment of native vegetation in the restored wetlands. If perennial pepperweed control is necessary, spraying with glyphosate or imazapyr formulated for aquatic use may be necessary, as described by Hogle et al. (2007) for the San Pablo Bay National Wildlife Refuge. Otherwise, preferred vegetation management will involve non-mechanized methods of removal including hand-pulling, saline spray, pond flooding (during nonbreeding seasons), and substrate-based controls. Aside from glyphosate and imazapyr for pepperweed control, the use of any herbicides will be subject to USFWS and NMFS approval. More details regarding spraying for perennial pepperweed is provided in the USFWS BO (Appendix B8 *Endangered Species Act Compliance*).
- **AMM-TBR-25: Nighttime Work Avoidance** – Nighttime work near tidal marsh habitat will be avoided to the extent feasible. If nighttime work cannot be avoided, lighting will be directed to the work area and away from habitat for the SMHM and California Ridgway's rail.

The BOs define work exclusion windows for the species addressed by the opinions. Figure 4.7-2 *Seasonal Construction and Maintenance Constraints for Species Addressed in the Shoreline Phase I Study Biological Opinions* shows these work exclusion windows by species and by type of activity. “No construction or maintenance” and “no construction” mean that there cannot be any maintenance and/or construction activity in suitable habitat for the species during the time indicated and within the listed parameters (e.g., not within 700 feet) when an active nest(s) has been identified during pre-construction surveys. “Levee breaching only” means that the only restriction during this time period is no levee breaching (i.e., other land work may occur). Areas that support California Ridgway’s rails can have case-by-case exceptions for construction and maintenance.

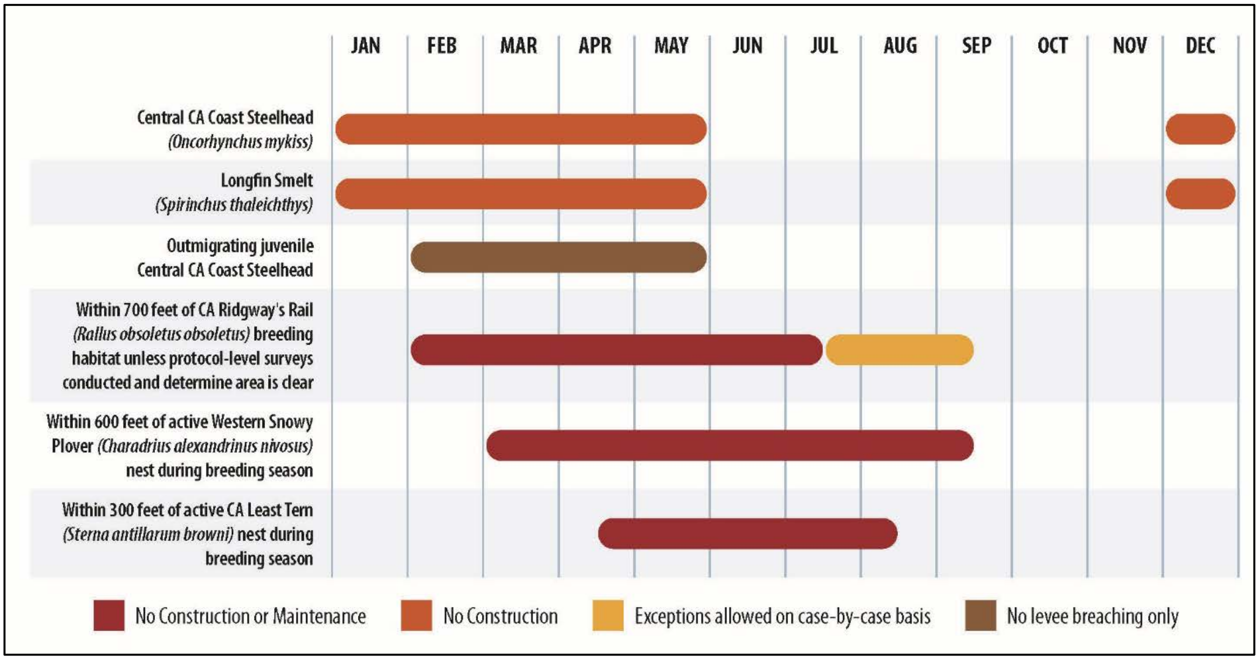

Figure 4.7-2. Seasonal Construction and Maintenance Constraints for Species Addressed in the Shoreline Phase I Study Biological Opinions

As shown in Figure 4.7-2 *Seasonal Construction and Maintenance Constraints for Species Addressed in the Shoreline Phase I Study Biological Opinions*, there are only about 2-1/2 months out of the year when the BO exclusions do not apply. The USACE and its partners will plan construction activities to meet the recommendations of the NMFS and USFWS; scheduling construction activities will require close coordination to ensure that the project activity can be completed in a timely manner, while meeting the requirements of the BOs.

4.7.2.2 Methodology for Impact Analysis

The analysis in this section uses the following methods to identify potential impacts on terrestrial biological resources:

- **GIS data:** collect and review recent GIS data for the study area, such as species occurrence data and habitat types; overlay these data on the Shoreline Phase I Study Area to determine areas of potential impacts
- **Previous studies:** compile and review data collected as part of baylands research, the SBSP Restoration Project, the Wastewater Facility Plant Master Plan (City of San José 2013d), and the Refuge management plans; compare these data to the Shoreline Phase I Study Area to determine areas of potential impacts
- **Ongoing studies:** compile and review information about ongoing studies, such as monitoring associated with the SBSP Restoration Project, as a comparison tool for potential effects and the future condition

In addition to environmental review requirements related to the NEPA/CEQA and Federal and State ESA regulations, according to the USACE Planning Guidance Notebook (ER 1105-2-100), the criteria for determining the significance of potential impacts associated with ecological resources "shall include, but not be limited to, **the scarcity or uniqueness of the resource from a national, regional, state, and local perspective**" (emphasis added; ER 1105-2-100, Appendix C, p. C-15). When identifying significant resources and effects, the USACE is to consider:

- **National Economic Development (NED) resources:** ecological resources having substantial commercial and/or recreational value such that they contribute to increases in the net value of the national output of goods and services
- **Significant environmental quality resources:** ecological resources, including fish and wildlife resources and associated habitats, that are technically, institutionally, or publicly recognized as having substantial nonmonetary value from an ecological, cultural, or aesthetic standpoint
- **Significant effects:** effects an alternative would have on ecosystems or ecological resources, including fish and wildlife, that are determined to have a material bearing on the USACE decision-making process

In ER 1105-2-100, Appendix E (p. E-162), regarding ecosystem restoration activity, the Planning Guidance Notebook states:

> In summary, the case can be made that environmental resources are significant based on technical recognition when, within a specified geographic range, those resources are either scarce; are representative of their respective ecosystems; will improve connectivity or reduce fragmentation of habitat; represent limiting habitat for important species; will improve or increase biodiversity; or trends indicate that the health of the resource is imperiled and declining, but can be recovered through human intervention.

Potential impacts were measured based on how each alternative could affect:

- The relative abundance of scarce resources (sensitive natural communities and special-status species and their habitats)
- Wildlife movement (e.g., ability to retreat to high ground in flooding)
- Habitat connectivity and habitat fragmentation
- Biodiversity
- Current wildlife population and habitat trends
- Conflicts with existing policies and plans

4.7.2.3 Significance Thresholds

An alternative is considered to have a significant effect if it would:

- **Impact TBR-1:** Have an effect on any sensitive natural community identified in local or regional plans, policies, or regulations or by the CDFW or the USFWS.

  Habitats considered in the analysis include:

  - Wetlands such as tidal salt marsh, brackish marsh, freshwater marsh, mudflats, and seasonal wetlands
  - Riparian habitat
  - Open water habitat

- **Impact TBR-2:** Have an effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by the California Department of Fish and Wildlife (the CDFW; formerly known as the California Department of Fish and Game) or the USFWS

  Species considered in the analysis include:

  - Salt Marsh Harvest Mouse
  - Salt Marsh Wandering Shrew
  - Western Snowy Plover
  - Burrowing Owl
  - California Ridgway Rail
  - Nesting Birds
  - Listed Plants

- **Impact TBR-3:** 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; this includes fragmentation of existing habitats

- **Impact TBR-4:** Have an effect on a population of existing native resident or migratory species, either directly or through habitat modification
- **Impact TBR-5:** Conflict with any local policies or ordinances protecting biological resources, such as a tree-preservation policy or ordinance or with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, Recovery Plan, or other approved local, regional, or State habitat conservation plan.

  The following adopted Recovery Plans apply to terrestrial resources in the study area: the Revised California Least Tern Recovery Plan (1985) and the Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (USFWS 2013b). The Final Santa Clara Valley Habitat Plan is the only adopted Habitat Conservation Plan that applies to terrestrial biological resources in the study area. The BCDC *San Francisco Bay Plan* and the RWQCB *Water Quality Control Plan* are not habitat conservation plans *per se* but are state plans with habitat protection provisions.

4.7.2.4 Alternatives Evaluation

4.7.2.4.1 No Action Alternative

Under the No Action Alternative, no new FRM levee would be constructed, and the current level of FRM would continue to be provided by the current dike system. Because no new FRM levee would be constructed, ecosystem restoration that would be enabled by placing either a bench or a 30:1 ecotone along Ponds A12, A13, and A18, and by breaching outboard and internal pond dikes, would not occur. Open-water areas associated with the former salt ponds that are not restored as part of future SBSP Restoration Project actions would remain as currently managed, and no additional tidal wetland habitats would be restored in these areas.

Under this alternative, other ecosystem restoration would take place in the project vicinity (SBSP Restoration Project, ongoing Refuge management) throughout the period of analysis. However, future activities either are not anticipated to result in substantial adverse effects on the biological condition within the study area or are not far enough along in the planning process for projections of the future biological condition based on these projects to be more than speculative. The SBSP Restoration Project Phase II Project, which focuses on enhancing the biological condition of areas near the Shoreline Phase I Study Area, will include enhancements to tidal habitat created through SBSP Restoration Project Phase I at Ponds A19, A20, and A21 (adjacent to the north side of the Shoreline Phase I Study Area); tidal restoration at Ponds A1 and A2W (west of the Shoreline Phase I Study Area); and the reuse of sediment in Pond A8 to establish an upland transition zone. SBSP Restoration Project Phase II is scheduled for construction beginning in 2017. The base year condition would be most affected by SBSP Restoration Project Phase II actions, while a forecast of the without project condition is based on the long-term outcomes of all phases of the SBSP Restoration Project and ongoing refuge management.

Fish and wildlife resources stewardship of project lands is a Federal responsibility (ER 1105-2-100, Appendix C, p. C-4). Under the No Action Alternative, the USACE would not implement any action that could actively improve the relative abundance of scarce wildlife resources or their habitats, or contribute to positive changes in tidal marsh wildlife population trends. The No Action Alternative would not lead to recruitment of new tidal marsh habitat in the area of the former salt ponds, but it also would not fragment baseline condition pond habitats. This alternative would not significantly affect biodiversity in the short term, but eventual SLC without any type of FRM action could ultimately change habitat distribution, type, and connectivity; adversely affect biodiversity; and adversely affect population and habitat trends by converting habitat.

The USFWS would continue to implement its management plans for the Refuge in the study area regardless of whether the Shoreline Phase I Project is implemented. Management programs, such as species and habitat monitoring, predator control, weed control, revegetation, and mosquito management, would continue as planned. The area would continue to be used for recreational purposes such as bird watching and educational school tours. The USFWS has identified a need to update the NCM Management Plan; doing so might identify new projects in the study area that could accomplish similar goals as the Shoreline Phase I ecosystem restoration elements (e.g., restoring tidal habitat and enhancing SMHM and California Ridgway's rail habitat). In summary, the USFWS would still implement its ongoing Refuge management activity under the No Action Alternative, although potential partnerships associated with the Shoreline Phase I Project would not be formed and cooperative efforts addressing FRM and ecosystem restoration would not be implemented.

The following sections discuss the potential effects of the No Action Alternative on scarce resources (including special-status species and their habitats), representative habitats, and sensitive natural communities; wildlife movement, habitat connectivity, habitat fragmentation, and biodiversity; population and habitat trends; and plan and policy conflicts.

4.7.2.4.1.1 Scarce Resources, Including Sensitive Natural Communities and Special-Status Species

Without any habitat restoration and assuming that no other activity would take place in the study area beyond that planned as part of the SBSP Restoration Project, habitats for special-status species in the area would remain much the same as they are now, and no waters of the United States would be directly affected. Anticipated conditions would be as follows:

- Suitable habitat for California Ridgway's rail and SMHM would not increase, but these species' habitats would continue to be the focus of other restoration and conservation efforts bay-wide.
- Salt marsh habitat suitable for use by salt marsh specialists such as SMHM, salt marsh wandering shrew, California Ridgway's rail, and Alameda song sparrow would not increase in the study area beyond that planned for SBSP Restoration Project actions.
- Special-status pond specialist species of birds that rely on open water for feeding and roosting would continue to use the saline and brackish ponds in or near the study area.
- There would be no direct effects on any riparian or upland habitats that currently provide nesting and/or roosting habitat for special-status species such as American peregrine falcon, California yellow warbler, loggerhead shrike, northern harrier, San

Francisco common yellowthroat, short-eared owl, western burrowing owl, or white-tailed kite. Because it would not cause the loss of open water that could be used by western pond turtle, this alternative is not expected to affect this special-status species.

- Mudflat (tidal flat) specialists would not experience a temporary increase in area of suitable foraging habitat. By leaving the habitats as they are, mudflat specialists would continue to be limited in the managed pond areas. Avian species—special-status and common species—that rely on intertidal mud flats at low tide would probably still use the shallow ponds, flats, levees, and water treatment plant settling ponds to roost during high tides. However, in the long term, sedimentation patterns in the South Bay are expected to result in a loss of intertidal mudflat due to conversion to emerging fringe marsh through sedimentation, conversion of subtidal habitat due to scour, and rising sea levels. This mudflat loss would occur and could adversely affect populations of special-status and common avian species that rely on mudflats.
- Without any change around the area of the NCM, long-term effects of the No Action Alternative on sensitive natural communities within the NCM are expected to be adverse. The USFWS would continue water management as feasible in the short term, but the marsh's low-lying position (at least 8 feet below sea level due to historic subsidence) makes it especially vulnerable in the long term to complete inundation with sea level change if such SLC overtops the Union Pacific Railroad tracks, which are located between the NCM and tidally influenced areas. The only drainage into and out of the area is through a very small ditch running parallel to the Union Pacific Railroad tracks, a gravity-fed siphon from Pond A16, and pumping into Artesian Slough. The first two serve as inputs only, with pumping being the sole option for getting water out of the NCM. Depending on the capacity of the pumps, the NCM could be inundated with standing water for significant periods. Estimating the potential extent of inundation and habitat loss is speculative, but hydrologic studies indicate that, using a USACE High SLC scenario, the entire adjacent (upstream) community of Alviso would begin to be flooded at least once a year sometime between 2044 and 2069. Flooding in the lower-lying marsh is expected to happen more frequently, and pumping and drainage out of the NCM would be increasingly more difficult and costly.

4.7.2.4.1.2 Wildlife Movement, Habitat Connectivity, Habitat Fragmentation, and Biodiversity

Under the No Action Alternative, wildlife movement patterns would continue. Wildlife movement and habitat connectivity would be affected by future SBSP Restoration Project actions in adjacent areas, which would improve connectivity for some species in most cases.

Under this alternative, the Shoreline Phase I Project would not cause any temporary construction-related impacts on birds using the study area and would not affect harbor seal activity near the Coyote Creek outlet. Current recreational use of the Refuge, much of which is based on the diversity of species in the area, would continue consistent with conservation measures described in the Refuge's management plans and the SBSP Restoration Project and Shoreline Phase I Project BOs issued by the USFWS.

4.7.2.4.1.3 Population and Habitat Trends

The No Action Alternative would not provide new areas of tidal marsh habitat and thus, in the long term, would not assist in the recovery of species (such as California Ridgway's rail) for which habitat is currently limited in the study area. Minor conversion of mudflats to tidal marsh may continue to occur as it has in recent decades. A recent example would be the ongoing marsh development in the Coyote Creek channel north of Pond A9.

Populations of common species would not change in the early years of the project but might change over time as adjacent habitats change as part of future SBSP Restoration Project actions. For example, local populations of open-water-dependent species might change as habitats transition to tidal habitats. These species would likely move to other areas in the region provided that suitable habitat is available. This alternative would maintain the former salt pond habitat in the Shoreline Phase I Study Area; this is not likely to change over time without restoration work that would be completed independently by some other entity.

4.7.2.4.1.4 Policy and Plan Conflicts

The No Action Alternative would not implement any ecosystem restoration activity. While this is not in direct conflict with adopted plans, it would not help the City of San José accomplish some of the ecosystem restoration and ecosystem protection objectives included in its general plan. Activity that takes place as part of ongoing Refuge management would probably accomplish some of the City's goals.

The alternative would not prevent the Refuge from continuing to implement its NCM Plan or ongoing Refuge management consistent with the current Refuge plan. Future Refuge management activities that rely on implementing project-related ecosystem restoration and improving recreational experiences included in the Shoreline Phase I Project could not occur. Therefore, the Refuge would either need to incorporate some of the Shoreline Phase I actions into future Refuge management plans, if such actions are important to long-term management of the Refuge, or find an alternative source of funding to complete ecosystem restoration. However, similar levels of restoration would not be possible without the FRM features of the Shoreline Phase I Project, so funding for FRM would also have to be identified by the Refuge.

4.7.2.4.2 Action Alternatives

The action alternatives all include construction of FRM levees and ecosystem restoration as described in Section 3.8 *Action Alternatives Component Details*. The following sections discuss the potential effects of the action alternatives on scarce resources (including special-status species and their habitats); representative habitats and sensitive natural communities; wildlife movement, habitat connectivity, and habitat fragmentation; biodiversity; population and habitat trends; and plan and policy conflicts.

4.7.2.4.2.1 Levee Construction Effects

Levee construction impacts would occur during the first 3 years of construction (2018–2021).

Grasses will be seeded on the entire upland levee surface for erosion control. A limited amount of native non-grass short-stature vegetation will be allowed on portions of the levee in accordance with guidance from the USACE Risk Management Center, in recognition of site conditions.

All of the FRM levee alternatives would result in the loss of upland and wetland habitats. Table 4.7-3 *Habitat Impacts from Levee Construction and Restoration Actions by Levee Segment and Alternative (in acres)* summarizes the type and amount of habitats that would be directly and indirectly affected by levee and transitional habitat construction for each alternative, by segment (e.g., Alviso [west of Artesian Slough] or WPCP [Wastewater Facility; east of Artesian Slough]). This section discusses impacts related to levee construction, while ecosystem restoration habitat impacts (including transitional habitat construction) are discussed separately in Section 4.7.2.4.2.2 *Ecosystem Restoration Construction Effects*.

Permanent direct effects would occur as a result of the new levee footprint. Some of the habitats that would be directly affected are waters of the United States, and the levee construction would result in a discharge of fill material to these waters. The numbers presented in Table 4.7-3 *Habitat Impacts from Levee Construction and Restoration Actions by Levee Segment and Alternative (in acres)* also include direct temporary impacts within construction easements. These easements might remain disturbed over time depending on their proximity to other developed areas and whether they might be used for long-term levee maintenance activities. For the purpose of providing a conservative analysis, all impact acreages, whether permanent or temporary, presented in Table 4.7-3 *Habitat Impacts from Levee Construction and Restoration Actions by Levee* Segment and Alternative (in acres), are all being considered direct, permanent impacts.

The following sections describe the construction-related effects associated with each FRM levee section.

Table 4.7-3. Habitat Impacts from Levee Construction and Restoration Actions by Levee Segment and Alternative (in acres)

Habitat Type	Alviso Segment				WPCP Segment [a]		
	Alt 2 North 12.5-ft Levee with bench	Alt 3 North 15.2-ft Levee with ecotone	Alt 4 Railroad 15.2-ft Levee with bench	Alt 5 South 15.2-ft Levee with bench	Alt 2 12.5-ft Levee with bench	Alt 3 15.2-ft Levee with ecotone	Alts 4, 5 15.2-ft Levee with bench
Brackish marsh	0.3	0.2	0.2	0.2	0.0	0.1	0.0
Freshwater marsh	0.8	0.8	0.7	0.6	0.2	0.3	0.2
Muted tidal/diked marsh	1.8	1.8	22.0	20.3	0.0	0.0	0.0
Tidal salt marsh	1.7	1.7	1.1	0.0	0.0	0.0	0.0
Non-tidal salt marsh	0.0	0.0	0.0	0.0	8.1	8.2	8.3
Seasonal wetland	3.7	3.7	4.2	0.0	0.0	0.0	0.0
Mudflat	0.6	0.6	0.4	0.4	0.0	0.0[b]	0.0
Total Wetland	8.9	8.8	28.6	21.5	8.3	8.6	8.5
Batch pond	7.9	32.6	9.2	7.3	0.0	0.0	0.0
Circulation pond	4.9	4.9	0.0	0.0	17.7	73.3	17.7
Open water	0.8	0.8	0.8	0.7	8.6	8.6	8.9
Total Open Waters	13.6	38.3	10.0	8.0	26.3	81.9	26.6
Upland vegetation	0.0[b]	0.0[b]	2.4	3.0	1.0	1.0	1.1
Water/sewage treatment	0.0	0.0	0.00	0.0	0.1	0.1	0.2
Levee	8.7	9.2	3.7	0.5	10.1	10.5	10.1
Developed	6.3	6.3	1.5	15.2	0.1	0.1	0.1
Total Other	15.0	15.5	7.6	18.7	11.3	11.7	11.5
Grand Total All Habitats	37.5	62.7	46.2	48.2	45.9	102.2	46.6

Source: H.T. Harvey & Associates 2013; City of San José 2014

* All height measurements for levees are in NAVD 88.

[a] WPCP = Water Pollution Control Plant, referred to as Wastewater Facility in document text. All alternatives share the same WPCP South footprint.

[b] For impacts <0.1 acre but >0.05 acre, assumed 0.1 acre in calculations; for <0.05 acre, assumed 0.0 acre in table calculations.

Alviso Levee Options

There are three alignment options for the FRM levee along the Alviso segment: the North levee option (included in Alternatives 2 and 3; Alternative 2 is the NED/NER and Alternative 3 is the Recommended Plan/Locally Preferred Project), the Railroad Spur levee option (Alternative 4), and the South levee option (Alternative 5). The Alviso North segment is the only option that considers both a 12.5-foot NAVD 88 levee (part of Alternative 2) and a 15.2-foot NAVD 88 levee (part of Alternative 3); the Alviso Railroad Spur (Alternative 4) and Alviso South (Alternative 5) levee options both include a 15.2-foot NAVD 88 levee.

All of the Alviso levee options would include:

- A flood gate at the Union Pacific Railroad line crossing and an Americans with Disabilities Act–compliant pedestrian bridge crossing over the railroad; the location of the railroad gate and pedestrian bridge is alternative dependent (see Figure 3.5 1 *Potential Alviso Segment Levee Alignments* in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* for locations of the flood gates by alternative)
- Protection in place or replacement with upgrades of an existing siphon that directs water from Pond A16 to the NCM
- A small breach along the west side of Artesian Slough to restore freshwater input to an existing freshwater marsh area just east of the EEC
- A tide gate closure system coupled with an Americans with Disabilities Act -compliant pedestrian bridge at Artesian Slough

These elements are described in Section 3.8 *Action Alternatives Component Details* of this document. The following paragraphs address the impacts of the Union Pacific Railroad crossing, existing siphon, and the breach. All construction work would be consistent with the Avoidance and Minimization Measures in Section 4.7.2 *Environmental Consequences*; these general measures include AMM-TBR-1: Reporting Requirements; AMM-TBR-4: Stage Outside Sensitive Habitats; AMM-TBR-5: Minimize Footprint; AMM-TBR-6: Install Exclusionary Fencing; AMM-TBR-7: Biological Monitor; AMM-TBR-8: Site Stabilization and Restoration; AMM-TBR-12: Worker Awareness; AMM-TBR-16: Cleaning of Equipment; AMM-TBR-17: Hazardous Spill Plan; AMM-TBR-18: Construction Site Maintenance; AMM-TBR-19: Speed Limit; AMM-TBR-20: Vehicle Staging and Fueling; AMM-TBR-21: Vehicle and Equipment Maintenance; AMM-TBR-22: Stormwater Management Plan; AMM-TBR-23: Use of Clean Fill; and AMM-TBR-25: Nighttime Work Avoidance.

Alviso North Levee Section Option (Included as Part of Alternatives 2 and 3)

The Alviso North levee option would be constructed from the Alviso Marina along the existing pond berms that run along the eastern edge of Pond A12 and the southeast corner of Pond A13, roughly parallel with the Union Pacific Railroad line. This levee section would then cross a shallow, hydrologically isolated remnant salt marsh area before meeting the Union Pacific Railroad line. A flood gate that could be closed to protect the area during flood events would be constructed across the rail line near the southeast corner of Pond A13 and southwest corner of Pond A16.

The levee section would continue east beyond the Union Pacific Railroad line and would cross another shallow tidal marsh channel that provides limited muted tidal flows of bay water to the NCM. It would then connect with the existing berm following the southern border of Pond A16, which is also the northern extent of the NCM. The Recommended Plan/Locally Preferred Plan (LPP; Proposed Project; Alternative 3) would affect a larger area than Alternative 2 primarily due to the addition of the 30:1 ecotone proposed to be incorporated as transitional habitat. For this levee segment, the largest difference in impacts between the two alternatives is from batch pond habitat being converted to ecotone in Ponds A12 and A13. In both cases, the levee segment alignment would follow existing berms and pond dikes for its entire length.

The Alviso North levee section would block a drainage channel that parallels the Union Pacific Railroad tracks from the bay to the NCM. Historically, this channel provided the only year-round flow input to the NCM. The USFWS recently installed a siphon that is used to supplement the NCM water levels, so blocking this channel should not significantly affect water supply to the NCM. This alternative includes avoidance and protection in place for the siphon, but, if conditions require moving or replacing the siphon, it would be replaced in a manner such that it would meet the same need and functionality as the current siphon.

Finally, the levee section would be located so that direct effects to the adjacent the NCM are minimized. The levee section would end at Artesian Slough. Figure 4.7-3 *Habitat Impacts for Alviso North Levee Section with 12.5-foot NAVD 88 Levee and Bench (Alternative 2)* and Figure 4.7-4 *Habitat Impacts for Alviso North Levee Section with* 15.2-foot NAVD 88 Levee and 30:1 Ecotone (Alternative 3) show the expected habitat impacts of the Alviso North levee segment.

Figure 4.7-3. Habitat Impacts for Alviso North Levee Section with 12.5-foot NAVD 88 Levee and Bench (Alternative 2)

Figure 4.7-4. Habitat Impacts for Alviso North Levee Section with 15.2-foot NAVD 88 Levee and 30:1 Ecotone (Alternative 3)

Impact TBR-1: Have an effect on any sensitive natural community identified in local or regional plans, policies, or regulations or by the CDFW or the USFWS

As shown in Table 4.7-3 *Habitat Impacts from Levee Construction and Restoration Actions by Levee Segment and Alternative (in acres)* and on Figure 4.7-3 *Habitat Impacts for Alviso North Levee Section with 12.5-foot NAVD 88 Levee and Bench (Alternative 2)* and Figure 4.7-4 *Habitat Impacts for Alviso North Levee Section with* 15.2-foot NAVD 88 Levee and 30:1 Ecotone (Alternative 3), constructing either version of the Alviso North levee segment would directly affect a total of about 8.9 acres of wetlands (Waters of the United States; estimate includes the following habitat types: brackish marsh, freshwater marsh, mudflat, muted tidal/diked marsh, tidal salt marsh, and seasonal wetland). Neither alternative impacts riparian or open water habitat. Both Alternative 3 and Alternative 2 have the lowest amount of wetland impacts of the Alviso levee segment options. The affected areas are primarily associated with a wetland complex near the Alviso Marina on the west end of the segment and Artesian Slough on the east end of the segment. An exception is saline marsh on the edges of Ponds A12 and A13.

This levee segment would abut an isolated remnant seasonal wetland west of the Union Pacific Railroad line. The levee section would directly affect about 3.7 acres of this seasonally inundated saline flat, which does not have a direct connection to the bay or to the NCM. This area, which is used by nesting western snowy plovers, receives water through rainfall and leakage from surrounding areas (Ponds A12 and A13, and the NCM).

This levee section option would directly affect 1.8 acres of muted tidal/diked marsh habitat. The USFWS, a joint lead agency, has expressed concern that the Alviso North levee section alignment would continue to isolate the NCM from the bay, limit the ability to restore the area to fully functioning (if muted) tidal marsh, and result in largely freshwater or brackish marsh. See Appendix B3 *Flood Risk Management Coordination with the USFWS* for correspondence from the USFWS regarding these concerns.

No detailed habitat information (to species detail) exists for the NCM; pickleweed distribution information was derived from digital aerial photographs (NAIP 2010). Total estimated pickleweed habitat in the NCM is about 100 acres. Impacts on pickleweed due to the construction of the Alviso North levee segment (either a 15.2-foot NAVD 88 height or a 12.5-foot NAVD 88 height) are anticipated to be minimal (less than 1 acre).

Construction of the Alviso North Levee option would block a freshwater input from Artesian Slough to a freshwater marsh area near the EEC west of Artesian Slough. This alternative (and all others) includes creating a small breach on the west side of the slough to maintain freshwater input to the marsh. The breach would be designed to provide the same level of inflow as afforded with the baseline condition and would not cause an increase or decrease in the amount of freshwater marsh.

Impacts to wetland habitat due to construction of the FRM levees would be significant absent the provision for the expansion of restored tidal marsh the FRM levees promotes in adjacent ponds. The project will provide self-sustaining wetlands and Endangered species habitat of high quality. This approach would offset impacts from levee construction, specifically for the loss of existing wetlands.

As noted in Table 4.6-8 *Post-Construction Tidal Marsh Totals in the Study Area*, ecosystem restoration associated with Alternative 3 is expected to result in the creation of 2,783 acres of tidal marsh (assuming the project is implemented as proposed and all ponds are converted). The minor losses of seasonal wetland (saline flat) and muted tidal/diked marsh habitat associated with levee construction effects would be completely offset in the long term by tidal marsh habitat gains associated with the Shoreline Phase I Project.

However, it is understood that compensation for the immediate direct effect on the habitat would not occur until a later date. Breach of Pond A18 to restore tidal action is scheduled for 2020; creation of fully functioning tidal marsh would depend on natural action and adaptive management, if needed. This process could take many years. Overall, however, this impact would not be significant since the project would not result in a net loss of tidal marsh habitat over time.

Impacts on sensitive natural communities, including seasonal wetland and muted tidal/diked marsh habitat as a result of the Alviso North levee segment option would be less than significant.

Impact TBR-2: Have an effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by the CDFW or the USFWS

Project construction activity could result in direct impacts on special-status species using the seasonal wetland west of the Union Pacific Railroad tracks (saline flat) and muted tidal/diked marsh habitat in the NCM. The NCM is known to support several special-status species, including SMHM, salt marsh wandering shrew, Alameda song sparrow, Bryant's savannah sparrow, and nesting western snowy plover.

Salt Marsh Harvest Mouse and Salt Marsh Wandering Shrew. The removal of vegetation that SMHM and salt marsh wandering shrew uses for cover, directly mortality from construction equipment, and earth movement could all impact individuals of these species. Population densities for these species are low, and impact areas amount to less than 4 acres in tidal areas (brackish, tidal salt, and muted tidal/diked marsh combined), so few individuals are expected to be affected in the construction footprint. Individuals within the construction footprint would tend to naturally move to adjacent undisturbed pickleweed habitat to seek shelter, can be moved into these areas if needed, or can be captured for relocation if found on Federal land. However the loss of individuals would be a significant impact.

Loss of SMHM and salt marsh wandering shrew habitat due to construction of the FRM levees would be significant absent the provision for the expansion of restored tidal marsh the FRM levees promotes in adjacent ponds. The project would provide high-quality habitat, which would benefit not only these species but other wetland species.

Tidal marsh habitat created through Pond A18 ecosystem restoration would provide more habitat for these species than what would be lost as a result of the levee construction activity habitat impacts. The project, then, would “self-mitigate” for impacts related to the loss of habitat. Although the tidal marsh habitat would not be established immediately, this impact is not considered significant since the project would not result in a net loss of habitat over time.

The BOs for the Shoreline Phase I Project recognize that the project could affect SMHM but concluded that the level of anticipated take associated with levee construction is not likely to result in jeopardy to the species.

Impacts to SMHM and salt marsh wandering shrew as a result of construction of the Alviso North levee segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Impacts to SMHM and salt marsh wandering shrew as a result of loss of habitat due to the construction of the Alviso North levee segment option would be less than significant.

Western Snowy Plover. This levee alignment abuts areas that provide suitable nesting habitat for western snowy plovers. Direct impacts on western snowy plovers would include the loss of a small amount of habitat in the impoundment between Pond A12 and the Union Pacific Railroad tracks. Indirect impacts would occur if snowy plovers do not nest in the impoundment, or nest in a reduced portion of the impoundment, as a result of the raising of the levee along Pond A12. Plovers may not nest close to the levee because it would block plovers’ view of a larger proportion of the area from which avian predators may approach the impoundment, as compared to the existing low levee.

Western snowy plover may self-relocate during construction activity and return to the area once construction is complete. Constructing this segment is not expected to affect western snowy plover when they are foraging, and construction would not occur during the nesting season if nesting birds are present. However, because this species is Federally Threatened and due to this species’ low population numbers, any impacts to this species involving direct take or reduction in suitable foraging or nesting habitat would be significant. The BOs for the Shoreline Phase I Project recognize that the project could affect snowy plover but concluded that the level of anticipated take associated with levee construction is not likely to result in jeopardy to the species.

Impacts to western snowy plovers as a result of construction of the Alviso North levee segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Burrowing Owl. Burrowing owls could use the existing berms for nesting, although burrowing owls have not been noted to be nesting in any of the project levees in recent years. Potential impacts on burrowing owls would depend on the presence of active burrows along this levee segment’s alignment; burrowing owls have historically used areas around the Alviso Marina, which is at the western end of all of the Alviso levee options and the NCM. According to the California Burrowing Owl Consortium’s guidelines (1993), adverse impacts would occur if (1) disturbance or harassment occurs within 76 meters (about 250 feet) of occupied burrows;

(2) burrows and burrow entrances are destroyed; and/or (3) foraging habitat adjacent to occupied burrows is degraded. Using these criteria, disturbing nearby occupied burrows, covering occupied burrows, or losing adjacent foraging habitat would be a significant effect on burrowing owls. Because the presence or absence of burrowing owls is not confirmed under the baseline condition, it is assumed that the owls could use berms that would be affected by this alternative.

Impacts to burrowing owl as a result of construction of the Alviso North levee segment option would be significant. Mitigation would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

California Ridgway's Rail. California Ridgway's rail, a salt marsh–dependent species, has been recorded in salt marsh habitats along Alviso Slough west of the western terminus of the Alviso North levee segment alignment. Direct disturbance or Ridgway's rail could occur from the presence of construction equipment and indirect impact may result from the loss of habitat. The disturbance of nesting Ridgway's rails would be a significant impact.

The BOs for the Shoreline Phase I Project recognize that the project could affect California Ridgway's rail but concluded that the level of anticipated take associated with levee construction is not likely to result in jeopardy to the species.

Construction of the Alviso North levee segment option would have direct and indirect impacts to California Ridgway's rail that would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Other Nesting Birds. Alameda song sparrows, Bryant's savannah sparrows, and San Francisco common yellowthroats have historically been recorded in the NCM and could use the edge of the marsh and the southern Pond A16 levee for nesting. The islands in Pond A16 and the NCM collectively provide regionally important nesting habitat for Forster's terns, black-necked stilts, and American avocets, and these birds may be disturbed by construction activities to the point of not nesting in some otherwise suitable areas while construction is occurring. Nesting birds are protected under the Migratory Bird Treaty Act (MBTA). Direct impacts resulting from construction activity could include direct injury or mortality of individuals (e.g., destruction of active nests). Indirect impacts, such as disturbance of nesting birds outside the footprint, are also expected. Loss of active nests or chicks would be a significant impact.

Timing construction outside of the nesting season (approximately February 1 through August 31) would eliminate direct impacts on nesting birds (AMM-TBR-2: Seasonal Restrictions). Construction activities occurring during the nesting season would require preconstruction surveys by a biologist to determine the presence of active nests and the establishment of species-specific buffers around active nests until the young have fledged (AMM-TBR-3: Conduct Preconstruction Surveys). No construction would be allowed within the nest buffers.

Removing vegetation within the impact area prior to the breeding season will reduce direct impacts on these species by preventing nesting within the construction footprint. In addition, preconstruction surveys for and protection of nesting birds, including maintenance of adequate buffers around active nests, would ensure that impacts on these special-status species (and other birds protected under the MBTA) are not significant after applying additional minimization measures.

Impacts to nesting birds including Alameda song sparrows, Bryant's savannah sparrows, and San Francisco common yellowthroats, as a result of construction of the Alviso North levee segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Listed Plants. This levee segment is not known to support any listed or sensitive plant species. Constructing the Alviso North levee segment is not expected to affect special-status species.

Impacts on special-status plant species as a result of the Alviso North levee segment option would be less than significant.

Impact TBR-3: 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; this includes fragmentation of existing habitats

The Alviso North levee option would follow existing barriers (non-engineered dikes and berms), so building a levee on this alignment would minimize effects on wildlife movement, habitat connectivity, and habitat fragmentation. Habitat on the landward side of the levee is primarily muted tidal marsh that is part of the NCM. Habitat on the bayward side of the levee consists of two batch ponds–one that may be breached just after the levee construction is completed (Pond A12, scheduled to be breached in 2020) and another that may be breached within 10 years of levee construction (Pond A13, scheduled to be breached in 2030)—and a pond that has already been converted to shallow water foraging habitat (i.e., a circulation pond) as part of the SBSP Restoration Project (Pond A16). Constructing this levee segment would not divide or otherwise fragment the current contiguous habitat types.

Some species live in one habitat, travel across the levee, and forage in another habitat. This levee section would not prevent movement between habitats; however, increasing the height of the levee and maintenance of low or no vegetative cover within a 15-foot band across the top of the bench could reduce movement and visibility for some species such as SMHM, salt marsh wandering shrew, American avocet (chicks), and black-necked stilt (chicks). The new FRM levee would include a vegetative buffer along Ponds A12/A13 and A18 to provide refuge if needed and would not be constructed in a manner that would prevent movement across the levee. Because it would not substantially change habitat types on either side of the levee, the Alviso North levee segment is not expected to affect any long-term population trends of special-status species. Long-term management of the area includes using this levee segment as a recreational trail, which is consistent with its current use; this is discussed further in Section 4.11 *Recreation*.

Constructing the Alviso North levee segment is not expected to result in regionally significant habitat losses that would affect local or regional biodiversity.

The construction-related impacts of the Alviso North levee option on wildlife movement, habitat connectivity, habitat fragmentation, and biodiversity would be less than significant.

Impact TBR-4: Have an effect on a population of existing native resident or migratory species, either directly or through habitat modification

The Alviso North levee option would be constructed along the location of existing non-engineered dikes and berms that separate distinct habitat types. On the bayward side are Ponds A12 and A13, which would be operated as batch ponds until they are breached in 2020 and 2030, respectively, and Pond A16, a shallow water circulation pond. On the landward side is the NCM. Because these habitats in these areas are so different, the presence of a new FRM levee is not expected to disrupt or change current habitat trends in these two areas.

The part of the Alviso North levee section between Pond A16 and the NCM is a movement corridor for young plover and other marsh species that hatch on the bird nesting islands in Pond A16 and subsequently move into the NCM for cover and foraging. Construction of the Alviso North levee segment means that the NCM could never be directly connected to bay tidal flows through levee breaching. However, the current condition in the NCM makes it highly unlikely that the USFWS would propose directly reconnecting the NCM to the bay. The NCM is about 8 to 10 feet below sea level and acts like a sump for the Alviso area. If the NCM were directly connected to the bay by breaching the existing managed pond dikes, it would immediately flood and convert to a deep, open-water pond and marsh habitat, which is important to a number of special-status species, would be lost. Additionally, breaching the existing levees that separate the NCM from the bay would create many technical challenges, not the least of which would be designing and constructing a levee to reduce the risk associated with the impounded water (essentially a dam) in order to protect the Alviso community. For these reasons, there are no current proposals to connect the NCM directly to the bay through levee breaching, and the site's technical challenges make it unlikely that such proposals would arise in the future.

The Shoreline Study considered other possible future changes to the NCM, such as filling the site to bring it to marsh plane elevation, but concerns about feasibility, affordability, and special-status species effects make this type of action highly speculative. The Shoreline Study results determined that, for the foreseeable future, the USFWS would most likely continue to manage the NCM in its current regime. The Alviso North levee would not change the current management regime.

Construction of the Alviso North levee segment would not change or interfere with the recent actions taken by the USFWS to improve the NCM habitat. In 2012, the USFWS installed a siphon in Pond A16 to increase water flow into the NCM and improved the pump (on Artesian Slough) to better circulate and manage water levels in the NCM. These recent upgrades, in addition to the recently completed SBSP Restoration Project work at Pond A16, are anticipated to provide increased management capacity and allow for habitat quality to improve (Bourgeois pers. comm. 2013). It is reasonable to expect that the USFWS would continue to manage water levels in a similar manner in perpetuity. The project includes avoidance and protection in place for the siphon, but, if conditions require moving or replacing the siphon, it would be replaced in a manner such that it would meet the same need and functionality as the current siphon. Provided that construction of the Alviso North levee segment maintains or replaces these water-management structures, this segment would maintain the marsh and its special-status species in the long term.

The Alviso North levee segment would also maintain the NCM in the long term by better protecting the marsh from the effects of SLC compared to the baseline condition. While the NCM may be subject to change or degradation in the future due to changes in climate, rainfall, or funding for maintenance, these impacts are a result of the NCM's location in the landscape. The construction of the Alviso North levee segment would not increase these non-project-related impacts on the NCM.

Construction activity could directly affect common upland bird species that might use habitats along the levee alignment for nesting. Similarly, western snowy plovers that forage in the eastern end of the NCM (upstream of the levee segment but not affected by the levee) and Alameda song sparrows that forage or perch on the edge of the salt marsh habitat could be temporarily displaced during construction. However, it is assumed that birds could use other areas in the project vicinity, including recently restored (through the SBSP Restoration Project) habitat in Ponds A16 and A17 and other adjacent upland areas.

If feasible, all construction activities will occur outside the breeding season. If construction must take place during the breeding season for these sensitive and upland bird species, the application of minimization measures (including preconstruction surveys and establishment of buffers around active nests until fledglings have left the nest) would avoid or minimize construction-related effects on these special-status species (and other local populations of migratory birds protected under the MBTA).

The construction-related impacts of the Alviso North levee option on population and habitat trends would be less than significant.

Impact TBR-5: Conflict with any local policies or ordinances protecting biological resources, such as a tree-preservation policy or ordinance or with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, Recovery Plan, or other approved local, regional, or State habitat conservation plan

The Alviso North levee option would be constructed adjacent to an area that is actively managed as part of the Refuge. The NCM area is subject to a management policy and actions described in the NCM plan, and the USFWS manages the remainder of the Refuge using its current Refuge-wide management plan.

The study area is beyond the 10,000-foot buffer zone of Moffett Field (11,350 feet) and Norman Y. Mineta San Jose International Airport (22,340 feet). However, the proximity of proposed ecosystem restoration efforts raised concerns for the potential to attract wildlife in or across the 5-mile zone serving as the immediate path for take-offs and landings. An evaluation of the current managed pond functionality, and future tidal habitat, determined that the numbers of shorebirds and waterfowl would very likely decrease from existing conditions over the long term. This determination confirmed that the project is unlikely to encourage hazardous wildlife movements into or across the path of take-offs and landings, so restoration efforts will not conflict with any airfield plans or policies.

Construction activities under the Alviso North levee option would comply with these existing policies and plans. As discussed in Section 4.3 *Land Use and Planning*, the project would be consistent with the objectives of the Santa Clara Valley Habitat Plan and the Norman Y. Mineta San Jose International Airport Master Plan.

Construction activities under the Alviso North levee option would comply with existing policies and plans; therefore, this impact would be less than significant.

Alviso Railroad Spur Levee Section Option (Included in Alternative 4)

The Alviso Railroad Spur levee option would be constructed from the Alviso Marina along existing pond berms that run along the eastern edge of Pond A12 and the southeast corner of Pond A13 roughly parallel to the Union Pacific Railroad line. A flood gate that could be closed to protect the rail line from tidal flooding would be constructed across the rail line [see the description of this flood gate and the associated pedestrian bridge under the section titled *Alviso* North *Levee Section Option (Included as Part of* Alternatives 2 and 3) on page 4-312]. The gate would be located where the railroad spur crosses abuts the Union Pacific Railroad rail line, which is slightly south of the gate included as part of the Alviso North levee section option.

The Alviso Railroad Spur levee section would continue beyond the Union Pacific Railroad line and cross the NCM along a currently idle railroad spur southeasterly until it reaches the southern side of the marsh. From this point, the primary FRM levee alignment would leave the railroad line and travel north along Grand Boulevard, which is an access road to the Refuge (EEC), until the eastern edge of the marsh along Artesian Slough. From this point, the FRM levee alignment would follow the Artesian Slough berm. The primary levee would skirt the west side of the EEC before connecting into the WPCP Levee segment at Artesian Slough.

This Alviso option includes an additional berm constructed along the eastern side of Pond A12; this berm, which would form the base of a bench transitional habitat that would be completed before Pond A12 is breached, would abut the primary levee for the first 3,280 feet before the primary levee turns easterly along the railroad alignment. The bench transitional habitat is discussed in more detail later in this section. Figure 4.7-5 *Habitat Impacts for Alviso Railroad Levee Section with 15.2-foot NAVD 88* Levee and Bench (Alternative 4) shows the expected habitat impacts of the Alviso Railroad Spur levee segment.

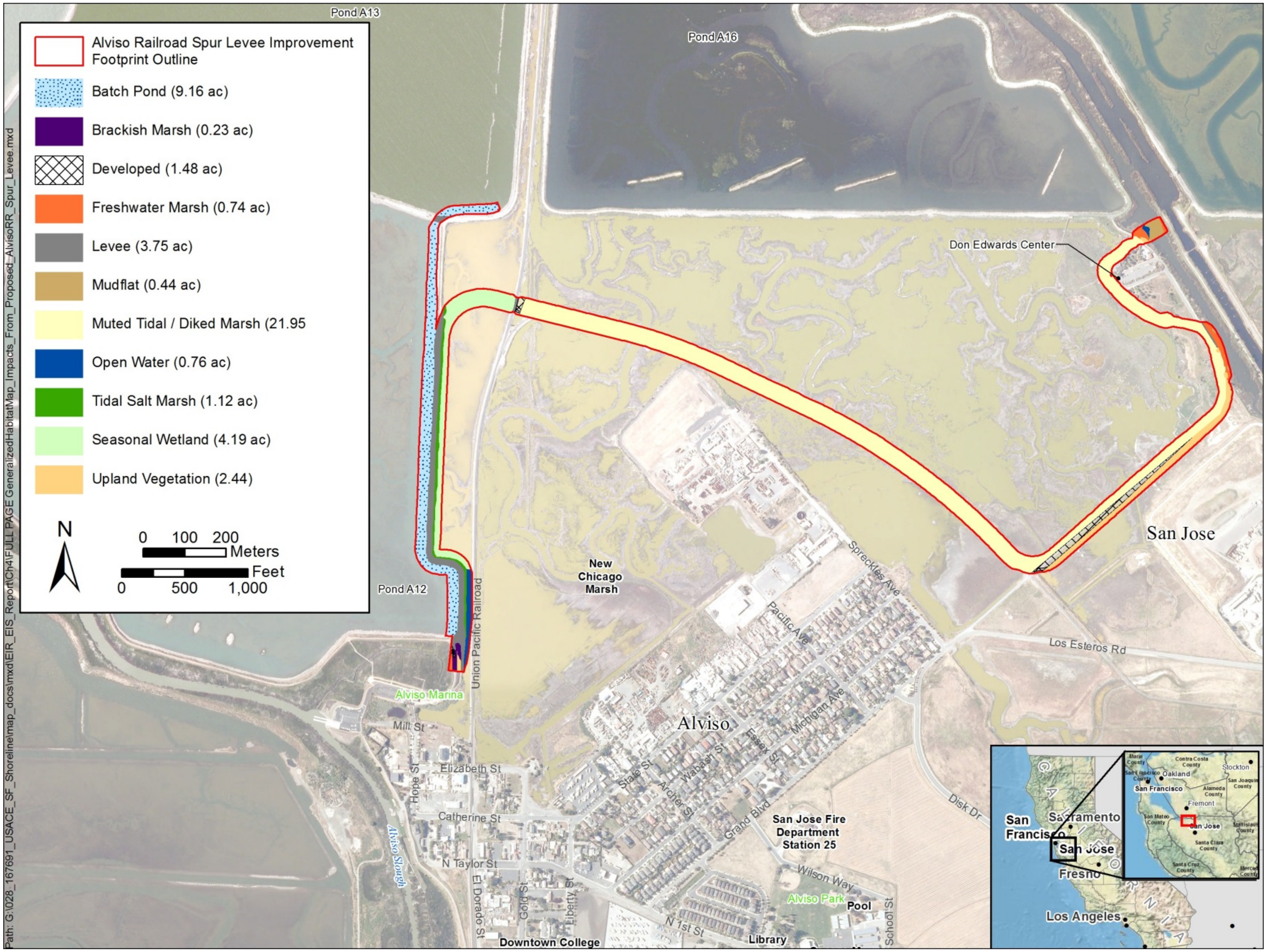

Figure 4.7-5. Habitat Impacts for Alviso Railroad Levee Section with 15.2-foot NAVD 88 Levee and Bench (Alternative 4)

Impact TBR-1: Have an effect on any sensitive natural community identified in local or regional plans, policies, or regulations or by the CDFW or the USFWS

As shown in Table 4.7-3 *Habitat Impacts from Levee Construction and Restoration Actions by Levee Segment and Alternative (in acres)* and on Figure 4.7-5 *Habitat Impacts for Alviso Railroad Levee Section with 15.2-foot NAVD 88 Levee and Bench (Alternative 4),* constructing the Alviso Railroad Spur levee segment would have the highest amount of wetland impacts of the three Alviso levee alignments under consideration. While this levee alignment option would follow an existing railroad berm through the NCM, the existing berm is very low and currently allows hydrologic connectivity to both sides of the NCM via culverts under the railroad track. The Alviso Railroad Spur levee section would be significantly larger than the existing berm that supports the spur and would directly fill a total of about 28.6 acres of wetlands (about 22 acres of which are in the NCM). Alternative 4 would not impact riparian or open water habitat.

Without a design that includes accommodation for hydrologic connectivity, placing the FRM levee through the middle of the NCM would also disrupt marsh hydrology; the alignment would fragment the contiguous marsh habitat. About 140 acres of marsh would be on the landward side of the levee. This area would be even more vulnerable to impacts because it either would be dependent on a second set of water-control structures to get water over or through the levee or would be completely cut off from the bay. It is reasonable to assume that the inland section of the NCM would likely convert to ruderal habitat due to difficulties in maintaining habitat quality. In total, this segment could lead to a 162-acre loss of marsh habitat associated with the NCM (140 acres on the landward side of the new levee plus the 22 acres of diked marsh habitat directly affected by the levee footprint). This could significantly affect the marsh and special-status species and other tidal marsh–dependent species in this area.

Construction of the Alviso Railroad Spur Levee option would block the freshwater input from Artesian Slough to a freshwater marsh area near the EEC west of Artesian Slough. This alternative includes creating a small breach on the west side of the slough to maintain freshwater input to the marsh. The breach would be designed to provide the same level of inflow as provided with the baseline condition and would not cause an increase or decrease in the amount of freshwater marsh.

Since the Shoreline Phase I Project would result in a net increase in the amount of tidal marsh in the study area, in the long term, this increase would balance the impact of fill and fragmentation of any alternative, including the 46.2 acres of habitat directly lost as a result of the Alviso Railroad Spur levee segment. Table 4.6-7 *Post-Restoration Conditions in the Study Area* shows the maximum amounts of tidal marsh habitat that would be created through ecosystem restoration. The tidal marsh habitat created through Pond A18 ecosystem restoration would provide more marsh habitat than what would be lost as a result of the levee construction activity habitat impacts. The project, then, would "self-mitigate" for impacts related to the loss of marsh habitat. Although the tidal marsh habitat would not be established immediately, this impact is not considered significant since the project would not result in a net loss of marsh habitat over time.

Impacts on wetlands and marsh habitat as a result of the Alviso Railroad Spur levee segment option would be less than significant.

Impact TBR-2: Have an effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by the CDFW or the USFWS

In addition to temporary habitat loss, constructing this levee segment option could also have direct effects on special-status species. As described for the Alviso North levee segment, construction-related impacts on listed species could be minimized by discouraging habitat use before construction and by applying measures to minimize impacts on SMHM and western snowy plovers.

Salt Marsh Harvest Mouse and Salt Marsh Wandering Shrew. The removal of vegetation that SMHM and salt marsh wandering shrew use for cover, direct mortality from construction equipment, and earth movement could all impact individuals of these species. Population densities for these species are low, and impact areas amount to less than 4 acres in tidal areas (brackish, tidal salt, and muted tidal/diked marsh combined), so few individuals are expected to be affected in the construction footprint. Individuals within the construction footprint would tend to naturally move to adjacent undisturbed pickleweed habitat to seek shelter, can be moved into these areas if needed, or can be captured for relocation if found on Federal land. However the loss of individuals would be a significant impact.

Impacts on pickleweed due to construction of Alviso Railroad Spur levee are anticipated to be about 7 acres. Tidal marsh habitat created through Pond A18 ecosystem restoration would provide more habitat for these species than what would be lost as a result of the levee construction activity habitat impacts. The project, then, would "self-mitigate" for impacts related to the loss of habitat. Although the tidal marsh habitat would not be established immediately, this impact is not considered significant since the project would not result in a net loss of habitat over time.

Impacts to SMHM and salt marsh wandering shrew as a result of construction of the Alviso Railroad Spur levee segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Impacts to SMHM and salt marsh wandering shrew as a result of loss of habitat due to the construction of the Alviso Railroad Spur levee segment option would be less than significant.

Western Snowy Plover. This levee alignment bisects an area that provides suitable nesting habitat for western snowy plovers. A higher levee through the impoundment between Pond A12 and the Union Pacific Railroad tracks and along the railroad spur through the NCM would likely result in indirect impacts on snowy plovers, since it would subject more plover nesting habitat (within the impoundment and on both sides of the spur levee) to the indirect effects related to avoidance of areas close to a higher levee. Direct impacts to western snowy plovers would include the loss of a small amount of habitat in the impoundment between Pond A12 and the Union Pacific Railroad tracks. Indirect impacts would occur if western snowy plovers do not nest in the impoundment, or nest in a reduced portion of the impoundment, as a result of the raising of the levee along Pond A12. Plovers may not nest close to the levee because it would block plovers' view of a larger proportion of the area from which avian predators may approach the impoundment, as compared to the existing low levee. Because this species is Federally Threatened and due to this species' low population numbers, any impacts to this species involving direct take or reduction in suitable foraging or nesting habitat would be significant.

Impacts to western snowy plovers as a result of construction of the Alviso Railroad Spur levee segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Burrowing Owl. Burrowing owls could use the existing railroad berm for nesting. Potential impacts on burrowing owls would depend on the presence of active burrows along this levee segment's alignment; burrowing owls have historically used areas around the Alviso Marina, which is at the western end of the Alviso Railroad Spur levee option. They have also nested at the gate where the railroad spur crosses Grant Road at the entrance to the EEC.

According to the California Burrowing Owl Consortium's guidelines (1993), adverse impacts would occur if (1) disturbance or harassment occurs within 76 meters (about 250 feet) of occupied burrows; (2) burrows and burrow entrances are destroyed; and/or (3) foraging habitat adjacent to occupied burrows is degraded. Using these criteria, disturbing nearby occupied burrows, covering occupied burrows, or losing adjacent foraging habitat would be a significant effect on burrowing owls. Because the presence or absence of burrowing owls is not confirmed under the baseline condition, it is assumed that the owls could use berms that would be affected by this alternative.

Impacts to burrowing owl as a result of construction of the Alviso Railroad Spur levee segment option would be significant. Mitigation would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

California Ridgway's Rail. As described for the Alviso North levee segment option, California Ridgway's rails use salt marsh habitats along Alviso Slough. There would be a temporal loss of habitat for this species with construction of the Alviso Railroad Spur levee segment. Direct disturbance of California Ridgway's rail could occur from the presence of construction equipment and indirect results may result from the loss of habitat. The disturbance of nesting California Ridgway's rails would be a significant impact.

In association with the Shoreline Phase I Project or Phase II of the SBSP Restoration Project (anticipated to begin construction in 2017), California Ridgway's rails could move into tidal marsh habitat once it is restored.

Construction of the Alviso Railroad Spur levee segment option would have direct and indirect impacts to California Ridgway's rail that would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Other Nesting Bird Species. Alameda song sparrows, Bryant's savannah sparrow, and San Francisco common yellowthroats have historically been recorded in the NCM and could use the edge of the marsh for nesting. Other mobile special-status species that forage in the area (such as northern harrier) would likely self-relocate during construction activity and return to the area once construction is complete.

Construction activity could directly affect these sensitive species that might use the edge of marsh habitat along the levee alignment for nesting through direct injury or mortality of individuals (e.g., destruction of active nests). Indirect impacts, such as disturbance of nesting birds outside the footprint, are also expected. These would be significant impacts resulting from construction.

Removing vegetation within the impact area prior to the breeding season would reduce direct impacts on these species by preventing nesting within the construction footprint. If construction must take place during the breeding season for these sensitive bird species, the application of avoidance and minimization measures (AMM-TBR-2 and AMM-TBR-3) would avoid or minimize construction-related effects on these special-status species (and other birds protected under the MBTA).

Impacts to nesting birds, including Alameda song sparrows, Bryant's savannah sparrows, and San Francisco common yellowthroats, as a result of construction of the Alviso Railroad Spur levee segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Special-Status Plant Species. This levee segment option would be close to an area where Congdon's tarplant has been recorded (an upland area associated with the Wastewater Facility property). However, the types of habitat that would be affected by construction do not typically support the species. It favors halophytic or disturbed upland areas; this option would affect 2.4 acres of undisturbed upland habitat, none of it on the Wastewater Facility property. Constructing the Alviso Railroad Spur levee segment is not expected to affect this special-status species.

Impacts on special-status plant species as a result of the Alviso Railroad Spur levee segment option would be less than significant.

Impact TBR-3: 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; this includes fragmentation of existing habitats

Like the previously described north levee alignment, the Alviso Railroad Spur levee section alignment would, for the most part, follow existing berms and levees. For the primary FRM levee, these berms and levees separate habitat types (managed pond from muted tidal marsh, marsh from upland) with the exception of the railroad spur berm that bisects the NCM. The berm through the marsh is a physical barrier, but, because this berm is not currently used for rail transport, local wildlife can move freely across the berm. The new FRM levee would be larger than the existing berm, so some wildlife moving from one side to the other would be more vulnerable to predation. The project includes measures to plant and maintain refugia next to disturbed areas for SMHM. These refugia would also provide some protection for other small mammals and birds.

The levee would be constructed such that wildlife could move across the levee. The existing railroad spur is not currently designated as a recreational trail, and the project would not establish a trail along this levee segment alignment. However, the existing trail along what would be the Alviso North segment would be able to remain in use. Therefore, impediments to wildlife movement would be minor.

Regionally, given the significant amount of wetland habitat that is proposed to be created in the project vicinity, constructing a larger barrier through the NCM is not likely to affect overall salt marsh habitat continuity in the South Bay. At the project level, however, fragmenting the habitat by building a larger barrier could affect the hydrology of the area and how wildlife uses the area. Without installing some way to keep the areas on the north and south sides of the levee hydrologically connected, that part of the marsh on the landward side could become drier over time, and the vegetation and species composition and diversity could change. In order to maintain hydrologic connection and maintain the NCM ecosystem as it currently exists, either the Alviso Railroad Spur levee section would need to have a pumping system to move water between the north and south areas, or there would need to be culverts through the levee. The culverts would need to have flap gates that could be closed during flood events.

Additionally, this situation would have the undesired effect of further complicating the management of water in the NCM and increasing the USFWS's operation and maintenance (O&M) costs. The inland section of the NCM would be even more subject to impacts from flooding due to rain (a smaller area capturing overland flow) or the failure of equipment or structures than it is under the current condition. The future condition of the inland area of the NCM would also very likely degrade. The new FRM levee could discourage wildlife movement from wetland areas along Alviso Slough and near the Alviso Marina because the distance between those areas and the bay side of the levee is too far and because the levee is too high. The new FRM levee would also place a barrier between Artesian Slough and adjacent marsh habitat. Part of the levee would encroach into freshwater marsh habitat associated with the slough, and, while this would not cause a regionally significant loss of freshwater marsh habitat, it could adversely affect the hydrology of these adjacent areas. Given the current condition and sensitivity of the marsh, this alternative would have a significant impact on the NCM ecosystem.

Impacts on wildlife movement as a result of the Alviso Railroad Spur levee segment option would be less than significant.

Impacts on habitat connectivity and habitat fragmentation of the NCM as a result of the Alviso Railroad Spur levee segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Impact TBR-4: Have an effect on a population of existing native resident or migratory species, either directly or through habitat modification

Parts of the Alviso Railroad Spur levee option follow existing berms that separate distinct habitats (managed pond from muted tidal marsh, muted tidal marsh from upland). Where these separations occur, the presence of the new FRM levee is not expected to substantially disrupt or alter current population and habitat trends related to the distinct areas. However, it is acknowledged that a higher levee may restrict wildlife movement for special-status species such as SMHM salt marsh wandering shrews, and snowy plovers and for avocet and stilt chicks that would have reduced visibility and be subjected to greater predation risk associated with lower vegetation cover.

In the very long term, SLC would inundate the part of the NCM on the bay side of the FRM levee, causing it to become pond habitat since the marsh is lower in elevation (due to subsidence) than adjacent bayward land. Tidal waters would likely pond for an extensive amount of time since the current pumping system would probably not drain the marsh quickly enough to prevent drowning of vegetation. This would adversely affect the special-status species that rely on the marsh characteristics of the habitat and could result in permanent habitat changes. It might be possible to restore the marsh back to its current condition after periodic floods, but, eventually, maintenance of the marsh through constant pumping may need to be abandoned.

The long-term loss of the NCM habitat and use by its salt marsh–dependent species with the Alviso Railroad Spur levee segment option would be significant.

In addition to diked marsh habitat impacts discussed in the previous paragraphs, the Alviso Railroad Spur levee option would affect approximately 9 acres of batch pond. As described above for the Alviso North levee option, the loss of this type of habitat in the study area would not result in regionally significant habitat effects.

Impacts on diked marsh habitat as a result of the Alviso Railroad Spur levee segment option would be less than significant.

Impact TBR-5: Conflict with any local policies or ordinances protecting biological resources, such as a tree-preservation policy or ordinance or with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, Recovery Plan, or other approved local, regional, or State habitat conservation plan

As noted in Section 4.3 *Land Use and Planning*, this levee section option is in conflict with the City of San José’s General Plan and with the NCM Management Plan. Section 4.3 *Land Use and Planning* also noted the project would be consistent with the objectives of the Santa Clara Valley Habitat Plan.

Construction activities under the Alviso Railroad Spur levee option would not comply with existing policies and plans; therefore, this impact would be significant.

Alviso South Levee Section Option (Included in Alternative 5)

The Alviso South levee option would start at the Alviso Marina, similar to the other Alviso levee segment options. This alignment would go south from the marina, cross the Union Pacific Railroad tracks (where a flood gate would be installed; see the description of the flood gate and the associated pedestrian bridge under the section titled *Alviso* North *Levee Section Option (Included as Part of* Alternatives 2 and 3) on page 4-312), and then follow the edge of development associated with the community of Alviso (the entire NCM would be on the bayward side of the levee, and the community would be on the landward side). The levee segment would follow Spreckles Avenue before turning northeast along Grand Boulevard until it reaches Artesian Slough, where the levee would turn north. From this point, the levee would follow the same alignment as the Alviso Railroad Spur levee option, skirting the Don Edwards EEC (so that the EEC is on the landward side of the levee) before connecting with the Wastewater Facility levee section at Artesian Slough. This levee section option would separate the NCM from the community of Alviso. Figure 4.7-6 *Habitat Impacts for Alviso South Levee* Section with 15.2-foot NAVD 88 Levee and Bench (Alternative 5) shows the expected habitat impacts of the Alviso South levee segment.

Figure 4.7-6. Habitat Impacts for Alviso South Levee Section with 15.2-foot NAVD 88 Levee and Bench (Alternative 5)

Impact TBR-1: Have an effect on any sensitive natural community identified in local or regional plans, policies, or regulations or by the CDFW or the USFWS

As shown in Table 4.7-3 *Habitat Impacts from Levee Construction and Restoration Actions by Levee Segment and Alternative (in acres)* **Error! Reference source not found.** and on Figure 4.7-6 *Habitat Impacts for Alviso South Levee Section with 15.2-foot NAVD 88 Levee and Bench (Alternative 5)*, constructing the Alviso South levee segment would directly affect about 21.5 acres of wetlands (Waters of the United States); this option would have the second-highest amount of wetland impact of the three Alviso alignment options. Most of the wetland that would be affected with this option (about 20 acres) is edge muted tidal/diked marsh habitat in the NCM. Most of the levee construction would need to encroach into the marsh in order to avoid direct effects on developed areas in the community of Alviso. This option would also affect small areas of wetland and some open water near Alviso Marina and at Artesian Slough. Alternative 5 would not impact riparian or open water habitat.

Construction of the Alviso South Levee option would block the freshwater input from Artesian Slough to a freshwater marsh area near the EEC, west of Artesian Slough. This alternative includes creating a small breach on the west side of the slough to maintain freshwater input to the marsh. The breach would be designed to provide the same level of inflow as provided with the baseline condition and would not cause an increase or decrease in the amount of freshwater marsh.

Impacts on pickleweed in the NCM (see Alviso North discussion for estimating method) due to the construction of the Alviso South levee segment are anticipated to be about 8 acres. Some of this pickleweed is located within the 22 acres of diked marsh habitat in the NCM that would be lost due to construction of the Alviso South levee section. The tidal marsh habitat created through Pond A18 ecosystem restoration would provide more marsh habitat than what would be lost as a result of the levee construction activity habitat impacts. The project, then, would "self-mitigate" for impacts related to the loss of marsh habitat. Although the tidal marsh habitat would not be established immediately, this impact is not considered significant since the project would not result in a net loss of marsh habitat over time.

Impacts on edge muted tidal/diked marsh habitat as a result of the Alviso South Levee Option would be less than significant.

Impact TBR-2: Have an effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by the CDFW or the USFWS

The NCM provides important habitat for a number of special-status species: SMHM, western snowy plover, salt marsh wandering shrew, Alameda song sparrow, Bryant's savannah sparrow, and San Francisco common yellowthroat. As described above, the long-term project-related increase in tidally influenced salt marsh habitat would be far greater than the amount of muted tidal habitat that would be lost with this alternative, which would benefit all of the species listed above except for western snowy plover (for an accounting of tidal marsh created through restoration, see Table 4.6-7 *Post-Restoration Conditions in the Study Area* and Table 4.6-8 *Post-Construction Tidal Marsh Totals in the Study Area*).

Constructing this levee segment could directly affect special-status species discussed below that rely on the muted tidal/diked marsh habitat type. Impacts on listed species could be minimized by discouraging habitat use before construction.

Salt Marsh Harvest Mouse and Salt Marsh Wandering Shrew. The removal of vegetation that SMHM and salt marsh wandering shrew use for cover, direct mortality from construction equipment, and earth movement could all impact individuals. Population densities for these species are low, and impact areas amount to less than 4 acres in tidal areas (brackish, tidal salt, and muted tidal/diked marsh combined), so few individuals are expected to be affected in the construction footprint. Individuals within the construction footprint would tend to naturally move to adjacent undisturbed pickleweed habitat to seek shelter, can be moved into these areas if needed, or can be captured for relocation if found on Federal land. However the loss of individuals would be a significant impact.

Impacts to SMHM and salt marsh wandering shrew as a result of construction of the Alviso South levee segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Impacts to SMHM and salt marsh wandering shrew as a result of loss of habitat due to the construction of the Alviso South levee segment option would be less than significant.

Western Snowy Plover. This levee option would likely have the least impact on western snowy plover. Because this levee option would not affect areas that have historically been used by nesting snowy plovers (such as the area between the eastern edge of Pond A12 and the Union Pacific Railroad tracks), it would not directly affect snowy plovers. Indirect impacts could occur if construction activity disturbs snowy plovers nesting in this area, which would be a significant impact.

Impacts to western snowy plovers as a result of construction of the Alviso South levee segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Burrowing Owl. Burrowing owls could use the existing berm for nesting. Potential impacts on burrowing owls would depend on the presence of active burrows along this levee segment's alignment; burrowing owls have historically used areas around the Alviso Marina, which is at the western end of the Alviso South levee option. They have also nested at the gate where the railroad spur crosses Grant Road at the entrance to the EEC.

According to the California Burrowing Owl Consortium's guidelines (1993), adverse impacts would occur if (1) disturbance or harassment occurs within 76 meters (about 250 feet) of occupied burrows; (2) burrows and burrow entrances are destroyed; and/or (3) foraging habitat adjacent to occupied burrows is degraded. Using these criteria, disturbing nearby occupied burrows, covering occupied burrows, or losing adjacent foraging habitat would be a significant effect on burrowing owls. Because the presence or absence of burrowing owls is not confirmed under the baseline condition, it is assumed that the owls could use berms that would be affected by this alternative.

Impacts to burrowing owl as a result of construction of the Alviso South levee segment option would be significant. Mitigation would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

California Ridgway's Rail. As described for the Alviso North levee segment option, California Ridgway's rails use salt marsh habitats along Alviso Slough. There would be a temporal loss of habitat for this species with construction of the Alviso South levee segment. Direct disturbance of California Ridgway's rail could occur from the presence of construction equipment and indirect results may result from the loss of habitat. The disturbance of nesting California Ridgway's rails would be a significant impact.

California Ridgway's rails could move into tidal marsh habitat once it is restored (in association with the Shoreline Phase I Project or Phase II of the South Bay Salt Pond Restoration Project [anticipated to begin construction in 2017]).

Impacts to California Ridgway's rail as a result of construction of the Alviso South levee segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Other Nesting Bird Species. Construction activity could directly affect special-status bird species that might use habitats along the levee alignment for nesting. If feasible, all construction activities will occur outside the breeding season. If construction must take place during the breeding season for Alameda song sparrows, Bryant's savannah sparrows, and San Francisco common yellowthroats, the application of AMMs (AMM-TBR-2 and AMA-TBR-3) intended to protect these species would minimize construction-related effects on these species and local populations of common birds (which are protected under the MBTA) but significant affects are still possible.

Impacts to nesting birds including Alameda song sparrows, Bryant's savannah sparrows, and San Francisco common yellowthroats, as a result of construction of the Alviso South levee segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Listed Plants. This levee segment is not known to support any listed or sensitive plant species. Constructing the Alviso South levee segment is not expected to affect special-status species.

Impacts on special-status plant species as a result of the Alviso South levee segment option would be less than significant.

Impact TBR-3: 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; this includes fragmentation of existing habitats

The pond berms and levees along which the Alviso South levee alignment would be constructed currently separate distinct habitat types (marsh from developed areas of Alviso). Building a levee on this alignment would have minimal effects on wildlife movement, habitat connectivity, and habitat fragmentation. The levee would be constructed so that wildlife could move across it, but there would likely be little back-and-forth migration given the urban setting on the south side of the levee. A levee following this alignment would not affect local or regional biodiversity.

The construction-related impacts of the Alviso South levee option on wildlife movement, habitat connectivity, habitat fragmentation, and biodiversity would be less than significant.

Impact TBR-4: Have an effect on a population of existing native resident or migratory species, either directly or through habitat modification

The Alviso South levee alignment would be constructed primarily on the roads and marsh adjacent to the community of Alviso. However, as described above for the Alviso Railroad Spur levee segment, SLC could inundate the NCM, converting it to pond habitat. The impact of the Alviso South levee segment option on the NCM would be greater than that of the Alviso Railroad Spur levee segment because more of the marsh would be on the bay side of the new FRM levee (and therefore subject to tidal inundation).

As described above for TBR-4 in the section *Alviso Railroad Spur Levee Section Option (Included in Alternative 4),* this change would adversely affect the special-status species that rely on the diked marsh characteristics of the area. In the future, it might be possible to restore the marsh to its current condition, but such restoration over time would become increasingly difficult and would most likely be abandoned (B. Buxton pers. comm. 2013).

The long-term loss of the NCM habitat and its salt marsh–dependent species associated with the Alviso South levee segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

The Pond A12 levee segment would also be constructed between two distinct types of habitat: batch pond recently restored to tidal marsh (Pond A12 would be breached at about the same time as levee construction is completed, in 2020 or 2021) and seasonal wetland (saline flat that is impounded by the Union Pacific Railroad tracks). The levee would result in the loss of about 7 acres of batch pond associated with Pond A12. As described above, the loss of this type of habitat in the study area would not result in regionally significant habitat effects.

Impacts on batch pond habitat associated with the Alviso South levee segment option would be less than significant.

Impact TBR-5: Conflict with any local policies or ordinances protecting biological resources, such as a tree-preservation policy or ordinance or with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, Recovery Plan, or other approved local, regional, or State habitat conservation plan

As noted in Section 4.3 *Land Use and Planning*, this levee section option is consistent with the objectives of the Santa Clara Valley Habitat Plan, but is not consistent with the USFWS's ongoing management of the NCM. The alignment would not protect the NCM from future flooding, and as the marsh elevation has subsided it would likely convert to open water.

Construction activities under the Alviso South levee option would not comply with existing policies and plans; therefore, this impact would be significant.

WPCP South Levee Section and Artesian Slough Tide Gate

The WPCP South levee section would generally follow existing levees along the southern edge of Pond A18. Land located to the south of this levee alignment includes the Wastewater Facility property, a former landfill site, former sewage drying ponds, and wetlands east of Artesian Slough. Pond A18 would be subject to ecosystem restoration starting in about 2021 (Year 3). Alternative 3, which would construct a 15.2-foot NAVD 88 levee and a 30:1 ecotone along Pond A18, has a larger footprint than all of the other alternatives and would therefore affect a larger area. Alternative 2, with a 12.5-foot NAVD 88 levee, has a narrower footprint than Alternatives 4 and 5, which have 15.2-foot NAVD 88 levees; however, the difference in levee widths (10.2 feet) associated with the 12.5-foot NAVD 88 levee versus the 15.2-foot NAVD 88 levee makes habitat impacts from Alternatives 2, 4, and 5 very similar in magnitude.

Figure 4.7-7 *Habitat Impacts for WPCP South Section with 12.5-foot NAVD 88 or 15.2-foot NAVD 88 Levee and Bench (Alternatives 2, 4, and 5)* and Figure 4.7-8 *Habitat Impacts for WPCP* South Levee Section with 15.2-foot NAVD 88 Levee and 30:1 Ecotone (Alternative 3) show the expected habitat impacts of the WPCP South levee segments for a 12.5-foot NAVD 88 levee or 15.2-foot NAVD 88 levee with bench [Figure 4.7-7 *Habitat Impacts for WPCP South* Section with 12.5-foot NAVD 88 or 15.2-foot NAVD 88 Levee and Bench (Alternatives 2, 4, and 5)) and a 15.2-foot NAVD 88 levee with 30:1 ecotone (Figure 4.7-8 *Habitat Impacts for WPCP* South Levee Section with 15.2-foot NAVD 88 Levee and 30:1 Ecotone (Alternative 3)], respectively. Separate maps for Alternatives 2, 4, and 5 with bench are not provided (i.e., at this geographic scale, they appear the same); however, there would be an additional 0.7 acre of impacts for the 15.2-foot NAVD 88 levee (Alternatives 4 and 5), as compared to the 12.5-foot NAVD 88 levee (Alternative 2).

Figure 4.7-9 *Proximity of Alternative 3 to Legacy Sewage Ponds on the Wastewater Facility Property* shows the proximity of Alternative 3 to the former sewage ponds on the Wastewater Facility property. These ponds are no longer used as part of the Wastewater Facility and have recently been identified as active wetlands. These “legacy sewage pond” areas likely provide valuable habitat for SMHM. As shown on Figure 4.7-9 *Proximity of Alternative 3 to Legacy Sewage Ponds on the Wastewater Facility Property*, Alternative 3, which would have a larger levee footprint than Alternatives 2, 4, and 5, would not directly affect these legacy sewage pond wetlands. Given the addition of permanent (O&M; 15 feet) and temporary (construction period only; 15 feet) easements (total of 30 feet from foot of levee during construction; shown on Figure 4.7-9 *Proximity of Alternative 3 to Legacy Sewage Ponds on the Wastewater Facility Property*), proximity to the ponds becomes close, so fencing and other control measures to protect the legacy ponds would be implemented in coordination with Wastewater Facility staff as part of the project.

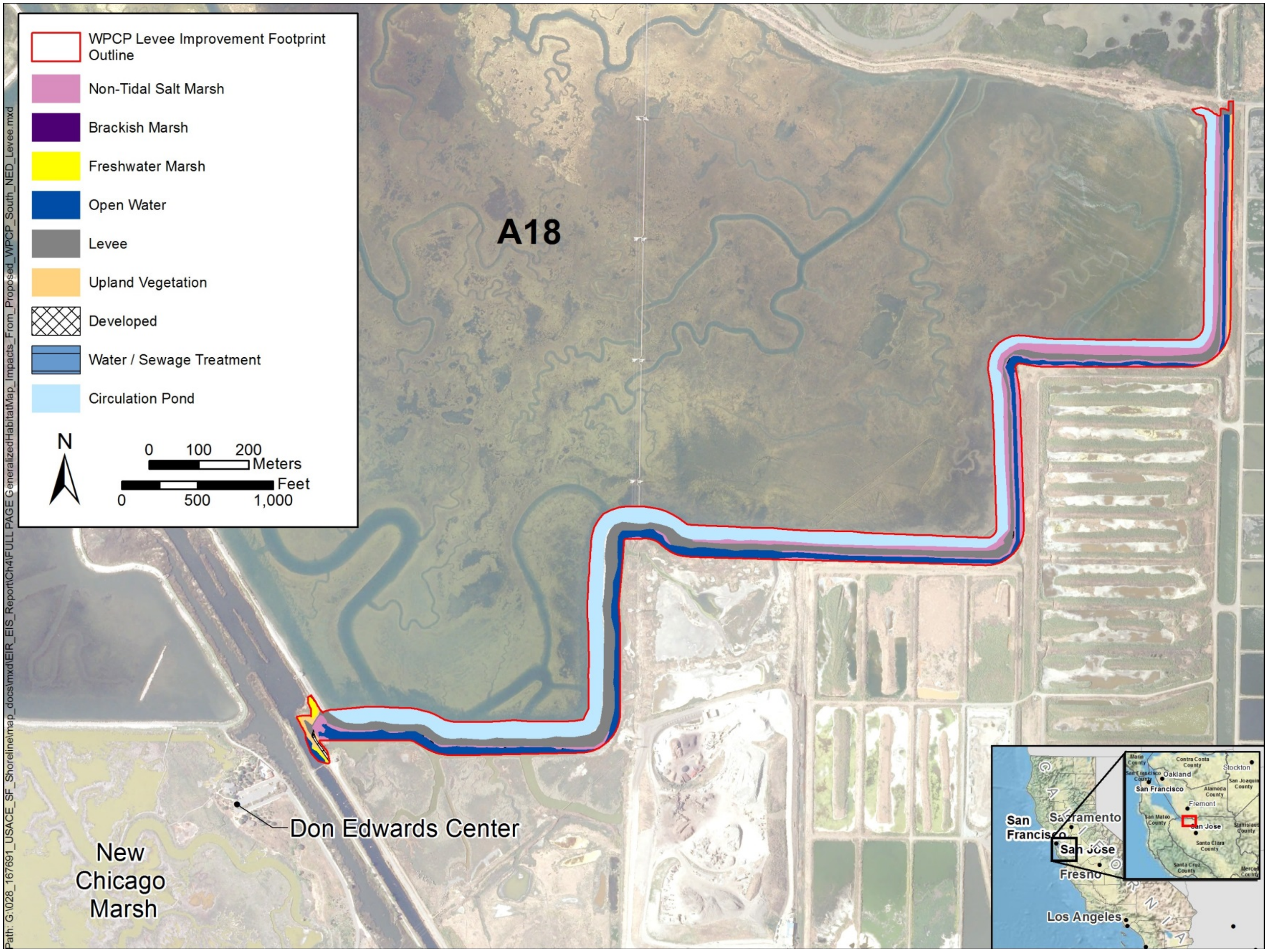

Figure 4.7-7. Habitat Impacts for WPCP South Section with 12.5-foot NAVD 88 or 15.2-foot NAVD 88 Levee and Bench (Alternatives 2, 4, and 5)

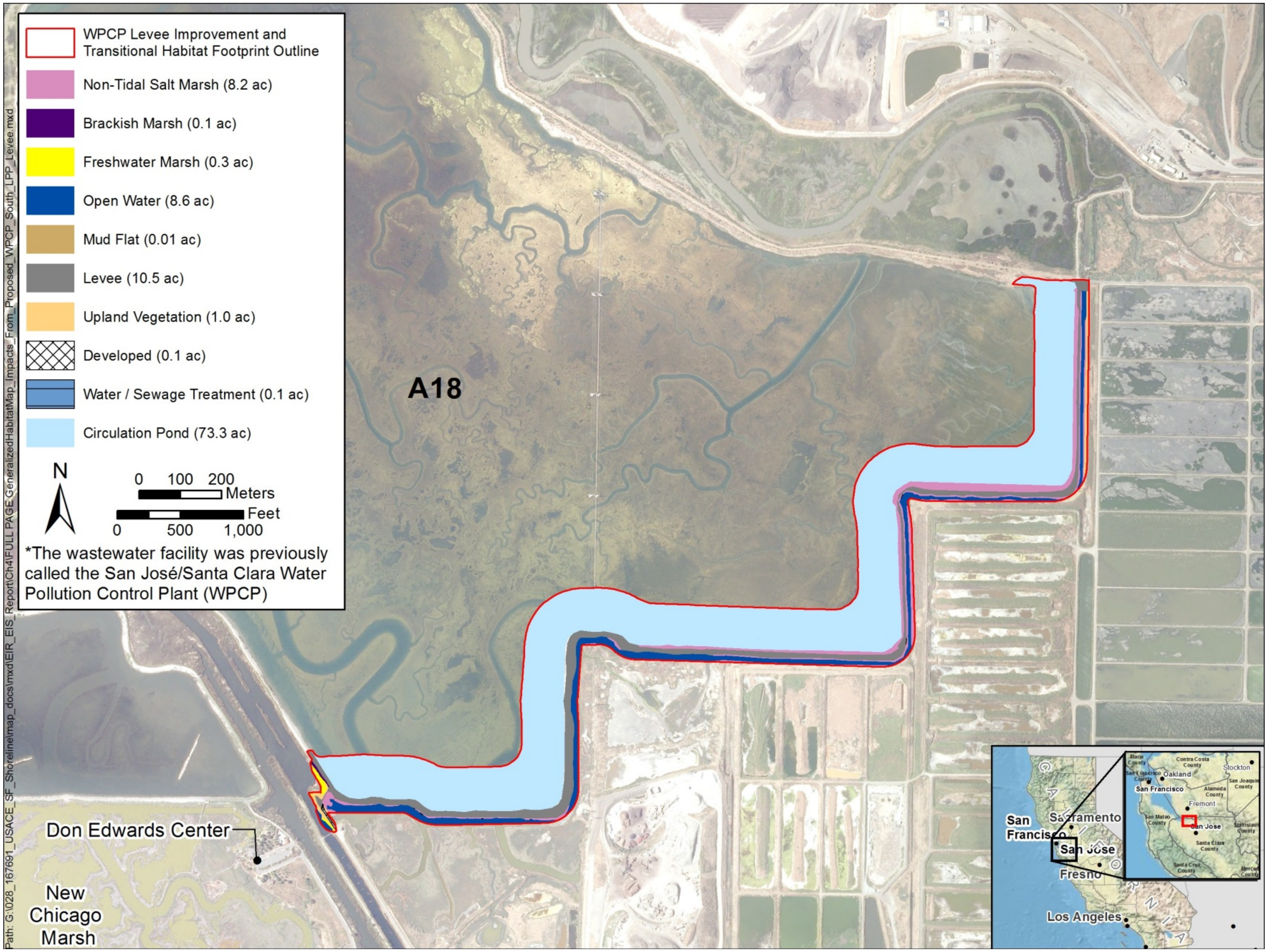

Figure 4.7-8. Habitat Impacts for WPCP South Levee Section with 15.2-foot NAVD 88 Levee and 30:1 Ecotone (Alternative 3)

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Figure 4.7-9. Proximity of Alternative 3 to Legacy Sewage Ponds on the Wastewater Facility Property

The following sections describe the construction effects of the WPCP South levee segment and tide gate at Artesian Slough that is common to all alternatives; discussion of ecosystem restoration options (including transitional habitat) is included in Section 4.7.2.4.2.2 *Ecosystem Restoration Construction Effects*.

Impact TBR-1: Have an effect on any sensitive natural community identified in local or regional plans, policies, or regulations or by the CDFW or the USFWS

As shown on Figure 4.7-7 *Habitat Impacts for WPCP South Section with 12.5-foot NAVD 88 or 15.2-foot NAVD 88 Levee and Bench (Alternatives 2, 4, and 5)* and Figure 4.7-8 *Habitat Impacts for WPCP* South Levee Section with 15.2-foot NAVD 88 Levee and 30:1 Ecotone (Alternative 3), constructing this levee section would directly affect edge habitats associated with Pond A18. Given essentially identical levee footprints (i.e., the only differences between the 12.5-foot NAVD 88 or 15.2-foot NAVD 88 levees are 1.7 feet of height and 10.2 feet of width; transitional habitat is discussed separately below), the maximum fill from any of the levee alternatives would be 8.6 acres of marsh habitats (8.2 acres of non-tidal salt marsh, 0.1 acre of brackish marsh, and 0.3 acre freshwater marsh), and 8.6 acres of open-water habitat along the edge of Pond A18, and 0.1 acre of mudflat in Artesian Slough.

The WPCP South levee segment would block a connection between Pond A18 and an area of non-tidal salt marsh and other wetland habitats behind the Pond A18 berm. In a triangle marsh area between Artesian Slough and the Pond A18 berm (Figure 4.7-1 *Shoreline Phase I Study Area and Terrestrial Biological Study Area* Habitat), there are approximately 25 acres of non-tidal salt marsh (the "Artesian Corner wetlands"). This marsh area was created through previous City of San José mitigation requirements and currently receives limited water from Artesian Slough through a culvert in the Pond A18 berm. The culvert is immediately downstream of the Wastewater Facility weir in Artesian Slough.

In addition, this area receives localized surface runoff. Water flows in a channel/ditch parallel to the Pond A18 berm through the Artesian Corner wetlands into the adjacent Zanker Landfill property. Due to limited flows from an insufficient hydrologic connection, the wetlands in this area (the "Zanker Landfill wetlands") are in a degraded condition. There is also an additional gated culvert through the Pond A18 berm that provides some limited connection with Coyote Creek via the Reach 1A mitigation site (a managed mitigation wetland that serves as a flood bypass for Coyote Creek and is located north of the legacy sewage ponds and south of Newby Island landfill).

To avoid blocking tidal flows with the construction of a FRM levee, both alternatives (12.5-foot NAVD 88 and 15.2-foot NAVD 88 levee) include a tide gate closure system across Artesian Slough and construction of a structure to replace the culvert that provides water to the Artesian Corner wetlands. This type of tide gate opens when the force on the gate's upstream side exceeds the force on the gate's downstream side. Under varying tide and storm conditions (i.e., normal, the 1-percent and 0.1-percent ACE tide conditions), the tide gate would be open more fully during low tides and less open during high-tide conditions. This fluctuation would allow daily tidal flows into wetland areas behind the FRM levee.

At some point in the future, with the onset of SLC, a pump station would likely be required to ensure that the Wastewater Facility's effluent continues to discharge against the tide gate. With a pump station in operation during extreme tidal events, the tide gate would never be closed, since the pump station would assist the discharge of the effluent against the higher tidal pressure under these extreme events and would be closed only during extreme flood events because the downstream tidal water surface elevation would be greater than the upstream side and would prevent tidal flows from flowing inland, thus protecting the surrounding human infrastructure.

With or without the project, the Wastewater Facility would need to develop a plan to pump or store waters during such events given increases in bay water levels that correspond with future SLC scenarios. During these extreme storm events, flooding of the NCM could also occur due to capacity constraints of the interior drainage system; however, the availability of facility pumps or the capacity to store excess waters could lessen the impacts to the marsh areas. Since the construction of the FRM levee would remove the current connection to the Artesian Corner wetlands, all alternatives also include a water control structure that would then be constructed behind the tide gate, upstream of the FRM levee, to maintain the flows to these wetland areas.

It may be possible through detailed project design or value engineering evaluations to modify the levee alignment in Pond A18 to avoid hydrological impacts on these wetland areas by, for example, rerouting the levee to go behind the Artesian Corner wetland area. Or, the levee alignment where the Pond A18 berm meets Coyote Creek could be shifted farther south through the Wastewater Facility's legacy sewage pond area (an area that the Wastewater Facility Plant Master Plan identifies as future wetland and flexible space) to increase the Coyote Creek riparian delta and improve habitat diversity in the project area. Such changes would decrease the estimated wetland fill impacts, depending on the final design, and would be desirable if they avoided impacts on existing wetlands or had other ecological benefits. However, since the project has not yet undergone further design, and since any changes would have to be made in coordination with Wastewater Facility management, this possibility is still speculative and cannot be included as a measure to avoid a significant impact.

Construction of the tide gate and water control structure would require small amounts of wetland fill. Because the overall project would ultimately result in an increase in salt marsh habitats, the minor losses of wetlands associated with this levee segment are not significant when considered at the project level.

Pickleweed losses along the WPCP South alignment segment were also estimated from aerial photographs, since no detailed habitat information currently exists. Since the pickleweed largely occurs adjacent to the existing non-engineered dike, impacts would be similar for all alternatives, regardless of whether the levee is coupled with a bench or the 30:1 ecotone. Estimated impacts from losses of pickleweed along the existing non-engineered Pond A18 levee (on the pond side only) are approximately 15 acres. Loss of this habitat would be potentially significant, but, because of the overall project increases in this habitat long term, these temporary losses are not significant when considered at the project level.

Impacts on wetlands, tidal, and other sensitive habitats associated with the WPCP South levee section option would be less than significant.

Impact TBR-2: Have an effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by the CDFW or the USFWS

This segment would result in edge loss of batch pond and developed habitats. The habitats might be occasionally used by special-status species (e.g., least terns might forage in batch ponds), but the batch pond and developed habitat losses associated with this segment are not expected to adversely affect any special-status species.

Salt Marsh Harvest Mouse and Salt Marsh Wandering Shrew. The removal of vegetation that SMHM uses for cover, directly mortality from construction equipment, and earth movement could all impact individual SMHM. Population densities for this species are low, and impact areas amount to less than 4 acres in tidal areas (brackish, tidal salt, and muted tidal/diked marsh combined), so few individuals are expected to be affected in the construction footprint. Individuals within the construction footprint would tend to naturally move to adjacent undisturbed pickleweed habitat to seek shelter, can be moved into these areas if needed, or can be captured for relocation if found on Federal land. However the loss of individual SMHM would be a significant impact.

The BOs for the Shoreline Phase I Project recognize that the project could affect SMHM but concluded that the level of anticipated take associated with levee construction is not likely to result in jeopardy to the species.

Impacts to SMHM and salt marsh wandering shrew as a result of construction of the WPCP South segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Impacts to SMHM and salt marsh wandering shrew as a result of loss of habitat due to the construction of the WPCP South segment option would be less than significant.

Western Snowy Plover. The WPCP South segment is not adjacent to habitat utilized by the western snowy plover. The plover is not known to breed in Pond A18 or in the adjacent Wastewater Facility property.

Impacts to western snowy plovers as a result of construction of the WPCP South levee segment option would be less than significant.

Burrowing Owl. Berms and levees that would be under the FRM levee footprint could provide burrowing owl habitat, so covering of these areas could lead to a loss of burrowing owl habitat and potentially burrowing owl individuals, which would be a significant impact.

According to the California Burrowing Owl Consortium's guidelines (1993), adverse impacts would occur if (1) disturbance or harassment occurs within 76 meters (about 250 feet) of occupied burrows; (2) burrows and burrow entrances are destroyed; and/or (3) foraging habitat adjacent to occupied burrows is degraded. Using these criteria, disturbing nearby occupied burrows, covering occupied burrows, or losing adjacent foraging habitat would be a significant effect on burrowing owls. Because the presence or absence of burrowing owls is not confirmed under the baseline condition, it is assumed that the owls could use berms that would be affected by this alternative.

Impacts to burrowing owl as a result of construction of the WPCP South levee segment option would be significant. Mitigation would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

California Ridgway's Rail. California Ridgway's rail is a salt marsh–dependent species. The WPCP South segment would not impact salt marsh habitat, therefore the alignment would not have a significant effect on California Ridgway's rail.

Impacts to California Ridgway's rail as a result of construction of the WPCP South levee segment option would be less than significant.

Other Nesting Bird Species. This levee segment would not disturb upland habitats associated with the Wastewater Facility. Construction activity in the developed areas could temporarily disturb upland special-status birds (such as loggerhead shrike, white-tailed kite, and northern harrier) that use the Wastewater Facility buffer lands for foraging, but these species would likely move away from the area and forage on other uplands in the vicinity, as available. After construction, temporarily displaced species could again use areas adjacent to the levee. These temporary construction effects would not be significant.

Construction activity could directly affect common upland bird species that might use habitats along the levee alignment for nesting. Disturbance of nesting birds would be a significant effect. If feasible, all construction activities will occur outside the breeding season (AMM-TBR-2). If construction must take place during the breeding season for these upland bird species, the impact could be significant.

Impacts to nesting birds including Alameda song sparrows, Bryant's savannah sparrows, and San Francisco common yellowthroats, as a result of construction of the WPCP South levee segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Special-Status Plant Species. Congdon's tarplant, a special-status plant, has been recorded in an upland areas associated with the Wastewater Facility and in the Refuge. Disturbance of a colony of Congdon's tarplant would be a significant impact.

Construction would be limited to the already-disturbed edge of the Wastewater Facility property. This species can occupy disturbed habitat. However, the levee construction would affect only approximately 1 acre of upland habitat. Since protocol level surveys have not been conducted to determine the presence of Condon's tarplant and it is known to occur nearby, it is possible for a colony to establish prior to construction, a significant impact is assumed.

Impacts on Congdon's tarplant associated with the WPCP South levee section construction could be significant. Mitigation would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Impact TBR-3: 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; this includes fragmentation of existing habitats

The WPCP South levee segment would mostly follow existing barriers (non-engineered pond dikes and berms), so building a new, engineered FRM levee on this alignment would have minimal effects on wildlife movement, habitat connectivity, and habitat fragmentation. Habitats on either side of the levee alignment are already different (e.g., former salt pond on one side and non-tidal marsh on the other). The new FRM levee would be taller and wider than existing berms and non-engineered dikes, so some wildlife, such as small mammals and ground-dwelling birds, would be more vulnerable to predation as they move from one side to the other. The project includes measures that encourage the maintenance of refugia next to disturbed areas for SMHM and other small mammals and birds. The levees would be constructed such that wildlife could move across the levee. However, dispersal by SMHM across a broad, bare-topped levee would occur very infrequently. Under long-term management of the area, this levee segment (along with one of the Alviso levee segments) would be used as a recreational trail. This planned trail use could affect wildlife movement in the future. This long-term impact is discussed in the section *Least Terns* on page 4-367.

The construction-related impacts of the WPCP South levee segment on wildlife movement, habitat connectivity, and habitat fragmentation would be less than significant.

Impact TBR-4: Have an effect on a population of existing native resident or migratory species, either directly or through habitat modification

Much of the WPCP South levee segment would be constructed on the edge of an area that is already disturbed (Wastewater Facility property and former landfill site). Constructing the levee would provide FRM to an area behind (upstream from) it and thus could ultimately lead to changes in these landward habitats by modifying surface hydrology. For most of the area, the impacts would affect already developed or previously disturbed upland areas. Changing the flood hydrology in these areas would not substantially change the overall landward habitat trends.

Constructing this levee segment is not expected to affect long-term wildlife population trends in the area because the types of habitats on either side of the existing berms and levees originally built for salt pond use are very different and are used by very different types of wildlife populations. Some species might live in one habitat and forage in another, but, as described above, this levee section would not prevent movement between habitats. Because it would not substantially change habitat types on either side of the levee, constructing the WPCP South levee segment would not affect any long-term population trends.

The construction-related impacts of the WPCP South levee segment on population and habitat trends would be less than significant.

Impact TBR-5: Conflict with any local policies or ordinances protecting biological resources, such as a tree-preservation policy or ordinance or with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, Recovery Plan, or other approved local, regional, or State habitat conservation plan

Most of the land that the WPCP South levee segment abuts is owned by the City of San José. As described in Section 4.3 *Land Use and Planning*, constructing the FRM levee through this area is consistent with the City's General Plan and Santa Clara Valley Habitat Plan. Constructing the WPCP South levee segment on its proposed alignment would not conflict with any adopted policies or plans.

Construction activities under the WPCP South levee option would comply with existing policies and plans; therefore, this impact would be less than significant.

4.7.2.4.2.2 Ecosystem Restoration Construction Effects

All of the action alternatives include basic in-pond preparation prior to breaching and some level of transitional habitat (for a description of the proposed ecosystem restoration activities, see Section 4.6.2.3.2 *Action Alternatives*). Alternatives 2, 4, and 5 include a transitional habitat bench for Ponds A12, A13 and A18, while Alternative 3 includes a 30:1 ecotone transitional habitat for the same footprint. The following sections focus on the general impacts associated with the different in-pond restoration activities (common to all alternatives; described in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*) coupled with either a 50-foot bench or a 30:1 ecotone.

Pond Preparation and Breaching

The Shoreline Phase I Project incorporates avoidance and minimization measures to ensure that construction-related effects on special-status species and sensitive natural communities are minimized. Specific measures are listed above; general avoidance measures include AMM-TBR-1, AMM-TBR-4, AMM-TBR-5, AMM-TBR-6, AMM-TBR-7, AMM-TBR-8, AMM-TBR-12, AMM-TBR-16, AMM-TBR-17, AMM-TBR-18, AMM-TBR-19, AMM-TBR-20, AMM-TBR-21, AMM-TBR-22, AMM-TBR-23, and AMM-TBR-25.

Impact TBR-1: Have an effect on any sensitive natural community identified in local or regional plans, policies, or regulations or by the CDFW or the USFWS

Construction would cause the immediate loss of some sensitive habitats. Currently, marshes on the outboard side of levees, such as those along Coyote Creek and Alviso Slough, provide important salt marsh habitat for salt marsh–dependent special-status species such as California Ridgway's rail, black rail, SMHM, salt marsh wandering shrew, and Alameda song sparrow. Levee breaches could lead to the permanent loss of small areas of salt marsh habitat. Estimated loss of pickleweed-inclusive habitat (dominant or secondary species in detailed habitat mapping) or bulrush-dominated habitat from outboard levee breaches would total 4.2 acres across all ecosystem restoration phases. Ecosystem restoration would also result in very minor amounts of mudflat losses in areas near outboard levee breaches along Coyote Creek and Alviso Slough.

Construction-related losses of pickleweed-dominated tidal marsh would occur when outboard levees are breached along the Coyote Creek and Alviso Slough corridors. Restoration activities would cause the direct loss of about 3.5 acres of pickleweed-dominated habitat (less than 1 percent of the total amount of pickleweed habitat in the study area). These corridors are relatively narrow, although the Coyote Creek corridor is adjacent to Triangle Marsh, which is one area that provides a valuable contiguous area of pickleweed-dominated habitat.

Impacts on batch pond, brackish marsh, and salt marsh habitats resulting from ecosystem restoration construction activities associated with all alternatives would be less than significant.

Impacts on tidal marsh ecosystems resulting from ecosystem restoration construction activities associated with all alternatives would be beneficial under the NEPA and less than significant under the CEQA.

Impact TBR-2: Have an effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by the CDFW or the USFWS

As mentioned in Section 4.7.1.2.2.1 *General Vegetation in and near the Shoreline Phase I Study Area*, marshes on the outboard side of levees along Coyote Creek and Alviso Slough provide salt marsh habitat. This habitat type is important for several saltmarsh– dependent special-status species. Impacts on these species are discussed below. Habitat for western pond turtle and sensitive plant species is not located in areas where restoration activities would occur, and there would be no impact to these resources.

Salt Marsh Harvest Mouse and Salt Marsh Wandering Shrew. The narrow corridors of pickleweed-dominated tidal marsh habitat along the sloughs are important for dispersal of SMHM and salt marsh wandering shrews between core habitat areas, such as along the sloughs and Triangle Marsh and areas restored as part of the SBSP Restoration Project. Therefore, even the limited habitat present in these corridors has high value as dispersal habitat.

Tidal marsh habitat created through Pond A18 restoration would provide more SMHM habitat than what would be lost as a result of the overall ecosystem restoration activity habitat impacts. The project, then, would “self-mitigate” for impacts related to loss of SMHM (and therefore, salt marsh wandering shrew) habitat.

In addition, because the project would result in a long-term increase in tidal marsh habitat and because tidal restoration would be phased, new pickleweed-dominated habitat is expected to form from early phases of restoration before later breaching actions and associated scour occur. Such benefits are expected to occur before short-term reductions in dispersal capability have substantial effects on populations of SMHM and salt marsh wandering shrews in core habitat areas.

Short-term, construction-related impacts on pickleweed-dominated habitat and occupant species would be less than significant.

Western Snowy Plover. Western snowy plover that forage and/or nest in the area may self-relocate during construction activity and return to the area once construction is complete. Pond preparation is not expected to affect plovers when they are foraging, and construction would not occur during the nesting season if nesting birds are present.

One of the potential steps in preparing ponds for breaching is drying of the area in order to access the pond with equipment to construct berms or ditch blocks. However, plovers use dry pond bottoms, isolated islands, and levees in salt production and managed ponds for nesting (Pitkin and Wood, eds., 2011). Therefore, this step would be dependent on relative closeness to snowy plover nesting season (i.e., would not occur during nesting season) and/or if bird access to area can be restricted, as dried pond areas invite snowy plover nesting, which can halt construction.

Applying avoidance and minimization measures intended to protect nesting western snowy plovers and other special-status species would minimize effects on these special-status species (AMM-TBR-9: Pond Levels for Snowy Plover). The BOs for the Shoreline Phase I Project recognize that the project could affect western snowy plover but concluded that the level of anticipated take associated with ecosystem restoration activity is not likely to result in jeopardy to the species. However, because this species is Federally Threatened and due to this species' low population numbers, any impacts to this species involving direct take or reduction in suitable foraging or nesting habitat would be significant. The ecosystem restoration portion of the project requires no mitigation. The avoidance and minimization actions to reduce incidental take of the snowy plover that are associated with the FRM levee are necessary under ESA and the Biological Opinion; this is not compensatory mitigation under NEPA.

Impacts on nesting western snowy plovers as a result of pond breaching would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Burrowing Owl. Construction activity on existing berms could adversely affect upland birds that use the habitats for nesting. As described in the discussions of the Alviso and WPCP levee options, burrowing owls have been recorded using these habitats. Because the presence or absence of burrowing owls is not confirmed under the baseline condition, it is assumed that the owls could use berms that would be affected by this alternative, which is a significant impact.

Direct impacts on burrowing owls resulting from ecosystem restoration construction activities associated with all alternatives would be significant.

Impacts to burrowing owl as a result of construction of the levee breeches would be significant. Mitigation would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

California Ridgway's Rail. Direct disturbance or Ridgway's rail could occur from the presence of construction equipment and indirect results may result from the loss of habitat. Construction activities would be limited in location and duration; however, the disturbance of nesting

Ridgway's rails would be a significant impact. The BOs for the Shoreline Phase I Project recognize that the project could affect California Ridgway's rail but concluded that the level of anticipated take associated with levee construction is not likely to result in jeopardy to the species.

Impacts to California Ridgway's rail as a result of ecosystem restoration construction activities would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Black Rails and Other Marsh Birds. Black rails and other avian species that use marsh habitat on the outboard side of levees are more mobile than the SMHM and salt marsh wandering shrew and are therefore expected to be able to disperse among core habitat units even if short-term marsh loss due to breaching and erosion occurs. If feasible, all construction activities will occur outside the breeding season.

Impacts on black rails and other marsh birds resulting from ecosystem restoration construction activities associated with all alternatives would be less than significant.

Other Nesting Bird Species. Alameda song sparrows, Bryant's savannah sparrow, and San Francisco common yellowthroats have historically been recorded in the NCM and could use the area for nesting. Cormorants also use Ponds A9-15 interior levees for nesting but after construction are expected to use high tide refugia and islands resulting from tidal restoration actions. Other mobile special-status species that forage in the area (such as northern harrier) would likely self-relocate during construction activity and return to the area once construction is complete. Direct impacts resulting from construction activity could include direct injury or mortality of individuals (e.g., destruction of active nests). Loss of active nests or chicks would be a significant impact.

Construction activity could directly affect these sensitive species that might use the edge of marsh habitat along the levee alignment for nesting through direct injury or mortality of individuals (e.g., destruction of active nests). Indirect impacts, such as disturbance of nesting birds outside the footprint, are also expected. Removing vegetation within the impact area prior to the breeding season would reduce direct impacts on these species by preventing nesting within the construction footprint.

Impacts to nesting birds including Alameda song sparrows, Bryant's savannah sparrows, and San Francisco common yellowthroats, as a result of construction of the Alviso North levee segment option would be significant. Additional minimization measures would be required to address this impact (see Section 4.7.3 Additional Minimization Measures*).*

Impact TBR-3: 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; this includes fragmentation of existing habitats

Ecosystem restoration construction activity could disturb the movement patterns of some wildlife species. Mobile species, such as birds, would likely self-relocate during construction, similar to that described during FRM levee construction. Depending on the species affected, they might or might not return to the area following the completion of construction, since ecosystem restoration activities would result in habitat changes. The long-term effects of these habitat changes are discussed in Section 4.7.2.4.2.3 *Operation and Maintenance Effects*. In general, self-relocation and the limited duration and area of construction activity would prevent significant impacts on mobile species such as common large mammals and birds.

Less mobile species, such as small mammals, might not be able to avoid direct construction-caused effects. The habitat connectivity for these animals could be lost, and they could be isolated from other nearby but no longer adjacent habitats. Construction monitoring would focus on special-status species such as SMHM, but preventative actions taken to benefit special-status species could also benefit common species. The amount of habitat that could potentially be isolated is minor (for example, small mammals using the outboard side of levees along Alviso and Coyote Slough could become isolated when levees are breached and gaps are created). Because the amount of habitat disconnected would be minor and because special-status species monitoring and actions could benefit other common species, impacts on small mammals and other less-mobile wildlife species (such as common reptiles and invertebrates) would be less than significant.

PG&E overhead power transmission lines and towers are located throughout the project area. The USFWS and PG&E have an operations and maintenance agreement for transmission lines and towers that are located on Federal land (in the Refuge). For Pond A18, which is owned and managed by the SCVWD as part of the Wastewater Facility property, the SCVWD would work with PG&E to identify and implement upgrades that ensure that the existing transmission infrastructure can withstand inundation, tidal changes, and wave splashing. Necessary modifications would be implemented concurrently with other pond preparation activity, thus avoiding future potential construction-related impacts to restored tidal marsh areas. Modifications could include replacing towers and footings, repairing concrete footings, or raising and modifying towers.

Restoring tidal marsh could also affect how and when PG&E accesses its infrastructure for maintenance. For example, introducing tidal inundation could prevent using existing access boardwalks in Pond A18 because the boardwalks could be under water. The Proposed Action includes upgrades to the existing boardwalk system to raise the boardwalks to provide clearance for tidal fluctuation and storm surges. No fill material would be used during construction, and all of the boardwalk material below the water line would be plastic. Untreated lumber would be used for the headers and boardwalk planks.

PG&E would continue routine maintenance of its infrastructure. Maintenance and repair activities include aerial and ground patrols and inspections; insulator washing and replacement; management of problems associated with bird roosting and nesting materials; repairs due to bird electrocutions or collisions; and foundation and structural repairs.

In order to minimize impacts to utility infrastructure in Pond A18, impacts on PG&E's ability to access this infrastructure, and indirect impacts to biological resources from ongoing and future PG&E maintenance and repair activities, the project partners would coordinate with

PG&E and other regulatory agencies including the CDFW, the RWQCB, the BCDC, the USFWS, and the NMFS to obtain all necessary permits for long-term operation and maintenance. Coordination would include the inclusion of PG&E facility improvements and access requirements in permit applications, identification of appropriate times and methods to access the lines and towers for maintenance and repair (e.g., restriction of work during breeding seasons), or alternative methods of access (e.g., use a helicopter instead of ground-based equipment). These avoidance and minimization measures would be included in all applicable permits. The project partners would also coordinate with PG&E and the USFWS to ensure that PG&E's ongoing maintenance and operations activities in and around Pond A18 are included in the BO for the project.

Construction activity is not expected to result in significant biodiversity changes in the short term for the study area.

Impacts on wildlife movement, habitat connectivity, habitat fragmentation, and biodiversity resulting from ecosystem restoration construction activities associated with all alternatives would be less than significant.

Impact TBR-4: Have an effect on a population of existing native resident or migratory species, either directly or through habitat modification

In addition to wildlife species that are present in tidal marsh habitats (discussed above), populations of birds that nest in nearby habitats may be adversely affected by construction activities. Such species include the double-crested cormorant, Caspian tern, Forster's tern, black skimmer, California gull, American avocet, black-necked stilt, and western snowy plover.

Because these species nest on levees and islands, tidal restoration activities such as breaching and pond enhancement activities could result in the direct alteration of areas where these birds nest and could affect local population trends. As described in greater detail in Section 4.7.1.2.7 *Birds*, more than 75 species of waterbirds regularly use the ponds, tidal marshes, mudflats, and subtidal habitats surrounding managed marshes, water treatment plants, and managed ponds in the greater South Bay area (Athern et al. 2011). Population levels for species can vary from year to year due to climatic and other environmental conditions. Section 4.7.1.2.7 *Birds* discusses the most recent available information on populations of pond-associated birds that may be affected by ecosystem restoration activities. Preconstruction surveys of the study area would establish numbers of breeding pairs of these species that may be displaced by tidal restoration (such as along the levee between Ponds A9 and A10).

Levee breaching would result in the tidal flooding of ponds, which could destroy nests placed on dried pond bottoms between the time the ponds are drained and the levees are breached. Construction activities would also involve the movement of heavy equipment, loud noises, and human presence in and adjacent to nesting habitat (indirect effects). These activities may result in the disturbance of birds nesting within ponds, potentially resulting in the abandonment of nests, eggs, or young, or facilitating predation on eggs or young by causing adults to flee.

To minimize these types of construction-related impacts, the Shoreline Phase I Study includes several avoidance and minimization measures. Work in and adjacent to potential bird nesting habitat would be conducted outside of the avian nesting season to the extent practicable. Work in these areas that could cause disturbance or direct take (e.g., accidental crushing of individuals or nests) would be limited to the nonbreeding period to the extent practicable (AMM-TBR-2). This condition would minimize potential impacts on nesting birds. If seasonal avoidance is not possible, preconstruction surveys would be conducted for nesting birds (AMM-TBR-3). If any nesting pond–associated waterbirds are detected in areas that could be disturbed by project-related construction activities, project implementation would be delayed or redesigned to minimize potential impacts on actively nesting birds, or other measures may be taken to avoid impacts in consultation with the USFWS and the CDFW.

Impacts on population and habitat trends resulting from ecosystem restoration construction activities associated with all alternatives would be less than significant.

Impact TBR-5: Conflict with any local policies or ordinances protecting biological resources, such as a tree-preservation policy or ordinance or with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, Recovery Plan, or other approved local, regional, or State habitat conservation plan

Ecosystem restoration construction activities would be consistent with and complementary to the City and County land-use plans, the Refuge management plans, Santa Clara Valley Habitat Plan, and the SBSP Restoration Project, there are no conflicts between the ecosystem restoration elements and adopted policies and plans. The ecosystem restoration elements of all alternatives complement these adopted plans.

Ecosystem construction activities would comply with existing policies and plans; therefore, this impact would be less than significant.

Transitional Habitat

A transitional habitat is present between two distinct habitat areas, in this case tidal wetland and upland habitats, that provides area adjacent to FRM levees or adjoining upland habitat. This transition can provide habitat that has largely disappeared from the bay over the last 100 years due to diking and filling of tidal marshes. This feature can also attenuate waves, reduce wave run-up, and increase habitat resiliency to SLC. The two options in the final array of alternatives—a 30:1 ecotone or a 50-foot bench—are discussed below.

30:1 Ecotone (Included in Alternative 3)

Alternative 3 includes a 30:1 ecotone type of broad, gently sloping transitional habitat along the FRM levee where it abuts Pond A12 and the corner of Pond A13 and Pond A18. The 30:1 ecotone would be constructed on the bay side of the FRM levee, and the slope would encroach about 345 feet into the ponds. Vegetation in the 30:1 transitional habitat area would be limited to nonwoody and semi-woody plants, but would otherwise be lightly managed (such as noxious weed removal) and would not be subject to the USACE policy on levee vegetation. The exception is a 15-foot band adjacent to the exposed levee slope, which would be maintained to USACE levee standards.

In the early years of the project following levee construction (2018–2021) and before sediment deposition, the 30:1 ecotone would provide a ready template for a greater diversity of habitats than would be present otherwise. These habitats include subtidal mudflat; intertidal mudflat; cordgrass-dominated low marsh (between the mean tide level and mean high water); pickleweed-dominated middle marsh (between the mean high water and mean high high water); high marsh, which is dominated by pickleweed, marsh gumplant, alkali heath, and spearscale (above mean high high water); and a gradual progression to upland grassland. Over time, the subtidal and intertidal mudflat habitats would be subject to natural sedimentation. This sedimentation, combined with expected SLC, is expected to affect the distribution of habitats along the ecotone in the very long term. However, since this change has not been modeled, estimating how the habitats might change and how those changes might affect terrestrial wildlife is speculative.

The terrestrial biological resource impacts from construction activities associated with the ecotone would be similar to other construction-related impacts discussed above: temporary wildlife disturbance (to breeding and foraging animals) due to equipment use, potential direct losses of less-mobile species, minor losses of some habitat types, and temporary disturbances of wildlife movement. Application of AMM-TBR-1, AMM-TBR-4, AMM-TBR-5, AMM-TBR-6, AMM-TBR-7, AMM-TBR-8, AMM-TBR-12, AMM-TBR-16, AMM-TBR-17, AMM-TBR-18, AMM-TBR-19, AMM-TBR-20, AMM-TBR-21, AMM-TBR-22, and AMM-TBR-23) would ensure that these potential impacts remain less than significant.

Construction of the 30:1 ecotone would take place just after the FRM levee is constructed. For Ponds A12/A13, the 30:1 ecotone, proposed for construction in 2020, would abut the FRM levee from the Alviso Marina area north to where Ponds A12 and A13 meet across the Union Pacific Railroad tracks from the southwestern corner of Pond A16. The ecotone would slope from the levee top downstream into Ponds A12 and A13. Ponds A12 and A13 are currently managed as batch pond habitat, but at the time the ecotone is constructed, the ponds would be in preparation for the upcoming breaches. The ponds' previous water-management strategies will have changed and it is likely that, for at least Pond A12, the pond will no longer be holding as much (if any) water when the ecotone is constructed.

Table 4.7-4 *Transitional Habitat Impacts* summarizes the expected effects of the 30:1 ecotone. Using current habitat types, the 30:1 ecotone would cause the loss of about 29 acres of batch pond associated with Ponds A12/A13. However, assuming that restoration of Pond A12 in 2020 to a tidally influenced habitat type would be underway just after the ecotone is constructed; another way to think about impacts is that about 29 acres of tidal marsh would otherwise *not* be created because that area would remain too deep for marsh establishment. Constructing the 30:1 ecotone in Pond A18, also proposed for 2020 would have similar results—it would convert circulation pond habitat to 30:1 ecotone along the edge of the FRM levee. However, the remaining area of Pond A18 would be restored to tidal wetland habitat. Overall, the Pond A12/A13 and Pond A18 30:1 ecotone would take up about 97 acres (mostly batch pond for Ponds A12/A13 and circulation pond for Pond A18).

Table 4.7-4. Transitional Habitat Impacts

in acres

Habitat Type	Impacts by Alternative, Location, and Habitat Type							
	Alternative 2 (NED/NER Plan)		Alternative 3 (Recommended Plan/LPP [Proposed Project])		Alternative 4		Alternative 5	
	Pond A12, Bench	Pond A18, Bench	Pond A12, 30:1 Ecotone	Pond A18, 30:1 Ecotone	Pond A12, Bench	Pond A18, Bench	Pond A12, Bench	Pond A18, Bench
Brackish Marsh	0.03	0.00	0.03	0.07	0.00	0.00	0.00	0.00
Freshwater Marsh	<0.01	0.00	<0.01	0.06	0.00	0.00	0.00	0.00
Tidal Salt Marsh	0.03	0.01	0.03	0.03	0.00	0.01	0.00	0.01
Seasonal Wetland	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.00
Mudflat	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Batch Pond	4.22	0.00	29.00	0.00	7.33	0.00	7.33	0.00
Circulation Pond	0.00	10.53	0.00	66.13	0.00	10.53	0.00	10.53
Levee	0.28	0.00	0.88	0.33	0.24	0.00	0.24	0.00
Developed	0.01	0.18	0.01	0.24	0.00	0.18	0.00	0.18
Subtotal of Impact	4.63	10.72	30.01	66.87	7.57	10.72	7.57	10.72
Total Impact by Alternative	15.35		96.88		18.29		18.29	
Totals are for the bench or 30:1 transitional habitats only and do not include the area of the corresponding levee footprint (12.5-foot NAVD 88 or 15.2-foot NAVD 88 levee).								

As previously discussed, the Shoreline Phase I Project would result in a significant increase in the amount of tidal marsh habitat in the long term. The ecotone would contribute to the value of the marsh and future success of special-status species using the marsh providing an important transitional zone and high-tide refugia. Dedicating mostly managed pond area to ecotone would not significantly reduce the amount of land dedicated to tidal marsh as part of the project and in fact would complement the marsh.

The 30:1 ecotone is expected to result in substantial benefits for wildlife in the study area. As noted above, this type of upland transitional habitat is not well represented in the South Bay. In the study area, transitional habitats are mostly absent along levees due to the current abrupt transition between middle marsh habitat and steep-sided levees. Constructing 30:1 ecotones adjacent to Ponds A12 and A18 would provide much-needed refugia for special-status species that live in the area, such as California Ridgway's rail and SMHM, especially if over time these species move between existing habitats and newly restored tidal marsh areas.

In the long term, the 30:1 ecotone would result in substantial beneficial effects on sensitive natural communities, terrestrial wildlife species, wildlife movement and habitat connectivity, and population and habitat trends. The 30:1 ecotone would comply with existing policies and plans.

Bench Habitat (Included in Alternatives 2, 4, and 5)

A 50-foot-wide bench providing substrate for natural tidal marsh and transitional habitat would be used for Ponds A12/A13 and A18 as part of Alternatives 2, 4, and 5. This bench would not have a gradual slope like the 30:1 ecotone described above. Instead, it would be a bench below the levee top and a steep slope down to the water level. The steep slope is anticipated to support very narrow bands of low marsh, middle marsh, and high marsh (transitional) habitats, provided there is moisture and a seed source present. These bands would be much narrower than with the 30:1 ecotone and may not support as great a diversity of plant species.

Because the slope is much steeper and the vegetative bands narrower, the bench would not provide as much refugium as the 30:1 ecotone. However, given the relative scarcity of transitional habitat between upland and marsh habitats in the area, the narrow bands of habitat that a bench would provide would be somewhat beneficial to wildlife using the adjacent tidal marsh areas, although this habitat could make it easier for predators such as red fox to find prey such as SMHM. As described for the 30:1 ecotone transitional habitat, vegetation would be limited to nonwoody and semi-woody plants and would be otherwise unmanaged. The bench would not be subject to the USACE policy on levee vegetation except for a 15-foot band adjacent to the exposed levee slope, which would be maintained to USACE levee standards. Because of the proposed FRM levee alignment for Alternative 5 (between Alviso and the NCM), the bench would be constructed separate from the levee, along the edge of Ponds A12 and A13 rather than along the edge of the levee.

As shown in Table 4.7-4 *Transitional Habitat Impacts*, the bench also differs from the 30:1 ecotone described above in that the bench would occupy a much smaller area since the bench would extend 50 feet bayside as compared to the 345 feet bayside required for the 30:1 ecotone slope.

In general, construction of a bench would have the same types of construction effects as described for the 30:1 ecotone. The Ponds A12/A13 bench would result in the permanent loss of between approximately 4.6 acres of mostly batch pond for the 12.5-foot NAVD 88 levee (Alternative 2) and 7.6 acres of mostly batch pond for the 15.2-foot NAVD 88 levee (Alternatives 4 and 5). The Pond A18 bench would directly affect about 10.7 acres of circulation pond under all of the bench alternatives.

As described for the 30:1 ecotone, the terrestrial biological resource impacts from construction activities associated with the bench would be similar to other construction-related impacts discussed above: temporary wildlife disturbance (to breeding and foraging animals) due to equipment use, potential direct losses of less-mobile species, minor losses of some habitat types, and temporary disturbances to wildlife movement. Application of the avoidance and minimization measures would ensure that these potential impacts remain less than significant.

The bench would change over time but not in the same manner as the 30:1 ecotone. Because the bench would slope so steeply, sedimentation would be concentrated at the base of the outboard side of the levee. This would have the effect of bringing the tidal and subtidal habitats closer to the refuge habitats but would not lead to the wider bands of low marsh, middle marsh, and high marsh habitats anticipated for the 30:1 ecotone. It could, however, accrete to some smaller amount of additional refugial habitat. Substantial changes would occur after many years beyond the planning period for this project. As with the 30:1 ecotone, SLC could affect the distribution of habitats along the outboard side of the transitional habitat, but estimating changes accurately is speculative.

The Recovery Plan calls for construction of wide, gently sloping transition zones between tidal marshes and uplands, as well as wide buffers between habitat for listed tidal marsh species and adjacent land uses. The bench in this alternative does not meet these criteria but would still be an improvement over current conditions. Numerous remnant islands created along the existing dike alignments would still provide substantially improved refugial habitat relative to current conditions.

In the long term, the bench transitional habitat would result in beneficial effects on sensitive natural communities, terrestrial wildlife species, wildlife movement and habitat connectivity, and population and habitat trends. The 30:1 ecotone would comply with existing policies and plans. The bench would not fully comply with the Recovery Plan, but only in the sense of not providing all proposed habitat improvements in the study area. Conditions for listed species would still greatly improve. Thus, impacts from this partial compliance would not be significant.

4.7.2.4.2.3 Operation and Maintenance Effects

Over time, the combined effect of the ecosystem restoration activities would result in area–wide habitat changes. Because ecosystem restoration would be phased, the long-term habitat changes would occur in differing stages over many years. In addition, changes early in the project period could also have indirect effects related to later changes, especially in terms of proximity to habitats already in the process of converting (and thus providing new habitat connectivity that is not currently available).

Batch ponds in the study area are high-salinity waters, and dabbling ducks such as northern shovelers and ruddy ducks use these ponds less than the lower-salinity ponds. Fish-eating birds generally do not use ponds like Ponds A12 and A13 because their prey species cannot tolerate the higher salinity levels. While the proposed action would contribute to regional losses of high-salinity habitat, the loss of this type of habitat is not expected to adversely affect wildlife population trends because such ponds provide little value to the area's native wildlife populations.

Species such as eared grebes that do use the higher-salinity ponds would have access to other high-salinity batch ponds, such as the Cargill batch ponds, and open-water habitat associated with the bay; this displacement is not expected to be significant. Impacts on special-status species that use Pond A12 for nesting, such as western snowy plover, American avocet, and black-necked stilt, are addressed separately in the analysis of Impact TBR-2. The loss of up to 32.6 acres of high-salinity batch pond would not be a significant impact.

Management, maintenance, and monitoring are expected to occur throughout the life of the project. Some of these activities are included in the Shoreline Phase I Study Monitoring and Adaptive Management Plan (MAMP; e.g., to monitor success of ecosystem restoration; Appendix F *Shoreline Study Monitoring and Adaptive Management Plan for Ecosystem Restoration*); however, many of these activities would be directed by Refuge operation plans and/or the SBSP Restoration Project Adaptive Management Plan and would be focused on the monitoring of, or management for, particular resources of concern. The integration of the SBSP Restoration Project and Shoreline Phase I MAMP's is discussed in Section 3.6.10 *Monitoring and Adaptive Management*. The net effect of these activities would be beneficial. However, some activities have the potential to adversely affect biological resources, at least in the short term. Specifically, management activities (listed below) have the potential to cause disturbance to breeding species and even site, nest, or colony abandonment. These activities may inadvertently contribute to low population numbers.

Long-term monitoring of the area would include surveys of restored marshes and other activities associated with applied studies. While most such monitoring locations would be in the study area and in the adjacent SBSP Restoration Project area, some monitoring may occur outside these two areas. Monitoring would entail surveys for western snowy plover conducted on foot; monitoring of SMHM populations by trapping within restored marshes; vegetation mapping from aerial photographs and "ground-truthing"; monitoring of fish through counts (e.g., of salmonids) and sampling with nets (for estuarine fish); and monitoring for other, nonbiological impacts. Although trapping for SMHM would involve handling of individuals and could result in minor mortality, most monitoring of biological resources would be passive. Impacts would primarily be minor and short term (e.g., flushing individual birds or seals along the survey route).

Following the breaching of levees around a pond restored to tidal action, the only management activities that might occur within restored tidal habitats are predator management and invasive plant management. Therefore, most management and maintenance activities associated with the Shoreline Phase I Project and SBSP Restoration Project areas would occur primarily in remaining managed ponds (mostly in the SBSP Restoration Project area), on the FRM levee, and in recreational access areas such as trails. Examples of such activities include the following:

- Raising or lowering water levels within ponds via inlet and outlet structures (or via limited pumping, if necessary)
- Annual mowing of the upland grasses that will occupy the levee side slopes within 12 to 15 feet of the levee crown. This area of mowing would correspond to the area above elevation 9 feet on the levee side slopes and to even higher elevations in reaches with ecotone. Pickleweed habitat is anticipated to occur below this elevation and will not be impacted by this annual maintenance effort.
- Controlling vegetation on nesting islands in areas designed as open-water habitat and along trails via mechanical control, hand pulling, spraying with saltwater, spraying with approved herbicides, or other means
- Predator management, including trapping or other removal of mammals and predatory birds
- Periodic augmentation of sediment or amendments on nesting islands
- Maintenance and repair of levees, berms, trails, boat launches, interpretive features, gates, and water-control structures, including annual or more-frequent mowing of vegetation on levees
- Flood-fighting activities during rare flood events, including vehicle access, presence of large work crews, placement of sandbags, and temporary stockpiling of materials

Predator management would occur on an as-needed basis to protect special-status and sensitive species, such as western snowy plovers, California Ridgway's rails, and SMHM, from predators such as California gulls, northern harriers, American crows, common ravens, red foxes, striped skunks, feral cats, and raccoons. Such management would result in adverse effects on the predators themselves via displacement (e.g., trapping and relocating predators such as northern harriers) or culling. However, predator management would be focused on specific areas where predation problems are occurring, and culling would be limited to certain individuals; target mammalian predators that are captured would be lethally removed, while target avian predators would be either lethally removed (e.g., crows and ravens) or relocated (e.g., raptors). Furthermore, most of these predators are common, widespread, and increasing in number, and habitat for marsh breeders such as the northern harrier is expected to increase with this project. Although predator management is expected to reduce numbers where implemented in specific problem areas, substantial impacts on regional populations of these predator species are not expected.

Maintenance and management related to the project area could potentially disturb foraging, roosting, and breeding wildlife species and, in some cases, could lead to the direct loss of individuals. Work involving vehicles or heavy equipment could result in the loss of individuals located within work areas (e.g., on levees, berms, islands, or vegetated areas), and loud noises and human presence in and adjacent to nesting areas may result in the disturbance of birds within ponds or marshes.

The Shoreline Phase I Project incorporates measures to minimize impacts from monitoring, maintenance, and management, and the BO for the project is anticipated to require additional avoidance and minimization measures. Activities that are sufficiently loud or obtrusive enough to cause disturbance to nesting birds or pupping harbor seals, or direct take (e.g., accidental crushing of individuals or nests), would be limited to the period from September 1 through February 1, to the extent practicable, thereby minimizing potential impacts on these species and their young. If seasonal avoidance is not possible, habitat assessments and/or pre-maintenance surveys would be conducted for nesting birds, SMHM, and other sensitive species. Establishment of avoidance buffers around active nests and passive relocation of SMHM would further help avoid impacts on these species (AMM-TBR-2, AMM-TBR-3, AMM-TBR-4, and AMM-TBR-7).

In situations warranting emergency repairs (e.g., to levees or water-control structures) or management (e.g., if predator management becomes necessary during the bird nesting season), such activities would incorporate any measures recommended by the USFWS and the CDFW to minimize impacts. In situations involving emergency actions to protect life and property, this would be done to the extent practical. Otherwise, particularly obtrusive activities such as levee, berm, and island refurbishment, or the maintenance of FRM levees, would occur between September 1 and February 1 unless preconstruction habitat assessments and surveys determine that no sensitive species would be adversely affected. As part of adaptive management, any monitoring, maintenance, or management activities would be evaluated for their impacts on representative species and habitats and would be adjusted to reduce impacts.

Under Alternative 3, the presence of the 30:1 ecotone would provide a buffer between the FRM levee and areas that have been restored to tidal influence. The ecotone structure, rather than the levee, would intercept wave run-up; this could result in less long-term levee maintenance.

Following restoration, management and maintenance activities would be less intensive since there would not be a need to maintain water levels in managed ponds. Rather, maintenance and management would have a net benefit on tidal marsh biological resources by maintaining the desirable condition, and the results of monitoring would inform adaptive management and the design of future phases of restoration.

A primary objective of the Shoreline Phase I Project is to increase contiguous marsh to restore ecological function and habitat quantity, quality, and connectivity (including upland transition zones) in the study area for native, resident plant and animal species, including special-status species. The MAMP includes restoration targets and success criteria for potential long-term effects on tidal marsh, a sensitive natural community, and two special-status species (Table 4.7-5 *Shoreline Phase I MAMP* Special-Status Species and Sensitive Natural Communities Restoration Targets and Metrics). The text following the table also addresses western snowy plover, since maintenance activity could adversely affect this special-status species.

PG&E would continue routine maintenance of its infrastructure. Maintenance and repair activities include aerial and ground patrols and inspections; insulator washing and replacement; management of problems associated with bird roosting and nesting materials; repairs due to bird electrocutions or collisions; and foundation and structural repairs.

In order to minimize impacts to utility infrastructure in Pond A18, impacts on PG&E's ability to access this infrastructure, and indirect impacts to biological resources from ongoing and future PG&E maintenance and repair activities, the project partners would coordinate with PG&E and other regulatory agencies including the CDFW, the RWQCB, the BCDC, the USFWS, and the NMFS to obtain all necessary permits for long-term operation and maintenance. Coordination would include the inclusion of PG&E facility improvements and access requirements in permit applications, identification of appropriate times and methods to access the lines and towers for maintenance and repair (e.g., restriction of work during breeding seasons), or alternative methods of access (e.g., use a helicopter instead of ground-based equipment). These avoidance and minimization measures would be included in all applicable permits. The project partners would also coordinate with PG&E and the USFWS to ensure that PG&E's ongoing maintenance and operations activities in and around Pond A18 are included in the Biological Opinion for the project.

Table 4.7-5. Shoreline Phase I MAMP Special-Status Species and Sensitive Natural Communities Restoration Targets and Metrics

Category	Restoration Target	Monitoring Metric
Restored Tidal Marsh Habitat Inside Ponds	Tidal marsh vegetation inside ponds is on a trajectory toward other successful marsh restoration sites in the South Bay.	Tidal marsh habitat acreage in ponds
California Ridgway's Rail	Contribute to the recovery of the California Ridgway's rail by providing new tidal marsh habitat and ensuring that restored marshes are on a trajectory toward vegetated marsh. Meet recovery plan criteria for Ridgway's rail numbers (0.25 birds/acre) once suitable habitat is established. Given the subsided nature of some of the ponds, this might not happen within the 10-year monitoring period that the USACE may be able to cost-share.	Presence and abundance in newly established habitat
Salt Marsh Harvest Mouse	Contribute to the recovery of SMHM by providing new tidal marsh habitat and ensuring that restored marshes are on a trajectory toward vegetated marsh. Meet recovery plan criteria for SMHM numbers (75% of viable habitat areas within each large marsh complex with a capture efficiency level of 5.0 or better in 5 consecutive years) once suitable habitat is established. Given the subsided nature of some of the ponds, this might not happen within the 10-year monitoring period that the USACE may be able to cost-share.	Presence and abundance in newly established habitat.

Impact TBR-1: Have an effect on any sensitive natural community identified in local or regional plans, policies, or regulations or by the CDFW or the USFWS

Tidal restoration would require direct alteration of habitats (e.g., levee breaching, levee lowering, and installation of pond water-control structures in adjacent ponds) that would affect levees and minor amounts of tidal marsh associated with the outboard side of levees and would require maintaining breached areas. Additionally, tidal marsh restoration would re-create larger tidal prisms within existing channels, which are expected to result in an increased level of erosion of existing fringing tidal marshes. In the long term, there would be a substantial increase in the amount of tidal marsh habitat and an overwhelmingly positive benefit to tidal marsh–associated species, although the thousands of acres of new marsh would be created over an extended period.

The monitoring metrics listed above would help the study area managers understand the success of the newly created salt marsh habitat. The SBSP Restoration Project, which would continue to be closely coordinated with the Shoreline Phase I Project, is also monitoring California Ridgway's rail habitat and numbers. Combined, the monitoring results would give a good indication of the habitat quality for the salt marsh–dependent species. Ongoing management would be adapted to improve conditions, if needed, and would not be likely to cause adverse effects on the tidal marsh habitat that exists at that time. Routine maintenance activities are not expected to adversely affect the quality, amount, or distribution of tidal marsh habitat.

Long-term O&M impacts on tidal marsh habitats and salt marsh–dependent species would be less than significant.

Impact TBR-2: Have an effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by the CDFW or the USFWS

Salt Marsh Harvest Mouse and Salt Marsh Wandering Shrew. The NCM serves as an important SMHM management area. In the long term, the species' recovery could benefit substantially through the project-related creation of tidal marsh habitat. The Alviso North levee section would allow the Refuge to continue to manage the NCM as it has historically while enabling the creation of more tidal marsh habitat that could be used by SMHM on the bayward side of the levee. These are beneficial effects of the Alviso North levee segment on SMHM.

For the most part, long-term effects are expected to be beneficial in that the restored habitats would create additional marsh habitat adjacent to the NCM. Animals once limited to the NCM may have additional ability to disperse for foraging and breeding. However, maintaining the diked marsh's hydrology after construction of the FRM levee and after restoration in adjacent areas would require direct management action; such action would depend on the FRM levee alignment selected. Under Alternatives 2 and 3, regular water-level maintenance of the NCM would continue much as it currently does. Under Alternatives 4 and 5, the NCM would be more exposed to tidal flooding, especially in the very long term as the sea level changes. Under these two alternatives, the USFWS would probably need to modify its water-control system to ensure that part or all of the NCM does not become entirely inundated.

Overall, long-term O&M of the NCM is not expected to adversely affect SMHM. Routine maintenance would be conducted in a manner that avoids direct habitat disturbance. Long-term impacts on SMHM are expected to be beneficial as adjacent tidal habitat develops over time. This would provide not only larger areas of habitat but also connectivity that currently does not exist.

Long-term operation and maintenance of the NCM would not adversely affect SMHM and salt marsh wandering shrew. Thus, the impact would be less than significant under CEQA and beneficial under NEPA.

Western Snowy Plovers. Operation and maintenance activities such as levee and island maintenance could temporarily affect western snowy plovers, but such activities are not expected to cause significant, long-term effects on this species. Predation will continue to be a problem, and monitoring conducted through the SBSP Restoration Project and the ongoing Refuge predator-control programs will help inform managers regarding the success of predator-control programs. Routine predator-control activity might temporarily disturb western snowy plovers but is expected to benefit western snowy plover in the long term.

Activity that results in the creation of islands would provide nesting habitat for western snowy plovers. If long-term changes result in a lack of island areas and that scarcity substantially affects western snowy plover nesting success, then management activity could include enhancing existing nesting habitat or creating additional nesting habitat. Such future work could temporarily disturb plovers but is expected to be beneficial in the long term.

Long-term operation and maintenance impacts on western snowy plovers would be less than significant.

Burrowing Owl. Burrowing owls could use the existing berms for nesting, although burrowing owls have not been noted to be nesting in any of the project levees in recent years. Potential impacts on burrowing owls would depend on the presence of active burrows along this levee segment's alignment; burrowing owls have historically used areas around the Alviso Marina, which is at the western end of all of the Alviso levee options and the NCM. New levees will be maintained in a burrow-free manner, so burrowing owls are not expected to take residence on the new levees. Maintenance activities are not expected to interfere with other burrowing owl habitat.

Long-term operation and maintenance impacts on burrowing owl would be less than significant

California Ridgway's Rail. Currently, California Ridgway's rail (and SMHM) habitat in most areas is limited in extent and quality (i.e., the tidal marshes are very narrow and have little to no escape cover). By creating new, large areas of tidal marsh and providing connectivity between areas that currently support Ridgway's rail, the long-term effects of the project would be beneficial. Including transitional habitat areas such as the bench or 30:1 ecotone would also provide much-needed high tide refugia for this species.

Long-term O&M activities might temporarily disturb California Ridgway's rails, but such activities are not expected to adversely affect the species' habitat quality, quantity, or connectivity. Maintenance and management would have a net benefit on biological resources by maintaining the desirable condition, and the results of monitoring described in Table 4.7-5 *Shoreline Phase I MAMP Special-Status Species and Sensitive Natural Communities Restoration Targets and Metrics* would inform adaptive management and the design of future phases of restoration.

Long-term O&M impacts on California Ridgway's rails would be less than significant under the CEQA and beneficial under the NEPA.

Nesting Birds. Routine maintenance activity in the area of the NCM could disturb nesting avocets, stilts, and other migratory birds. Operation and maintenance activities would be similar to those currently undertaken at the NCM, so this type of activity would not be new. Refuge managers would continue to perform maintenance activities in a manner that avoids levels of disturbance that might cause nest abandonment. Refuge managers would continue to observe seasonal restrictions.

Routine O&M activities might temporarily disturb nesting birds but are not expected to significantly affect these species or their nesting success.

Nonnesting Birds. Nonnesting waterbirds and shorebirds would use newly created tidal marsh habitats and the open-water habitats associated with the sloughs, Coyote Creek, and adjacent open bay. Terrestrial birds would also use the newly created wetland habitats but would continue to use adjacent uplands, such as the Wastewater Facility buffer lands. All species would probably use the newly constructed transitional habitats at varying times depending on the tide level and season.

Routine maintenance activity could temporarily disturb birds feeding or roosting in areas near or in work zones (such as along levee tops), and ongoing monitoring of tidal marsh habitats could temporarily affect roosting or foraging shorebirds and other waterbirds. Roosting or foraging birds would move to adjacent habitat to avoid these short-term disturbances. There is adequate adjacent habitat for birds to move to.

Routine O&M activities are not expected to significantly affect the populations or distributions of nonnesting birds.

Impact TBR-3: 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; this includes fragmentation of existing habitats

Restoration activities would result in a substantial increase in the amount of tidal marsh habitat. This habitat currently exists along the edges of the outboard sides of levees and along Coyote Creek and Alviso Slough. Along with the SBSP Restoration Project restoration activity, restoring the Shoreline Phase I ponds would improve long-term habitat connectivity and would improve opportunities for wildlife movement in and through the study area. However, it is acknowledged that dispersal by some species, such as SMHM and salt marsh wandering shrews, across a broad, unvegetated levee would occur infrequently. Routine maintenance activity might temporarily disturb wildlife movement but would not cause habitat fragmentation.

Operations and maintenance impacts on wildlife movement, habitat connectivity, habitat fragmentation, and biodiversity would be less than significant.

Impact TBR-4: Have an effect on a population of existing native resident or migratory species, either directly or through habitat modification

Restoration activities could have long-term effects on population and habitat trends in and near the study area. Table 4.7-6 *Shoreline Phase I MAMP Population and Habitat Trend Restoration Targets and Metrics* summarizes the MAMP categories, restoration targets, and monitoring metrics that would be used to measure population and habitat changes for non-special-status species or sensitive natural communities over time.

Table 4.7-6. Shoreline Phase I MAMP Population and Habitat Trend Restoration Targets and Metrics

Category	Restoration Target	Monitoring Metric
Invasive and Nuisance Plants	Habitat trajectory toward native/nonnative composition of a reference marsh and other restoration sites. Qualitative inspections for invasive species (especially *Spartina* hybrids and *Lepidium latifolia*) will occur annually using quadrant or transect sampling once marsh has 20% vegetation cover. Any hybrid *Spartina* presence will be reported to the regional control effort, and any marsh containing over 30% *Lepidium* will trigger control activities.	Abundance of nonnative species
Upland Transition Zones	Transition zone habitat comprising wide, gently sloped vegetated upland with a diverse habitat mosaic dominated by (>50% relative cover) perennial native grassland and forb species interspersed with salt panne and seasonal wetland habitats transitioning along a salinity gradient to native salt marsh community representative of historical transition zone habitats.	Plant species composition in upland transition zones

The following sections touch on the MAMP categories and other important biological resources that might be affected by long-term O&M of the Shoreline Phase I Project.

Invasive and Nuisance Plants

Invasive plant management will be a long-term management challenge in restored areas. The invasion of restored wetlands by smooth cordgrass and its hybrids could compromise the primary biological objectives of the Shoreline Phase I Project. Control of invasive vegetation, especially smooth cordgrass and its hybrids, would occur as needed within existing and restored tidal marshes. Invasive cordgrass control would be performed per the methods employed by the Invasive Spartina Project, although some methods may be modified as cordgrass-control techniques become refined. In addition to controlling invasive plants in marsh areas, avoidance and minimization measures to clean equipment and supplies to prevent the spread of seeds and plant material of nonnative perennial pepperweed and other invasive plants would be implemented during construction and restoration activities and during maintenance activities such as driving on levees and mowing (AMM-TBR-16: Cleaning of Equipment, AMM-TBR-24: Invasive Species Monitoring).

Invasive species management could temporarily affect wildlife in areas being treated. Any maintenance would be conducted consistent with the BO for the Shoreline Phase I Project to ensure the continued protection of special-status species. Treatments would avoid times of the year when migratory birds might be nesting. Some animals might still be temporarily disturbed during invasive species management activities, but such effects are not expected to adversely affect wildlife populations.

Without tidal restoration in the far South Bay, continued sedimentation may result in increased colonization by perennial pepperweed as the tidal prism continues to decrease and brackish marsh expands. Breaching of levees and subsequent increases in the tidal prism could reduce the amount of brackish marsh habitat available for colonization by perennial pepperweed. However, large areas of created upland transition zone habitat would also provide new areas for potential pepperweed colonization. The MAMP includes monitoring for the abundance of nonnative species such as perennial pepperweed, and results would be used to modify BMPs to keep the invasive species under control.

Control methods for managing perennial pepperweed identified by the University of California Agriculture and Natural Resources Integrated Pest Management Program (2004) will be incorporated into the MAMP. Such control methods would focus on limiting perennial pepperweed establishment by use of BMPs listed above, establishing fast-growing native plant species that will compete with perennial pepperweed as part of the restoration effort, and repeat applications of post-emergent herbicides that are approved for use in aquatic environments at the flower-bud stage and targeted in areas of perennial pepperweed infestations (Marriott et al. 2013). Under the MAMP, invasive species management would be conducted in a manner to ensure that special-status plant or animal species are not affected during control activities.

Impacts from invasive-species management would be less than significant.

Upland Transition Zones

As noted above, development of a 30:1 ecotone for Alternative 2 and benches for the other action alternatives would provide new upland transition zones. Upland transition zones are an important habitat type that is currently largely absent from the South Bay. Some of the existing, limited upland transition zones would be retained (such as transition zone habitats associated with non-engineered dikes that would not be removed through ecosystem restoration). The MAMP would be used to monitor plant species composition in the transition areas, thereby providing information about the success of best management practices (BMPs) targeted to invasive species and success of the habitat type. Vegetation trends would provide clues about the potential for different wildlife species to use the transition areas. This is an important consideration for transition zones that provide refuge in areas adjacent to tidal habitats that are known to support special-status species such as California Ridgway's rail and SMHM. In the study area, these areas are concentrated along Coyote Creek and Alviso Slough.

Long-term monitoring and adaptive management of upland transition zones would enable Refuge managers to maintain the upland transition zones that would be established as part of the Shoreline Phase I Project.

The long-term maintenance of the upland transition zones would have a beneficial effect under the NEPA and a less-than-significant impact under the CEQA.

Least Terns

Least terns are not known to breed in the project area, but do use the south bay for foraging after leaving their breeding grounds in the Alameda area and prior to migrating south. The project will reduce the amount of open water in ponds, but there is still adequate open water area in the south bay. In the event that least tern starts to breed in the south bay, the refuge would implement avoidance and minimization measures to lessen impacts on breeding terns (AMM-TBR-10: Least Tern Breeding Buffer, AMM-TBR-11: Pond Levels for Least Tern).

Conversion of salt ponds to tidal marsh would have a less-than-significant impact on least terns.

4.7.2.4.2.4 Recreation and Public Access Effects

All of the action alternatives include trail changes (e.g., losses) and improvements throughout the project area. See Section 3.8 *Action Alternatives Component Details* and Section 4.11 *Recreation* for more details regarding the recreational elements of the Shoreline Phase I Project, potential impacts on current trail features, and proposed upgrades.

All of the action alternatives also include construction of two ADA-compliant pedestrian bridges: one over the Union Pacific Railroad tracks (the location of which varies by alternative; see Figure 3.5.1 *Potential Alviso Segment Levee Alignments* in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*), and one over Artesian Slough between levee segments along Ponds A16 and A18. For all alternatives, the goal is to establish links with existing or planned San Francisco Bay Trail paths on both the west and east ends of the proposed levee trail, providing pedestrian traffic new access across the project area and furthering the goals of the Bay Trail to provide a continuous trail around the bay (www.baytrail.org; for more details on the Bay Trails program, see Section 4.11 *Recreation*).

Terrestrial biological resources impacts from Shoreline Phase I Project proposed recreation features are discussed below, while recreation impacts associated with these structures are discussed in Section 4.11 *Recreation*.

Trail System Modifications

The Shoreline Phase I Study Area currently supports a trail system that is managed as part of the Refuge. As described in Section 4.11 *Recreation*, the current trail system uses existing non-engineered dikes and informal trails. Trail improvements would be phased along with the FRM levee construction and restoration activities. Existing and future proposed trail maps can be found in Section 3.7.1 *Recreation Measures* (Figure 3.7-5 *Existing Project Area Recreational Trails System* and Figure 3.7-6 *Future Project Area Recreational Trails System*) and in Section 4.11 *Recreation*.

For Alternatives 2 and 3, the project proposes to include a maintenance road on top of the new FRM levee that may be enhanced as a trail to allow public pedestrian access for all action alternatives. For Alternatives 4 and 5, the same footprint is identified for a future trail; however, since this is not the levee footprint for these two alternatives, the trail would be following an existing non-engineered levee (along which the outboard bench will be placed for these alternatives) that is consistent with current use for recreational access to the loop trails around Ponds A9 through A15. If constructed, this trail would connect the Alviso Marina area on the west side of the study area to the Coyote Creek corridor on the east side. Trail construction is not expected to cause any additional impacts beyond those expected as part of levee construction.

Trails would be improved as needed, and, at the discretion of the Refuge, some new trails may be built during the ecosystem restoration process. At about the time the Pond A12 breach occurs in 2020, the trail system would be enhanced by adding a new short spur on the north side of Pond A12. At the same time, most of an existing trail along the outboard levee of Pond A12 would be removed. The new trail, which would be constructed on an existing non-engineered dike, would include a new observation and educational platform.

Construction activity could disturb common wildlife that uses the levee for roosting. Such wildlife would probably self-disperse to other similar habitats in the study area, and such habitats are plentiful. There are no historical records of burrowing owls using this levee for nesting, but preconstruction surveys would ensure that, if this species is present, impacts would be avoided. The Pond A12 outboard levee trail would be abandoned in place, and some of it would be removed as restoration actions are implemented; the remaining spur would be upgraded to include a new observation and educational platform. Section 4.7.2.4.2.2 *Ecosystem Restoration Construction Effects* includes a discussion of potential construction-related effects related to restoration activities. Application of the project’s AMMs, including restrictions during nesting periods, would ensure that construction-related effects on terrestrial biological resources using the levee on the northern side of Pond A12 are avoided or minimized (AMM-TBR-2 and AMM-TBR-3).

By the time Ponds A13, A14, and A15 are breached (2030), the trail system would have changed substantially. The existing trails on the outboard levees of Ponds A9, A10, A11, A13, and A14 would be abandoned as described for Pond A12 above. As further breaching occurs and individual ponds begin to merge, remnants of the existing levees that previously supported trails will likely be left in place to provide nesting islands for waterbirds. This would be a beneficial effect. Some, but not all, of the existing trail along the Pond A15 outboard levee would be abandoned, and the remaining spur would include a new observation and education platform. There would be no new trails constructed during this phase.

Because proposed trail spurs would follow existing non-engineered levee trails and would require minimal construction in place, and because project proponents would apply the same avoidance measures used in levee construction, development of new trail spurs and abandonment of existing trail segments would not significantly affect any terrestrial biological resources.

There is currently an informal (non-paved) trail parallel to SR 237 that connects the Alviso community to the Coyote Creek corridor. This project includes constructing a formal, paved multi-use trail along this alignment at 100% non-Federal cost. Improving this trail would provide a thoroughfare for non-motorized commuters (e.g., cyclists) to travel between the Sunnyvale area and Milpitas. This upgraded connection would encourage non-pedestrian traffic to use the paved SR 237 trail, leaving the proposed levee trail for pedestrian use only. See Section 4.11 *Recreation* for more information about the proposed multi-use trail.

Because this trail segment would follow an already developed (although informal) trail corridor and would pass through urban areas that are already disturbed, its construction would not significantly affect any terrestrial biological resources.

Recreational Use of the Shoreline Phase I Area

Long-term recreational use of the Shoreline Phase I Study Area, which would be part of the Refuge, is of greater concern than potential construction effects associated with bridge and trail development. Improved recreational access to the area is an important objective of the Shoreline Phase I Project; such access is not only important to the quality of life of South Bay residents and visitors, but, from the standpoint of biological resources, it would likely also be necessary to maintain public support for funding of future restoration. The changes in the trail system would improve some trail features for pedestrians and bicyclists but would allow Refuge managers to isolate more biologically-sensitive areas, thus discouraging heavy public access that could disturb sensitive species.

Increased recreational use and the maintenance of trails and recreational facilities have the potential to disturb wildlife, trample vegetation, decrease nesting success, increase predation, increase the introduction of nonnative species, and decrease habitat quality (e.g., see Korschgen and Dahlgren [1992] for a summary of the effects of human disturbance on waterfowl). Ultimately, such impacts could result in decreases in the abundance of breeding, foraging, and roosting wildlife.

Human disturbance of nesting birds can result in abandonment of nests and chicks, leading to decreased reproductive success and increased predation, particularly of eggs and young (Rodgers and Smith 1995; Carney and Sydeman 1999; USFWS 2007; Ruhlen et al. 2003; Lafferty et al. 2006). Disturbance can also lead to decreased abundance or behavioral alteration of nonbreeding birds (Burger and Gochfeld 1991; Schummer and Eddleman 2000; Lafferty 2001; Burger et al. 2004).

Public access in the vicinity of nesting California Ridgway's rails has the potential to disturb breeding pairs when humans are present, although there are situations in which rail activity close to public trails (e.g., Palo Alto Baylands, Laumeister Tract, and Greenbrae boardwalk) is high (Rottenborn pers. comm. 2012). Rails in these areas with public use seem to have become somewhat accustomed to people, although dogs would likely cause greater disturbance to these birds. Current regulations restricting access of dogs on Refuge lands in the study area would apply to most of the land that is part of this project. An exception is Pond A18, which is owned and managed by the City of San José. However, avoidance and minimization measures adopted as part of the Shoreline Phase I Project would apply to Pond A18, and those measures address public and dog access concerns (AMM-TBR-13: Closure of Trails for Bird Species, AMM-TBR-14: Interpretive Signs, AMM-TBR-15: No Dogs in Refuge**)**. Additionally, the project does not propose to add a substantial amount of new recreational features to Pond A18; the only new feature would be the FRM maintenance road at the crest of the proposed levee along the south side of the pond. Minimizing access to the Pond A18 area would prevent significant disturbance impacts on restored habitats and wildlife using that area.

The Wastewater Facility Plant Master Plan (City of San José 2013d) shows a possible meandering boardwalk midway across Pond A18 above (north of) the transition to upland habitat and a new trail east of active treatment plant through the legacy sewage pond area that will transition to flexible space as part of the master plan development. Neither of these potential recreational developments are part of Shoreline Phase I Project plans. The Plant Master Plan EIR addressed the boardwalk and trail concepts but did not evaluate the direct effects of specific alignments. The Plant Master Plan EIR includes a mitigation measure specifying that the City will undertake additional environmental review for project-level improvements like a boardwalk and trails.

California Ridgway's rails along levee trails adjacent to the NCM and Triangle Marsh/Pond A15 would be subject to higher predation risk because they tend to avoid high cover along levees during high tides (instead swimming within the flooded marsh or using areas of sparser cover) due to human presence on the levee. Disturbance of rails could potentially lead to abandonment of nests and chicks, resulting in decreased reproductive success (Albertson 1995).

Nesting western snowy plovers might also be adversely affected by increased human use of the area, especially around Ponds A12, A13, and A15 and on the south side of Pond A18. Disturbance could lead to direct inadvertent crushing of nests (which are very well camouflaged), the separation of chicks from attending adults, and subsequent abandonment of chicks (Ruhlen et al. 2003; Lafferty et al. 2006). Disturbance could also lead to reduced egg viability or nest abandonment, particularly if disturbance causes plovers to remain off the nest for long periods.

Recreation could have these same effects on other nesting birds, such as stilts, avocets, and terns, especially in the area of the NCM and the remaining levees interior to Ponds A9 through A14 during restoration phasing; however, activity on the existing non-engineered levee trails is already occurring. Increased recreational use of levee trails could reduce habitat quality in managed ponds for nesting, roosting, and foraging waterbirds. Although some species and individuals habituate to human activity, others would maintain some distance between trails and areas they select for nesting, foraging, or roosting. The intervening distance is essentially unused by these individuals, thereby reducing the actual extent of habitat available.

The presence of dogs would be particularly disturbing to waterbirds, including western snowy plover. Current Refuge regulations address dog restrictions. Pond A18 is owned and managed by the City of San José, and the Refuge restrictions do not apply to that area. To ensure that regulations are consistent, the project includes an avoidance and minimization measure specifying how and when dogs can access the Pond A18 area and specifying that dogs are restricted in all other areas of the study area (AMM-TBR-15).

Human activity on levee trails could affect marsh species using existing and restored habitats adjacent to the trails. Flush distances (distances at which birds flush when approached) for birds using vegetated marshes are shorter than those for waterbirds that use managed ponds, likely because of the greater security provided by the vegetative cover in marshes (Rottenborn pers. comm. 2012). Flush distances for western snowy plovers nesting in the area may be 600 feet or more (Robinson pers. comm. 2012).

Trulio and Sokale (2002, 2006) found no statistical difference in abundance or diversity of waterbirds, especially shorebirds, foraging on mudflats adjacent to trails versus at disturbance-free control sites in the San Francisco Bay Area (Bothin Marsh in Mill Valley, Redwood Shores in Redwood City, and Shoreline at Mountain View). Bird abundance and species richness were substantially different among locations but not between impact and control sites, between weekdays and weekends, or as a function of human use. Although abundance and richness at Redwood Shores were greater at control sites than at impact sites, there was no trend at Bothin Marsh, and, at Shoreline, abundance and richness were greater at impact sites. Thus, variability related to location, and other biotic and abiotic factors apparently played a much larger role than human presence in determining where birds foraged on mudflats around San Francisco Bay. The authors proposed that this study indicates that non-motorized trail use on raised levees tangential to mudflat habitat does not have a significant effect on the numbers, species richness, or behavior of foraging shorebirds.

As described above, much of the trail system that would be developed over time consists of levees that are currently used by pedestrians. Thus, recreational access may not increase substantially on the reorganized trail system and, as described above, would be reduced in areas where trails are abandoned. The project includes a specific avoidance and minimization measure that prescribes trail closures in sensitive areas during nesting periods (AMM-TBR-13).

Educational materials and interpretive features (including signs) would include guidelines for recreational use of the study area with respect to avoidance and minimization of adverse effects on biological resources (AMM-TBR-14). Adverse impacts would be offset to some degree by the potential positive effects of increased public awareness and interest in ecological issues in the South Bay resulting from increased wildlife viewing and interpretive signs. These positive effects, however, are difficult to quantify.

There is no expectation that recreational activities associated with the project would result in impacts on other terrestrial wildlife species, such as small mammals, approaching the level of significance. Terrestrial mammals that would be disturbed by human activities are either (1) small species such as SMHM and salt marsh wandering shrews that are expected to stray from salt marsh areas only rarely and that are unlikely to be disturbed by humans due to the dense vegetative cover of salt marshes or (2) regionally abundant species. Therefore, no population-level effects of recreation disturbance on these species are expected.

In addition to signs and other educational features that would discourage public activities that could result in adverse effects on wildlife, other measures have been incorporated into the planning of recreational features to limit adverse effects on wildlife. Habitat specifically managed for nesting western snowy plovers would be set back at least 300 feet from public trails, boardwalks, and electrical towers and at least 600 feet from areas where people are likely to congregate, such as wildlife observation platforms. Monitoring of the effects of recreation on wildlife would inform land managers as to which activities are resulting in particularly high disturbance of wildlife and of particularly sensitive species present or nesting close to public access areas, thus informing future restoration and public access features and possibly indicating whether temporary closures of certain areas are necessary.

Long-term monitoring conducted through both the Shoreline Phase I Study and SBSP Restoration Project MAMPs and ongoing Refuge management would provide information about the overall success of tidal marsh restoration and species distribution. This information would be used in adaptive management of recreational access in two ways. First, observations and results would inform land managers as to the locations and breeding status of sensitive species at any given time; this information would then be used to determine when to close or open seasonal trails. Second, the observations and results would provide some information about the potential adverse effects of public access on sensitive terrestrial biological resources so that public access can be modified if necessary to reduce or avoid impacts.

After about Year 18, the length of trails available for use in the study area would be less than that currently available. By removing much of the trail access to the newly established tidal marshes, broad expanses of these sensitive habitats would be far removed from land-based human activity. This would be a beneficial effect of the project. Prior to Year 18, ongoing Refuge management and monitoring would help identify potential problem areas, thereby enabling managers to modify use so that impacts remain less than significant.

In general, there is uncertainty regarding the future use of trails on the Refuge, the degree to which wildlife would tolerate or habituate to such recreational use, and the degree to which users would adhere to guidelines for recreational use of the study area. For this reason, the impacts from recreational access would be considered and addressed throughout the life of the project. The long-term potential effects of human disturbance would be monitored, and management actions could be implemented to prevent impacts from reaching a significant level.

Long-term maintenance of recreational features and uses of the project area would have a less-than-significant impact on populations of native and migratory terrestrial biological resources.

Impact TBR-5: Conflict with any local policies or ordinances protecting biological resources, such as a tree-preservation policy or ordinance or with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, Recovery Plan, or other approved local, regional, or State habitat conservation plan

Maintenance of project features and long-term restoration of the salt ponds to tidal marsh is consistent with local polices as discussed in Section 4.3 *Land Use and Planning* and with the objectives of the Santa Clara Valley Habitat Plan and refuge management plan.

Maintenance and operational activities would comply with existing policies and plans; therefore, this impact would be less than significant.

4.7.2.4.2.5 Comparison of Action Alternatives

Table 4.7-7 *Summary of Action Alternative Impacts on Terrestrial Biological Resources* summarizes the terrestrial biological resource impacts of each alternative.

The *types* of impacts on terrestrial biological resources due to activities related to ecosystem restoration and recreation access would be similar for all action alternatives. These restoration and recreation access impacts are not included under each action alternative. Rather, they are shown at the end of Table 4.7-7 *Summary of Action Alternative Impacts on Terrestrial Biological Resources* and apply to all action alternatives.

Table 4.7-7. Summary of Action Alternative Impacts on Terrestrial Biological Resources

Alternative	Impact Summary
2 – Alviso North with12.5-foot Levee and Bench combined with WPCP South Levee	Alviso North Levee Segment, 12.5-foot Levee • Permanent loss of about 9 acres of wetland, mostly near Alviso Marina • Permanent minor loss (about 2 acres) of muted tidal/diked marsh associated with the NCM; less than 1 acre loss of pickleweed habitat. • Permanent loss of 8 acres of batch pond and 5 acres of circulation pond • Temporary construction-related effects on SMHM and salt marsh wandering shrew • Temporary construction-related effects on nesting western snowy plover • Temporary construction-related effects on nesting burrowing owls • Temporary construction-related effects on California Ridgway's rail • Temporary construction-related effects on nesting Alameda song sparrow, and nesting San Francisco common yellowthroat • Permanent loss of habitat near Pond A12 for western snowy plover • Temporary (construction-related) minor effects on wildlife movement adjacent to the work area WPCP South Levee Segment • Permanent minor (insignificant) loss of tidal salt marsh in Pond A18, brackish marsh in Artesian Slough, freshwater marsh in Artesian Slough, and tidal/diked marsh adjacent to Artesian Slough • Permanent minor loss of circulation pond habitat in Pond A18; estimated loss of up to 4 acres of pickleweed habitat specifically. • Temporary construction-related effects on nesting burrowing owls • Temporary (construction-related) minor effects on wetland and upland special-status bird species • Temporary (construction-related) minor effects on wildlife movement adjacent to the work area

Table 4.7-7. Summary of Action Alternative Impacts on Terrestrial Biological Resources

Alternative	Impact Summary
3 – Alviso North with 15.2-foot Levee and 30:1 Ecotone combined with WPCP South Levee	Alviso North Levee Segment, 15.2-foot Levee • Similar impacts on wetlands and pickleweed habitat as with Alternative 2 • Permanent loss of much more batch pond than with the 12.5-foot NAVD 88 levee (33 acres compared to 8 acres); same amount of circulation pond impact • Temporary construction-related effects on SMHM and salt marsh wandering shrew • Temporary construction-related effects on nesting western snowy plover • Temporary construction-related effects on nesting burrowing owls • Temporary construction-related effects on California Ridgway's rail • Temporary construction-related effects on nesting Alameda song sparrow, nesting Bryant's savannah sparrow, and nesting San Francisco common yellowthroat • Permanent loss of habitat near Pond A12 for western snowy plover • Temporary (construction-related) minor effects on wildlife movement adjacent to the work area WPCP South Levee Segment • Similar to that for Alternative 2 • Greater permanent loss of circulation pond habitat in Pond A18 than with Alternative 2; in the long term, substantially more transitional habitat available for marsh species along ecotone segment • Temporary construction-related effects on nesting burrowing owls • Temporary (construction-related) minor effects on wetland and upland special-status bird species • Temporary (construction-related) minor effects on wildlife movement adjacent to the work area

Table 4.7-7. Summary of Action Alternative Impacts on Terrestrial Biological Resources

Alternative	Impact Summary
4 – Alviso Railroad with 15.2-foot Levee and Bench combined with WPCP South Levee	Alviso Railroad Spur Levee Segment • Permanent loss of about 29 acres of wetland, mostly associated with the NCM (22 acres of the total); overall not a significant loss of type of habitat, but a potentially significant effect on the NCM ecosystem because of levee position and potential changes to hydrology • Much greater temporary loss of pickleweed habitat than with Alternative 2 or 3 (estimated 7 acres for Alternative 4 compared to less than 1 acre for Alternatives 2 and 3). • Permanent loss of about 9 acres of batch pond • Temporary construction-related effects on SMHM and salt marsh wandering shrew • Temporary construction-related effects on nesting western snowy plover • Temporary construction-related effects on nesting burrowing owls • Temporary construction-related effects on California Ridgway's rail • Temporary construction-related effects on nesting Alameda song sparrow, nesting Bryant's savannah sparrow, and nesting San Francisco common yellowthroat • Permanent loss of habitat near Pond A12 for western snowy plover • Significant adverse effect on the NCM hydrology • Temporary (construction-related) minor effects on wildlife movement adjacent to the work area • Permanent impacts on habitat connectivity and habitat fragmentation of the NCM • Permanent impacts from long-term loss of the NCM habitat and its use by salt marsh-dependent species • Conflicts with Refuge management plans and City of San José General Plan WPCP South Levee Segment • Essentially same as for Alternative 2 (0.7 acre more affected due to slight increase in levee width)
5 – Alviso South with 15.2-foot Levee and Bench combined with WPCP South Levee	Alviso South Levee Segment • Permanent loss of about 22 acres of wetland, mostly associated with the NCM (20 acres of the total) • Much greater temporary loss of pickleweed habitat than with Alternative 2 or 3; slightly more than with Alternative 4 (estimated 8 acres) • Permanent loss of about 7 acres of batch pond • Temporary construction-related effects on SMHM and salt marsh wandering shrew • Temporary construction-related effects on nesting western snowy plover • Temporary construction-related effects on nesting burrowing owls • Temporary construction-related effects on California Ridgway's rail • Potential construction-related effects on nesting Alameda song sparrow, nesting Bryant's savannah sparrow, and nesting San Francisco common yellowthroat • Potential for significant future adverse change to the NCM hydrology because of levee position landward of marsh • Permanent loss of habitat near Pond A12 for western snowy plover • Temporary (construction-related) minor effects on wildlife movement adjacent to the work area WPCP South Levee Segment • Essentially same as for Alternative 2 (0.7 acre more affected due to slight increase in levee width)

Table 4.7-7. Summary of Action Alternative Impacts on Terrestrial Biological Resources

Alternative	Impact Summary
Ecosystem Restoration: Pond Preparation and Breaching and Transitional Habitat (all alternatives)	Construction-Related Effects • Permanent minor losses of outboard side levee tidal marsh habitats associated with levee breaches • Permanent minor losses of intertidal mudflat in areas of levee breaches • Permanent minor losses of outboard side levee pickleweed or bulrush habitat during pond breaches (estimated up to 4.2 acres lost) • Temporary construction-related effects on SMHM and salt marsh wandering shrew • Temporary construction-related effects on nesting western snowy plover • Temporary construction-related effects on nesting burrowing owls • Temporary construction-related effects on California Ridgway's rail • Temporary construction-related effects on black rail and other marsh birds that use the outboard side of the levees • Temporary construction-related effects on nesting Alameda song sparrow, nesting Bryant's savannah sparrow, nesting San Francisco common yellowthroat, and northern harrier • Temporary construction-related effects on other terrestrial species that use outboard levees and adjacent habitats for nesting and foraging • Permanent minor losses of levee habitat; substantial losses of managed pond habitat • For Alternatives 2, 4, and 5,bench transitional habitat would result in the permanent loss of minor amounts of wetlands; for Alternative 3, 30:1 ecotone transitional habitat would result in a greater amount of permanent wetland loss, but the amount lost would still be minor • Temporary (construction-related) minor effects on wildlife movement adjacent to the work area Restoration Effects • Permanent but minor changes to tidal marsh habitats adjacent to breaches and on outboard sides of levees near breach sites • Permanent losses of managed pond habitat, which could adversely affect salt pond–dependent species (effects related to the birds having to concentrate into fewer areas—areas that still include ponds—outside the study area) • Short-term increases in intertidal mudflat habitat, but long-term losses due to bay sedimentation • Permanent beneficial impact due to potential for species dispersal between the NCM and other newly created adjacent tidal marsh habitats • Potential adverse effects on nesting avocets, stilts, terns, and western snowy plovers as a result of long-term habitat disturbance or loss • Permanent beneficial impact on fish-eating birds because of increases in abundance of estuarine fish • Permanent loss of deeper water habitats that are important to diving ducks • Permanent beneficial impacts to terrestrial wildlife by creating new upland transition zones
Recreational Features and Recreational Use of the Study Area (all alternatives)	• Minor but permanent losses of wetland habitat types associated with pedestrian bridges over Artesian Slough and the Union Pacific Railroad tracks • Temporary increase in wildlife disturbance associated with upgrades to new trail spurs (along existing trail segments) • Permanent minor increase in wildlife disturbance associated with recreational use of evolving trail network • Permanent beneficial impacts from long-term reduction in trail access to sensitive areas • Permanent beneficial impacts related to providing improved public access (i.e., connectivity to Bay Trail system) that also ensures protection of sensitive species and their habitats (i.e., alternative paved trails for non-pedestrian use)

4.7.3 Additional Minimization Measures

The following measures will be implemented to reduce significant impacts on SMHM, salt marsh wandering shrew, western snowy plover, burrowing owls, California Ridgway's rail, nesting migratory birds, sensitive plant species, and the NCM ecosystem.

- **Minimization Measure (MM)-TBR-2a: Construction Avoidance Measures for Salt Marsh Harvest Mouse**: To minimize or avoid the loss of individual SMHM from any excavation, fill, or construction activities in suitable habitat within tidal marsh areas the following measures will be implemented:
  - Vegetation removal will be limited to the minimum amount necessary to permit the activity to occur.
  - Sufficient pickleweed habitat, as determined by a USFWS-approved biologist, will remain adjacent to the activity area to provide refugia for displaced SMHM.
  - Silt fences will be erected adjacent to construction areas to define and isolate potential SMHM habitat.
  - Vegetation removal where SMHM may occur, including salt and brackish marsh vegetation, both tidal and non-tidal, consisting primarily of pickleweed or with a strong admixture of pickleweed and other halophytes, will start at the edge farthest from the salt marsh and work its way toward the salt marsh. This method of removal provides cover for SMHM (and the salt marsh wandering shrew) and allows individuals to move toward the salt marsh as vegetation is being removed. On Federal lands (the Refuge), SMHM may be moved into adjacent undisturbed vegetation or else captured and relocated, based on the provisions of the BO and coordination with the USFWS Ecological Services office. In areas not under Federal ownership, the State of California Fish and Game Code would apply and must be complied with. Under this code, SMHM is a Fully Protected species and cannot be captured except under permit for scientific purposes. This means that capture and relocation of this species would not be allowed for this project in these areas.
  - In areas where SMHM habitat extends in a highly linear fashion with completely unsuitable habitat (bare ground or water) on both sides, such as portions of levee faces and along the levee located southeast of Pond A18, removal of vegetation would not necessarily provide a good escape route for any SMHM that may be present. Individuals discovered during vegetation clearance would therefore be captured and relocated in consultation with the USFWS. However, capture and relocation would not be available as an avoidance measure on non-Federal lands.
  - On non-Federal lands impact areas would be assessed to determine which vegetation has the potential to harbor SMHM. Next, this vegetation would be removed manually on a gradual and progressive basis, such that the advancing front of vegetation removal moves toward vegetation that would not be disturbed. This would be done over a period of several days to 1 week prior to construction to

allow individual SMHM to relocate to remaining vegetation as they seek shelter. A biologist would monitor vegetation removal and would make specific recommendations with respect to the rate of vegetation removal, whether vegetation needs to be retained temporarily in certain areas to provide temporary shelter and facilitate dispersal of mice into habitat outside the impact area, and whether temporary berms may need to be constructed over borrow ditches to allow mice to disperse across channels.

- **MM-TBR-2b: Construction Avoidance Measures for western snowy plovers**: To minimize or avoid the loss of individual western snowy plovers during FRM levee construction**:**
  - No activities will be performed within at least 600 feet of an active western snowy plover nest during the western snowy plover breeding season, which is March 1 through September 14 (or as determined through surveys).
  - Vehicles driving on levees and pedestrians walking on boardwalks or levees will remain at least 300 feet away from western snowy plover nests and broods.
  - Personnel who must stop at a specific site for brief inspections, maintenance, or monitoring activities will remain 600 feet away from western snowy plover nests and broods. *Exception*: Only inspection, maintenance, research, or monitoring activities may be performed during the western snowy plover breeding season in areas within or adjacent to western snowy plover breeding habitat with approval of the USFWS and the CDFW under the supervision of a qualified biologist.
  - If western snowy plover chicks are present and are foraging along any levee that will be accessed by vehicles (e.g., for construction, inspection, or access), vehicle use will be under the supervision of a qualified biologist (to ensure that no chicks are present within the path of the vehicle).
  - Breaching of ponds that contain suitable snowy plover habitat will not be performed during the breeding season (March 1 through September 14) unless surveys have documented that no active nests or unfledged chicks are present within the ponds to be flooded by breaching.
- **MM-TBR-2c: Additional Measures for western snowy plover:**
  - Breeding habitat for snowy plover will be enhanced on an island in Pond A16. Islands were constructed in Pond A16 in 2012 and 2013 as part of Phase I activities of the SBSP Restoration Project, for the purpose of providing nesting, roosting, and foraging habitat for a variety of pond-associated bird species, including snowy plovers. Snowy plovers nested on one of these islands in 2013. However, the dark substrate of the islands, and their relatively homogeneous surfaces, could make snowy plovers on the islands relatively conspicuous to predators. The Phase I Study Project will provide small gravel (or other appropriate substrate) that will be distributed in patches on one of the islands in A16 (with the island to be selected by the Refuge), and the Project will fund the maintenance of this gravel. Pea gravel

has been intentionally provided in some areas as a substrate for use by nesting snowy plovers. Gravel may make it more difficult for predators such as California gulls and northern harriers to detect plovers due to camouflage (e.g., plovers may be difficult to distinguish within the gravel from a distance) and increased topographic relief associated with the gravel and footprints left by people distributing the gravel. As a result, predation rates on both eggs and chicks are likely to be lower in areas with such gravel, and more plovers may be attracted to nest in areas with gravel. Providing gravel on an island in Pond A16 is expected to increase plover nesting abundance, and possibly nesting success, thus compensating for the adverse effects of other Project activities on nesting plovers.

- Predator management is currently performed on Refuge lands, but as partial compensation for adverse effects from FRM levee construction on snowy plovers, the intensity of this management will be increased in Pond A16 and the NCM during the snowy plover breeding season. This enhanced predator management will include more frequent monitoring for predators nesting (e.g., gulls and corvids), roosting, or foraging in these areas islands; more frequent trapping of mammalian predators in the NCM and along Artesian Slough; and ongoing identification and implementation of deterrence or removal measures for those predators. This measure will consist of funding a predator management technician for an additional 10 hours/week during the period March 1 through September 14 (approximately 28 weeks).

- **Mitigation Measure (M)[3]-TBR-2d Pre-construction Surveys and Passive Relocation of Burrowing Owls:** Prior to construction, areas that support known or suspected burrowing owl burrows will be surveyed using the protocol described in the California Burrowing Owl Consortium's Burrowing Owl Survey and Mitigation Guidelines (1993). If active burrows are identified an area buffer will be established until the young have fledged.

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- **MM-TBR-2e Construction Avoidance Measures for California Ridgway's Rails:** To minimize or avoid the loss of individual Ridgway's rails, activities within or adjacent to Ridgway's rail habitat will not occur within 2 hours before or after extreme high tides (6.5 feet or above, as measured at the Golden Gate Bridge), when the marsh plain is inundated, because protective cover for Ridgway's rails is limited and activities could prevent them from reaching available cover.

  - To minimize or avoid the loss of individual Ridgway's rails, activities within or adjacent to tidal marsh areas will be avoided during the Ridgway's rail breeding season from February 1 through August 31 each year unless surveys are conducted to determine Ridgway's rail locations and Ridgway's rail territories can be avoided, or the marsh is determined by a qualified biologist to be unsuitable

Ridgway's rail breeding habitat. If breeding Ridgway's rails are determined to be present, activities will not occur within 700 feet of an identified calling center. If the intervening distance across a major slough channel or across a substantial barrier between the Ridgway's rail calling center and any activity area is greater than 200 feet, then construction activity may proceed at that location within the breeding season. *Exception*: Only inspection, maintenance, research, or monitoring activities may be performed during the Ridgway's rail breeding season in areas within or adjacent to Ridgway's rail breeding habitat with approval of the USFWS and the CDFW under the supervision of a qualified biologist.

- **MM-TBR-2f Construction Avoidance Measures for Nesting Birds:** To avoid potential impacts on nesting migratory birds, project construction in areas that provide habitat for migratory birds will be performed outside of the bird nesting season (February 1 to September 15), where feasible. If construction must occur during this period, a qualified biologist will conduct preconstruction surveys within suitable habitat areas potentially affected by the Proposed Project. If nesting migratory birds are found during preconstruction surveys, the USACE or its construction contractor will consult with the CDFW and/or the USFWS regarding appropriate actions to comply with the Migratory Bird Treaty Act and the Fish and Game Code. Unless the CDFW and/or the USFWS specify otherwise, established protection zones will remain until young birds have fledged.
- **M-TBR-2g Conduct Focused Protocol-level Surveys for Congdon's tarplant:** Pre-construction protocol-level focused surveys shall be conducted in suitable habitat for Congdon's tarplant. These surveys shall be conducted according to the CNPS (2001), CDFG (2009), and USFWS (2003) special-status plant survey protocols. If no plants are discovered then no further mitigation is necessary.
  - If Congdon's tarplant is found in the study area, consultation shall be initiated with USFWS or CDFW to finalize a mitigation plan, as appropriate. If required, the mitigation plan shall minimally include:
    - Preparation by a qualified botanist with experience in native plant restoration, mitigation, and management;
    - Description of avoidance measures, such as construction setbacks, installation of exclusionary fencing prior to and during construction, and pre-construction training of construction personnel on the identification and location of these plants. If sensitive plant species can be avoided, then no further mitigation is required;
    - If plants cannot be avoided, compensatory mitigation for unavoidable impacts, which will include preservation or creation;
    - Creation of a new population using propagules collected from the impact site or protection of an existing population at a ratio of 2 acres preserved for each acre removed or as determined in agency consultation; including clearly

defined performance criteria focusing on plant establishment and nonnative species control measures and locations and procedures for restoration. Plants shall be salvaged only where feasible as determined by a qualified botanist. Plant salvage will not be conducted in lieu of population creation using local propagules or population preservation.

- Specification of a minimum 5-year post-construction maintenance and monitoring plan for any plant salvage or habitat creation to ensure that the plant establishment performance criteria are met. The monitoring program shall include potential remedial action measures. Annual reports and a final report shall be prepared and submitted to USFWS or CDFW, as appropriate, to document the success of the mitigation;
- Secure a source of funding for mitigation and monitoring operations; and

- Alternatively, plant credits may be purchased at a mitigation bank at a ratio of 2:1 at a local site.

- **MM-TBR-3 Hydrologic Upgrades to Alviso Railroad Spur Levee (Alternatives 4):** The Alviso Railroad Spur FRM levee will need to either (1) incorporate a pumping system to move water between the north and south sides or (2) include several culverts fitted with flap gates that could be closed during a flood event as long as such culverts could be installed in a manner that will allow the levee to be certified as a FRM levee. The purpose of the feature is to maintain connectivity between the sides of the marsh that will be split by the levee.

4.7.3.1 Residual Impacts and Additional Measures Necessary to Address Significant Impacts

- To avoid construction related impacts to SMHM and salt marsh wandering shrew measure MM-TBR-2a is provided to discourage habitat use in advance of construction. The measure would consist of phased manual vegetation removal and fencing to encourage individual SMHM animals to move to adjacent vegetated areas. *With the implementation of measure MM-TBR-2a, ground disturbing impacts to SMHM and salt marsh wandering shrew would be less than significant.*
- To avoid construction related impacts to western snowy plover, measure MM-TBR-2b will protect nesting western snowy plovers and other special-status species during construction. To compensate for permanent impacts and temporal impacts due to loss of habitat from construction of FRM features to western snowy plover, measure MM-TBR-2c will be implemented. *With the implementation of measures MM-TBR-2b and MM-TBR-2c, impacts would be less than significant.* The ecosystem restoration portion of the project requires no mitigation. The avoidance and minimization actions to reduce incidental take of the snowy plover that are associated with the FRM levee are necessary under ESA and the Biological Opinion; this is not compensatory mitigation.
- If construction must occur during nesting season for burrowing owls, nesting birds may be disturbed potentially resulting in loss of nests. Under measure M-TBR-2d,

preconstruction surveys would be conducted and burrows would be avoided if possible. If occupied burrows cannot be avoided owls would be passively removed consistent with the restrictions of the mitigation measure. *With implementation of measure M-TBR-2d, impacts to burrowing owl during construction would be less than significant*.

- Application of measure MM-TBR-2e intended to protect California Ridgway's rail would avoid or minimize effects on this special-status species. A standard construction buffer of 700 feet around known Ridgway's rail nesting/calling sites would be applied to construction activity during the nesting season and would, therefore, minimize potential construction-related effects on this species. *With the implementation of measure MM-TBR-2e, impacts to California Ridgway's rail would be less than significant.*

  Consistent with measure MM-TBR-2f, timing construction outside of the nesting season (approximately February 1 through August 31) would eliminate direct impacts on nesting birds. Construction activities occurring during the nesting season would require preconstruction surveys by a biologist to determine the presence of active nests and the establishment of species-specific buffers around active nests until the young have fledged. No construction would be allowed within the nest buffers. Maintenance of adequate buffers around active nests would ensure that impacts on these special-status species (and other birds protected under the Migratory Bird Treaty Act [MBTA]) are not significant after applying MM-TBR-2f. *With the implementation of measure MM-TBR-2f, impacts to nesting birds during construction would be less than significant.*

- Surveys for Condon's tarplant have not been conducted, so their presence is assumed. Consistent with measure M-TBR-2g a preconstruction survey will be done prior to start of grading. If colonies of Condon's tarplant are discovered they will be avoided. If avoidance is not possible then a replacement population will be provided or other compensatory mitigation provided with agreement from the resource agencies. *With the implementation of measure M-TBR-2g, impacts to Condon's tarplant during construction would be less than significant.*

- To minimize impacts to the NCM from a dividing levee under Alternative 4, measure MM-TBR-3 will be implemented to include either a pumping system or culverts into the design of the levee through the NCM to maximize the connectivity between the sides of the new levee. There is uncertainty of successfully maintaining connectivity the two sides of the marsh bisected by the levee in this alterative. The bayward side would be not be protected from tidal flooding and rising sea levels, while the landward side would be cut off from the bay and would need to depend on the pumps or culverts to maintain its current level. This uncertainty leads to a conclusion that impact would be significant and unavoidable. There are no other measures that could ensure both sides of the marsh be maintained in their current condition. *The USACE will implements measure MM-TBR-3 to maintain connectivity in the NCM; however, given* *the uncertainty of successfully maintaining connectivity similar to the baseline condition, this impact would be significant and unavoidable.*

Implementation of the measures above would reduce construction related impacts to terrestrial biological resources to a less than significant level. Alternative 4 would have significant impacts to habitat connectivity, population trends, and be inconsistent with plan and policies developed to protect natural resources by developing a levee through the NCM. Additional measures are proposed to minimize these impacts, but the impact would remain significant. There are no other measures available to the project proponents that would avoid or further reduce these impacts. Alternative 5 would have significant impacts to habitat trends in the NCM as existing marsh communities would likely be transformed to open water with rising sea levels. This impact would be significant and unavoidable.

4.7.4 Cumulative Effects

The Shoreline Phase I Project is one of many past, present, and reasonably foreseeable future actions in the region that could affect managed pond habitats and adjacent upland areas in the South Bay (see Section 4.1.7 *Social Environment of the Study Area*). The most notable project, based on size, proximity, and similarity, is the SBSP Restoration Project Phases I and II. As described in Section 3.8 *Action Alternatives Component Details*, the Shoreline Phase I Project is a companion project to the SBSP Restoration Project. Both projects include activity that would directly affect (or, in the case of the SBSP Restoration Project, have already affected) managed pond habitats by restoring tidal action. Several of the other projects listed in Section 4.1.8.2 *Projects Addressed in the Cumulative Impact Analysis* also involve ecosystem restoration that could affect the type, amount, and distribution of habitats in the region.

The past, present, and reasonably foreseeable future actions in the region that are specifically considered for this cumulative effects analysis of terrestrial biological resources are:

- SBSP Restoration Project Phase I and II
- Active management of the Refuge consistent with the Don Edwards San Francisco Bay National Wildlife Refuge Comprehensive Conservation Plan
- Continued implementation of the Santa Clara Valley Habitat Plan
- Continued implementation of the Wastewater Facility Plant Master Plan
- The San Francisco Bay Restoration Authority (Authority) regional restoration projects (Bair Island, Coyote Point, East Palo Alto Shoreline, and Lower San Francisquito Creek)

4.7.4.1 Cumulative Impacts Associated with FRM Levee Construction

FRM levee construction under any of the action alternatives would result in impacts related to short-term wetland habitat loss (which would be compensated for by wetland habitats created through ecosystem restoration), construction-related disturbance of terrestrial wildlife (special-status species and nesting and foraging common species), and permanent loss of managed ponds. Applying the measures presented in Section 4.7.3 *Additional Minimization Measures* would reduce the significance of these impacts for the project. The SBSP Restoration Project Phase I resulted in similar effects related to wetland habitat loss, temporary disturbance of wildlife, and loss of managed ponds (although on a much smaller scale) and applied similar types of measures. Because the SBSP Restoration Project and other regional restoration projects minimize and/or compensate for these types of effects, the Shoreline Phase I Project, in combination with these other regional restoration projects, would not result in a cumulatively significant impact on wetland habitat or short-term disturbance of terrestrial wildlife.

All of the action alternatives would result in significant impacts on SMHM. Applying the prescribed avoidance and minimization measures would lessen effects, but activity could still lead to the take (death) of individual SMHM. Because this species is Fully Protected under California law, any taking is prohibited. There is no guarantee that the project would not result in accidental taking of this species, which means that project effects on SMHM are significant. However, in the long term, tidal marsh restoration activities associated with the Shoreline Phase I Project would more than compensate for potential impacts on this species such that the net effect of the project on SMHM would be beneficial. When combined with restoration activities of the cumulative projects that could also affect this species and the species' scarcity (it is listed as Endangered under the FESA), the effects of the Shoreline Phase I Project on SMHM would not be cumulatively significant.

Alternatives 4 and 5 would result in significant effects on the NCM due to hydrologic changes that, when combined with SLC, could permanently change marsh habitat over time. The SBSP Restoration Project Phase I did not include any activity that directly affected the NCM; the SBSP Restoration Project Phase II would not directly affect the NCM either. The USFWS restored the marsh in 1994 and carefully manages it as part of the Refuge. Activity at the Wastewater Facility is carried out to ensure that impacts on the NCM, which is adjacent to the west side of the Wastewater Facility property, are avoided. The NCM is a valuable social and environmental asset, so the City of San José has emphasized compatible development in the Alviso area, which has also prevented or minimized effects on the marsh and its wildlife. The direct NCM effects associated with Alternatives 4 and 5 represent the only significant adverse effects on the marsh when combined with past, present, and reasonably foreseeable future projects. Alternatives 4 and 5 of the Shoreline Phase I Project, in combination with cumulative projects, would result in a significant impact on the NCM. The incremental impact of the Shoreline Phase I Project would be cumulatively considerable. Minimization measures would be the same for the impact identified at the project level; implementation of measure MM-TBR-3. There is uncertainty of successfully maintaining connectivity the two sides of the marsh bisected by the levee with this measure. The bayward side would be not be protected from tidal flooding and rising sea levels, while the landward side would be cut off from the bay and would need to depend on the pumps or culverts to maintain its current level. This uncertainty leads to a conclusion that the cumulative impact is unavoidable. There are no other measures that could ensure both sides of the marsh be maintained in their current condition.

Alternative 4, which would place the FRM levee through the NCM, is inconsistent with the Refuge management plans for the area and with the City of San José General Plan policies.

Recent development projects in the community of Alviso have been carefully planned and implemented so that they are compatible with the City's General Plan and the Refuge management plans. The incompatibility of Alternative 4 represents the only potentially significant adverse effect related to a policy conflict when combined with past, present, and reasonably foreseeable future projects. Alternative 4 of the Shoreline Phase I Project, in combination with cumulative projects, would not create a cumulatively adverse condition but would remain significant at the project level.

4.7.4.2 Cumulative Effects of Ecosystem Restoration to Scarce Resources

4.7.4.2.1 Western Snowy Plover

Restoration of circulation ponds to tidal marsh would result in a loss of western snowy plover nesting habitat due to inundation and loss of suitable nesting substrate. Some of the areas that would be restored to tidal marsh have long been used regularly for nesting by western snowy plovers. In the past, such regular use resulted from the type and consistency of management of these ponds for salt production (e.g., the same ponds representing the same stage in the salt-making process provided a condition that is consistently suitable for use by nesting plovers). Other ponds are used more sporadically by this species, and in any given year there may be extensive habitat in the South Bay that appears to be suitable for nesting but is unoccupied by western snowy plovers.

Without management of ponds targeted specifically for this species, such an apparent excess of potential nesting ponds is necessary to ensure that suitable nesting habitat is present in the South Bay, given that changes in precipitation, rate of evaporation, predation pressure, and pond management could make any given pond unsuitable in a given year. Western snowy plovers move around considerably among South Bay ponds, both between years and between nesting attempts within years, taking advantage of ponds with suitable nesting conditions. A reduction in the extent of suitable habitat could presumably occur without a decline in numbers of western snowy plovers if some ponds are managed specifically (and consistently) for nesting western snowy plovers.

Some of the restoration activities would result in the construction of islands that could be specifically managed to provide island nesting habitat for western snowy plovers and other nesting birds. Activity associated with the companion SBSP Restoration Project is currently using this approach. With targeted management, it is expected that densities of western snowy plovers can be increased so that South Bay populations can be maintained or increased despite a reduction in the extent of managed ponds. However, even if habitat availability is adequate to support the desired number of nesting plovers, concentration of nesting birds in fewer locations may result in increased predation pressure (e.g., if individual gulls, corvids, foxes, or other predators focus on these locations), subject larger numbers of birds to disturbance by humans or predators at any given nesting area, and provide fewer options for nesting birds if pond conditions in preferred nesting areas are unsuitable (e.g., due to high water levels in wet years or loss of islands due to SLC).

The exact acreage of long-term western snowy plover habitat loss is not known, due to uncertainty in what currently constitutes suitable, occupied habitat. Because the Shoreline Phase I and SBSP Restoration Project activities would be completed in phases, direct habitat losses would occur over time. Birds displaced during construction could move to adjacent areas that continue to provide suitable habitat, but, in the long term, the overall amount of habitat available for this species in the study area would decrease. When combined with the losses associated with the SBSP Restoration Project, this loss could be considerable.

Island creation and maintenance, active pond management, and predator management associated with the SBSP Restoration Project and Shoreline Phase I Projects are expected to allow high densities of nesting plovers to be achieved, yet there is considerable uncertainty as to the response of San Francisco Bay western snowy plover numbers to the changing landscape that would occur as a result of the Shoreline Phase I Project. If western snowy plover numbers were to decline as a result of project-related restoration, and if management activities intended to address declines in western snowy plover populations were implemented but were unsuccessful, impacts on this species would be significant.

The MAMP does not include any restoration targets for western snowy plover. However, the SBSP Restoration Project Adaptive Management Plan, which specifies an adaptive management goal of supporting 250 breeding adults within the SPSP Restoration Project area, would be used to monitor changes in abundance and to adapt ongoing management and future restoration in the Shoreline Phase I Study Area to ensure that regional declines do not reach a cumulatively significant level. Future restoration (including determination of the maximum tidal restoration achievable without causing a significant impact on western snowy plovers) would be planned to ensure that adequate habitat to allow successful nesting by western snowy plovers is available. As a result, long-term, cumulative impacts on western snowy plovers would be less than significant.

4.7.4.2.2 California Least Tern

California least tern is not known to nest in the Shoreline Phase I Study Area but do use the area for foraging during the post-breeding period. In and near the study area, least terns typically forage over areas on the outboard sides of levees along Coyote Creek and over the bay in and adjacent to the northwestern corner of the study area.

The extent to which least terns rely on South Bay ponds is unknown. If this species does rely heavily on the area for foraging, the conversion of pond habitat to tidal marsh would lead to a redistribution of foraging birds in the San Francisco Bay Area. If other foraging sites are less productive than South Bay ponds, this redistribution could lead to decreased post-fledging survival of juveniles or adults from bay-area populations.

Foraging habitat for California least terns in deep-water circulation ponds is expected to decline regionally as ponds are converted to tidal habitats as part of the SBSP Restoration Project and Shoreline Phase I Projects. However, in the long term, tidal restoration is expected to benefit prey fish populations for the California least tern, and miles of sloughs that would provide foraging habitat for this species are proposed to be restored by the Shoreline Phase I Project.

Furthermore, it is highly unlikely that this species' bay-area populations are limited by South Bay foraging habitat, due to the relatively low abundance of the species and the extensive nature of foraging habitat. California least terns displaced from current South Bay foraging locations would likely find alternative foraging areas, either within the South Bay or elsewhere in the Bay Area. The degree to which a reduction in foraging habitat in ponds as the project is operated and maintained would be offset by increases in habitat and prey abundance in the bay and in restored sloughs. It is unknown whether the Shoreline Phase I Project would have considerable impacts on the species or would contribute to a cumulatively adverse condition at all.

It is expected that ample roosting habitat for California least terns would continue to be present on islands, levees, and boardwalks in the South Bay, and some of the newly created islands and broken levee segments might continue to be used. While least terns have not historically nested in the Shoreline Phase I Study Area, these islands could provide nesting habitat in the future. If California least terns continue to roost or forage in managed ponds in a reduced-pond landscape, birds could be displaced from the project areas. However, given the relative abundance of foraging habitat in the region, the Shoreline Phase I Project is not expected to cause or contribute to a cumulative adverse foraging habitat impacts.

4.7.4.2.3 Salt Marsh Harvest Mouse

The SMHM would benefit from the proposed action as a result of continued protection of current habitat in the NCM and other areas such as Triangle Marsh, an increase in area of potential habitat as a result of ecosystem restoration, and improved connectivity between suitable habitat areas. However, because SMHM is a Fully Protected species under State law, activity on non-Federal land could directly affect this species by causing mortality of individuals during ecosystem restoration activity. This effect is significant at the project level.

The USFWS actively monitors and manages habitat for SMHM. Given this species' status, any potential adverse effect on this species could contribute to cumulative losses. However, the combined increase in tidal marsh habitat that could be used by SMHM as a result of the Shoreline Phase I Project and SBSP Restoration Project is a significant beneficial effect that should contribute to the long-term success of this species. The Shoreline Phase I Project, in combination with other cumulative projects, would not substantially affect local populations of SMHM.

4.7.4.2.4 California Ridgway's Rail

Like SMHM, California Ridgway's rail would benefit from the Shoreline Phase I Project as a result of habitat improvements. These improvements, when combined with the SBSP Restoration Project, would have positive benefits on the recovery of this Endangered species, although the benefits would occur over decades. Ecosystem restoration activity could temporarily affect California Ridgway's rail but is not expected to cause long-term, permanent adverse effects on the species. The Shoreline Phase I Project would not cause or contribute to cumulatively adverse impacts on California Ridgway's rail and would contribute positively to the species' recovery.

4.7.4.3 Cumulative Impacts of Ecosystem Restoration to Wildlife Movement, Habitat Connectivity, and Habitat Fragmentation

Ecosystem restoration activity could temporarily adversely affect local wildlife populations by disturbing foraging, roosting, or nesting animals. Other activity associated with the SBSP Restoration Project and ongoing recreational use of the Shoreline Phase I Study Area could also temporarily disturb local wildlife.

In most cases, disturbance would be temporary and is not expected to cause long-term, adverse impacts on overall wildlife movement patterns. The study area has long been subject to recreational use, and the Shoreline Phase I Project is not expected to cause a significant increase in recreational use. The USFWS currently places seasonal and locational restrictions on recreational use of sensitive areas of the Refuge; this practice will continue. Temporary disturbance associated with the Shoreline Phase I Project would not create long-term, cumulatively adverse disturbance that would significantly affect wildlife use of the area or wildlife movement.

The Shoreline Phase I Project would result in the loss of a substantial amount of human-created managed pond habitat that is used by managed-pond-specialist waterbirds for foraging and roosting. This impact would not be significant in the short term because not all of the ponds would be converted. However, if the Shoreline Phase I Project is implemented as proposed, over time all of the ponds in the study area would be converted, meaning that all managed pond habitat in the study area could be lost. However, pond specialists would have habitat in adjacent areas of the Refuge and might still forage in adjacent low-salinity habitats that are created as a part of the SBSP Restoration Project and other brackish open waters such as Alviso Slough and Coyote Creek. Importantly, implementation of the MAMP is critical in preventing adverse effects from reaching a level of significance. Adaptive management involves monitoring between project phases, which generates information that allows conversion to tidal marsh to be stopped or delayed if population declines or other triggers indicate that continuation of converting the salt ponds to tidal marsh will create an adverse impact to pond-associated waterbirds.

The SBSP Restoration Project and other tidal restoration projects in the South Bay have been restoring other managed ponds to tidal influence. Cumulatively, when considered with all other past, present, and reasonably foreseeable tidal restoration projects planned for the bay, this would cause the loss of a substantial amount of managed ponds in the Alviso pond complex.

The SBSP Restoration Project Programmatic EIS/EIR (EDAW et al. 2007) analyzed the impact of converting large amounts of pond habitat to tidal wetlands. Recognizing that wetland restoration could potentially have negative long-term effects on populations of waterbirds (“pond specialists”) that preferentially utilize these ponds, the SBSP Restoration Project proposed reconfiguring ponds in each of that project’s three complexes (Eden Landing, Ravenswood, and Alviso) to enhance pond habitat. The intention of the SBSP Restoration Project is to create improved managed pond habitat early in the restoration process in order to prevent significant impacts to the pond specialists while other ponds are restored to tidal wetlands in future phases. In Phase I, the SBSP Restoration Project reconfigured Pond A16, which is adjacent to the Shoreline Phase I Project, to improve water management, create nesting and roosting islands, and enhance habitat quality for pond specialists. This pond will not be altered by the Shoreline Phase I Project and is anticipated to continue to provide enhanced managed-pond habitat into the future.

In addition, even if all the ponds in the project area are converted to tidal wetlands, pond specialists would have habitat in adjacent areas of the Refuge, such as the NCM and Pond A16. When combined with other available habitats, such as mudflats available in the restored ponds and adjacent bay and sloughs at low tide, there still would be extensive habitat available for pond specialists in the project area, even if all the Shoreline Phase I Project ponds are converted to tidal wetlands.

However, the most important mechanism for preventing significant adverse effects to pond specialists is the implementation of the MAMP. The Shoreline Phase I Project MAMP is modeled on and coordinated with the adaptive management program of the SBSP Restoration Project. Adaptive management program of both projects involves monitoring between project phases, which generates information that allows land managers to find ways to change management measures or adjust implementation designs in order to head off undesirable results before they reach the level of significance. Or, if such actions are not successful, as a last resort, the conversion of ponds to tidal marsh in the project area could potentially be delayed or stopped if adverse impacts, such as significant population declines of pond-specialist species, appeared.

The magnitude of potential adverse effects would depend on the long-term success of the Shoreline Phase I Project, the SBSP Restoration Project, and other tidal restoration projects, population trends, and the adaptability of the pond specialists. The cumulative loss of managed pond habitat could adversely affect pond specialists, waterfowl, and some species of shorebirds. Due to the scale of the Shoreline Phase I Project relative to other projects considered in this cumulative impacts analysis, the incremental impact of the Shoreline Phase I Project would be cumulatively considerable. This impact could only be addressed by replacing pond habitat being converted to tidal marsh. The conversion of other habitat to pond would be inconsistent with the objectives of the project, so no measures are available to lessen this impact.

4.7.4.4 Cumulative Impacts of Ecosystem Restoration on Population and Habitat Trends

4.7.4.4.1 Pond-Associated, Breeding Waterbirds

In the study area, avocets and stilts use several different types of habitats. As noted above, these species nest in the NCM and Pond A16. They also nest on levees and islands in the current ponds and around some of the water treatment ponds associated with the Wastewater Facility. Non-special-status birds, such as double-crested cormorants, Caspian terns, and Forster’s terns, nest on islands in ponds in and near the Shoreline Phase I Study Area. All of these birds forage in and near the study area.

Restoring managed ponds to tidal marsh (such as has been done for Pond A17) could result in a loss of nesting habitat for stilts, avocets, terns, gulls, and cormorants due to inundation of dry nesting substrate, potentially contributing to a decline in South Bay breeding populations.

However, at any given time, some island substrate is unoccupied by these birds, suggesting that some reduction in suitable nesting habitat can occur without resulting in a substantial decline in numbers. The Shoreline Phase I Project does not include the specific construction of nesting islands for these species, but some nesting islands will probably be formed through internal levee breaches that leave some sections of levees intact and would create levee “islands” in the restoration areas that could be use by cormorants and gulls as well as avocets and stilts. Some of these remnant levee segments might not be surrounded by water and thus would not provide the isolation these species prefer. Monitoring performed as part of the SBSP Restoration Project would inform subsequent restoration and management activities to improve management for nesting avocets, stilts, terns, gulls, and cormorants within the Shoreline Phase I Study Area. For example, land managers could draw down water in seasonal ponds, which could increase the extent of terrestrial breeding habitat and lead to an increase in nesting habitat for avocets and stilts.

The SBSP Restoration Project predicted that restoration activity associated with drawdown of water in seasonal ponds, which could increase the extent of terrestrial breeding habitat, could lead to an increase in the numbers of avocets and stilts. Drawdown is a normal part of pond operation and is described in each pond’s operation plan, if applicable. Until the study area ponds are breached, drawdown would continue consistent with the operation plans. Once the ponds are breached, the USACE and the SCVWD would work with the USFWS to monitor how the ponds might affect avocets, stilts, terns, gulls, and cormorants over time.

The project could affect South Bay populations of nesting stilts, avocets, terns, gulls, and cormorants by reducing foraging habitat. For example, shallow-water foraging habitat in managed ponds is expected to decrease from baseline levels, thereby reducing the extent of high-tide foraging habitat available to stilts and avocets, while the minor intertidal mudflat losses would further reduce foraging habitat for avocets. Foraging habitat for terns within managed ponds would decline due to conversion to tidal habitats, although the increase in tidal foraging habitat, and the increases in fish populations expected to occur as a result of tidal restoration, may more than offset the loss of managed pond foraging habitat.

As part of the SBSP Restoration Project Programmatic EIS/EIR analysis, Point Reyes Bird Observatory Conservation Science (PRBO; now Point Blue Conservation Science) modeled predicted declines (relative to the baseline condition) in black-necked stilt numbers in the South Bay during winter; this modeling also predicted declines in winter American avocet numbers in the South Bay. These models predicted changes in abundance based on predicted changes in winter foraging habitat for stilts and avocets; the availability of breeding habitat was not included in the model parameters, and changes in breeding abundance were not predicted by this modeling. PRBO’s modeling did not capture the increase in densities expected to occur as a result of island creation, shallow-water management, and predator management associated with the SBSP Restoration Project. In all cases, PRBO’s results predicted declines as a result of restoration activity. Model results predicted that activity that converted former salt ponds to tidal marsh would have the greatest adverse effects on these species.

Numbers of avocets and stilts may not decrease to the extent predicted by PRBO's modeling if numbers in the current system are far below the system's carrying capacity, if reconfigured ponds outside the study area are able to sustain very high densities of foraging and breeding birds as has been achieved elsewhere, or if increased predator management increases breeding success substantially relative to the baseline condition. Likewise, tern numbers may not decline substantially if the creation of numerous nesting islands and restoration of tidal foraging habitat (with expected resulting increases in fish numbers) offsets potential adverse effects of the loss of a few nesting islands in restored ponds and the loss of foraging opportunities in managed ponds.

The intensity of pond, island, and predator management would be important determinants of the densities and reproductive success of nesting stilts, avocets, terns, gulls, and cormorants achievable in managed ponds in the region. Concentration of nesting birds into relatively few ponds, as more ponds are restored to tidal habitats, increases the susceptibility of large proportions of South Bay populations of these species to predation, disease, and disturbance by predators and by human activity and to nesting failure in the event of lapses in management or failure of pond infrastructure. The degree to which these factors would affect the nesting densities and reproductive success achievable in managed ponds is unknown.

If numbers of breeding stilts, avocets, terns, gulls, and cormorants in San Francisco Bay were to decline substantially as a result of restoration (e.g., due to the adverse effects of concentrating breeding at fewer locations on rates of predation, disease, or productivity), and no management activities intended to reverse these declines were implemented, impacts on these species would be significant. However, as discussed in Section 4.7.4.3 *Cumulative Impacts of Ecosystem Restoration to Wildlife Movement, Habitat Connectivity, and Habitat Fragmentation* and in the paragraphs directly above, with implementation of MAMPs by the SBSP Restoration Project and the Shoreline Phase I Project, these species' populations would be maintained sufficiently that no significant impact would occur. Because it has a larger footprint than the Shoreline Phase I Project, the SBSP Restoration Project will have more influence over cumulative impacts to these species than do the Shoreline Phase I Study activities. The integration of operation plans and MAMPs between the SBSP Restoration Project and Shoreline Phase I Project would help managers ensure that the long-term populations are sustained and that regional, adverse cumulative effects are not significant both in the Shoreline Phase I Study Area and in the larger SBSP Restoration Project area.

4.7.4.4.2 Migratory Fish-Eating Birds, Shorebirds, and Other Waterbirds, Including Managed Pond–Dependent Species

Fish-eating species in the South Bay include the pied-billed grebe, western grebe, Clark's grebe, American white pelican, brown pelican, large waders (i.e., herons and egrets), and mergansers. Several of these species, including green herons, great egrets, snowy egrets, and black-crowned night herons, nest in marshes in the project region. Great blue herons nest on artificial structures such as electrical towers, and pied-billed grebes nest in non-tidal ponds in the South Bay. Many fish-eating birds are present in the study area as nonbreeders.

Tidal restoration associated with the Shoreline Phase I Project is likely to benefit nesting egrets and herons by providing more marsh habitat, which is expected to include some isolated stands of tall marsh vegetation along sloughs similar to that used, or formerly used, for nesting at Artesian Slough. As a result, nesting habitat availability for these species would increase due to the project. This is a beneficial effect.

Project effects on foraging fish-eating birds depend on the effects on both abundance and availability of prey fish. Low-salinity ponds may concentrate fish, thus facilitating their capture by fish-eating birds. As a result, conversion of some low-salinity ponds to tidal habitats would reduce foraging habitat in circulation ponds. However, as noted in Section 4.6 *Aquatic Biological Resources*, tidal restoration is expected to result in a considerable increase in the abundance of native estuarine fish in the South Bay, and the tidal sloughs and channels that would develop in restored marshes are expected to be used heavily by foraging fish-eating birds. The Shoreline Phase I Project is expected to have a net benefit to most fish-eating species, since the minor impacts from the loss of managed ponds would be far outweighed by the increase in fish abundance and tidal foraging habitat. The impacts on foraging fish-eating birds are expected to be less than significant.

Several species of waterbirds that may not otherwise be present in high numbers in the South Bay use ponds in the study area in considerable numbers. These salt pond specialists, which include the eared grebe, Wilson’s phalarope, red-necked phalarope, and Bonaparte’s gull, are closely associated, at least on the scale of San Francisco Bay, with high-salinity ponds. High-salinity ponds generally support high invertebrate biomass but low species diversity (Carpelan 1957; Swarth et al. 1982; Takekawa et al. 2004). Brine shrimp have an optimum salinity range from 90 to 150 ppt (Larsson 2000), while water boatmen have an optimum salinity range of 35 to 80 ppt (Maffei 2000f). Brine flies can be present in high densities in both moderate- and high-salinity ponds. Eared grebes, phalaropes, and Bonaparte’s gulls use primarily moderate- to high-salinity ponds, where they forage on brine shrimp and brine flies (Harvey et al. 1992). While relatively small numbers of eared grebes breed in the South Bay, most individuals of all four of these species breed primarily outside of the Shoreline Phase I Study Area and are present in the project region only during winter or during spring and fall migration.

Substantial numbers of nonbreeding waterbirds have been recorded using ponds in the South Bay. However, implementation of the SBSRP Initial Stewardship Plan resulted in declines of some managed pond specialists in the project region due to reductions in salinity to a target of 40 ppt or lower in most ponds. Point Reyes Bird Observatory’s modeling of the current condition (based on estimated Initial Stewardship Plan salinities) predicts lower totals of Wilson’s phalaropes, red-necked phalaropes (in fall), and eared grebes (in winter). However, although these managed pond specialists are adapted for foraging primarily in the high-biomass environment of high-salinity ponds, they do use low-salinity aquatic habitats for foraging.

Tidal restoration of managed ponds would also reduce the availability of high-tide roosting habitat for small shorebirds. High-tide roosting habitat is unlikely to limit populations, since pond dikes, islands, and other alternative habitats can support high densities of roosting birds. However, conversion of managed ponds to tidal habitats would reduce the numbers of sites where shorebirds can congregate at high tide, potentially resulting in increased predation, possibly increased susceptibility to disease, and increased disturbance by predators and humans (and associated increases in energy expenditure).

Because large shorebirds use alternative habitats such as managed ponds primarily for roosting, and roosting habitat on levees, islands, and artificial structures such as boardwalks is expected to be present in abundance even if ponds are restored, the Shoreline Phase I Project is not expected to result in significant adverse effects on large shorebirds due to loss of pond habitat. However, the potential reduction of areas where shorebirds can congregate at high tide could result in increased predation, possibly increased susceptibility to disease, and increased disturbance by predators and humans (and associated increases in energy expenditure).

The presence and abundance of waterbirds, including shorebirds, is currently being monitored as part of the SBSP Restoration Project. If restoration targets are not being met, adaptive management could result in different water-management actions, or restoration activities will cease in areas that have not yet been restored and possibly in some of the restored habitats in the Shoreline Phase I Study Area. Changes would focus on providing or enhancing foraging and/or breeding habitat for part of the year. If the declines in numbers of salt-pond-specialist waterbirds predicted by PRBO’s modeling for similar activity (pond conversion rather than pond management) conducted as part of the SBSP Restoration Project were to occur, and no management actions intended to reverse these declines were implemented, impacts on these species could potentially be significant. However, adaptive management that would be implemented as part of the SBSP Restoration Project and ongoing long-term management of the Shoreline Phase I Study Area through the Refuge O&M plans would help managers ensure that the long-term populations are sustained and that regional, adverse cumulative effects are not significant.

4.7.4.4.3 Diving Ducks

Diving ducks such as lesser and greater scaup, buffleheads, canvasbacks, and other species are present in the South Bay primarily during migration and winter. These species forage in relatively shallow aquatic habitats in the South Bay, including shallow subtidal habitats, intertidal habitats (when flooded at high tide), and low-salinity circulation ponds. Diving ducks generally avoid the smaller tidal channels but can be found in abundance, particularly during their nonbreeding season, near the mouths of the larger tidal sloughs and in the open waters. The habitats of ruddy ducks in the study area are different in that they primarily forage in ponds (rather than in subtidal and intertidal habitats).

The Shoreline Phase I Project could affect numbers of diving ducks in the South Bay in several ways. By converting to tidal habitats the deeper circulation ponds that currently provide foraging habitat for diving ducks, the project would result in a loss of foraging habitat. This conversion is expected to adversely affect habitat for ruddy ducks, which rely primarily on circulation ponds. Subtidal habitat in sloughs and larger channels within restored ponds would provide foraging habitat for species such as canvasbacks and scaup, potentially offsetting the effects of the loss of managed pond habitat.

Additionally, density-dependent effects, which are particularly difficult to quantify, may occur. Such effects may include increases in rates of predation, disease, or competition due to increases in diving duck densities. Increases in adverse effects of human disturbance due to recreation (e.g., bicycling, walking, fishing, or kayaking), and particularly mortality and disturbance by waterfowl hunting, are also expected to occur. Such disturbance could affect proportionately more ducks as tidal restoration reduces the number of managed ponds.

It is not known whether numbers of diving ducks in the South Bay are currently limited by habitat availability. While many waterfowl populations may be regulated by variable reproductive success during the breeding season (Austin et al. 1998; Mowbray 2002), mortality during winter and other factors also play a role in population regulation (Kessel et al. 2002). The effect of the Shoreline Phase I Project on diving ducks is expected to vary among species and would depend largely on the degree to which a reduction in former salt pond habitat would result in a reduction in duck numbers, the degree to which diving ducks associated with the currently circulation ponds would shift to other managed ponds, the degree to which diving ducks would benefit from restored subtidal habitat in sloughs, and the potential benefits of tidal restoration on these species' food (primarily aquatic vegetation and invertebrates such as mollusks). As noted above, the loss of circulation pond habitat would probably have the greatest adverse effect on ruddy ducks.

The impacts of converting managed ponds to tidal habitats on numbers of diving ducks in the South Bay are difficult to assess, and particularly to quantify, for a number of reasons. Modeling conducted by PRBO for the SBSP Restoration Project considered only the potential changes in numbers within the ponds and marshes and did not attempt to quantify the effects on diving duck abundance of changes in the extent of intertidal and subtidal habitat areas within the bay itself. Bird numbers may not decrease to the extent predicted by PRBO's modeling if numbers in the current system are far below the system's carrying capacity (i.e., if they are regulated by factors external to the South Bay), if diving ducks shift to the open bay or other managed ponds in the South Bay as SBSP Restoration Project and Shoreline Phase I Project managed ponds are converted to tidal habitats, if foraging conditions within tidal habitats are enhanced by tidal restoration, or if the assumptions of the models are incorrect.

Due to the uncertainty regarding the potential project-related effects on diving ducks in the South Bay, the SBSP Restoration Project is conducting monitoring of diving duck populations and will implement adaptive management (if needed) to document potential changes in diving duck numbers. SBSP Restoration Project monitoring results would help inform long-term management of the Shoreline Phase I Study Area if the numbers of South Bay diving ducks begin to significantly decline.

Through the life of the SBSP Restoration Project and Shoreline Phase I Projects, open-water habitat (non-pond) conditions in the South Bay are expected to change negligibly, resulting in a net decrease of less than 1 percent in potential foraging habitat for diving ducks. Habitat change in circulation ponds could contribute to a decrease in diving duck numbers.

If the declines in numbers of South Bay diving ducks predicted by PRBO's modeling for the SBSP Restoration Project were to occur, and no management actions intended to reverse these declines were implemented, impacts on these species would be significant. As part of the SBSP Restoration Project, monitoring and adaptive management is being used to track the actual effects on diving ducks of converting circulation ponds. Information gained through the SBSP Restoration Project would be shared with the Shoreline Phase I Project managers and would inform long-term management needs, thereby ensuring that potential effects on diving ducks are minimized, or restoration efforts will cease. Cumulative impacts on diving ducks would be less than significant.

4.7.4.4.4 Invasive Species

Pacific cordgrass (*Spartina foliosa*) is the only cordgrass that is native to San Francisco Bay. Remnant clonal stands of uninvaded, Pacific cordgrass still exist in areas of the South Bay. Pacific cordgrass is less robust than the introduced nonnative smooth cordgrass (*Spartina alterniflora*, generally referred to as invasive *Spartina*) in size, growth rate, production, and ecological tolerances (Smart and Barko 1978). In winter, Pacific cordgrass clones die back to young shoots and buds near the sediment surface, making the Pacific cordgrass stands less effective at trapping sediment than the invasive smooth cordgrass (State Coastal Conservancy and USFWS 2003). Pacific cordgrass is the principal native pioneer plant species that establishes in new marsh on mudflats and provides valuable habitat for a number of species, including the Endangered California Ridgway’s rail, which forages for food within or near the protective canopy of cordgrass.

Smooth cordgrass, represented in San Francisco Bay primarily by hybrids with Pacific cordgrass, is competitively superior to the native Pacific cordgrass in San Francisco Bay. Smooth cordgrass and its hybrids can survive in a wider range of temperature, salinity, and inundation conditions; are able to establish in unvegetated areas; and can spread more rapidly by rhizome expansion and dispersal than the native species. Unlike Pacific cordgrass, smooth cordgrass can grow in low intertidal habitats and invade open mud, which is prime habitat for foraging shorebirds and marine life and is important for flood channel maintenance (Anttila et al. 1998). As a result, smooth cordgrass hybrids can clog marsh slough channels, thereby altering marsh hydrology. Additionally, the sediment-trapping characteristic of smooth cordgrass can contribute to significant habitat alteration by transforming large expanses of bare mudflat into high marsh areas. Due to its higher seed production and germination rate, smooth cordgrass and its hybrids establish new colonies faster than the native cordgrass (Josselyn et al. 2004).

Large, dense patches of the invasive perennial pepperweed (*Lepidium latifolium*) are present within terraced areas in brackish marsh areas otherwise exclusively dominated by alkali and/or saltmarsh bulrush (Josselyn et al. 2004). This nonnative invasive is of concern for the conservation and recovery of Rare or Endangered plant species because of its widespread distribution and ability to invade rapidly and develop monotypic stands. Perennial pepperweed is also an aggressive colonizer in upland areas and could affect important upland transition zones in the study area.

Realistic control of invasive, nonnative plant species such as perennial pepperweed would require preconstruction suppression of seed sources; rapid pre-emptive cover of levees by competitive, clonal, perennial, native plant species; substantial, specific, explicit weed management design (including timely revegetation designs); and cooperation of adjacent landowners. Many of the invasive species listed in Section 4.7.1.2.3 *Invasive Plant Species within the Shoreline Study Area* require labor-intensive methods of control (seed source removal, mowing, hand removal, or other manual extraction) for many years in sensitive areas, and complete eradication is difficult to impossible. Monitoring infestations of invasive plants and preventing their spread using BMPs are important steps in invasive plant management.

Intentional and unintentional breaching of levees and subsequent increases in tidal habitat could inadvertently help spread invasive *Spartina*, resulting in a potentially significant impact. However, the Shoreline Phase I Project is operating under the assumption that invasive *Spartina* would be monitored and controlled through the Invasive Spartina Project, with the MAMP providing additional invasive species monitoring data.

With local management of invasive species, the Shoreline Phase I Project is not expected to significantly contribute to the regionally cumulative adverse effects related to cordgrass and pepperweed.

4.7.5 Summary

Table 4.7-8 *Terrestrial Biological Resources NEPA Impact Conclusions* summarizes the project effects under the NEPA.

Table 4.7-8. Terrestrial Biological Resources NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
TBR-1: Construction effects on sensitive natural communities	Negative	Moderate	Short term	Probable	Local
TBR-1: Long-term habitat effects on sensitive natural communities	Beneficial	Major	Long term	Probable	Local
TBR-2: Construction effects on special-status species					
Salt marsh harvest mouse	Negative	Moderate	Short term	Probable	Local
Salt marsh wandering shrew	Negative	Moderate	Short term	Probable	Local
Western snowy plover	Negative	Moderate	Short term	Probable	Local
Burrowing owl	Negative	Moderate	Short term	Probable	Local
California Ridgway's rail	Negative	Moderate	Short term	Probable	Local
Nesting birds	Negative	Moderate	Short term	Probable	Local
Western pond turtle	Negative	Moderate	Short term	Possible	Local
Sensitive plants	Negative	Moderate	Short term	Probable	Local
TBR-2: Long-term habitat effects on special-status species	Beneficial	Major	Long term	Probable	Local
TBR-3: Construction effects on wildlife movement, habitat connectivity, habitat fragmentation, and biodiversity	Negative	Moderate	Short term	Possible	Local
TBR-3: Long-term habitat effects on wildlife movement, habitat connectivity, habitat fragmentation, and biodiversity	Beneficial	Major	Long term	Probable	Local
TBR-4: Construction effects on population and habitat trends	Negative	Moderate	Short term	Probable	Local
TBR-4: Long-term habitat effects on population and habitat trends	Beneficial	Major	Long term	Probable	Local
TBR-5: Policy and plan conflicts (Alts 2, 3)	Beneficial	Moderate	Long term	Probable	Local
TBR-5: Policy and plan conflicts (Alts 4, 5)	Negative	Moderate	Long term	Possible	Local

Table 4.7-9 *Terrestrial Biological Resources CEQA Impact Conclusions* summarizes the project effects under the CEQA. Measures that address significant impacts are summarized in the table.

Table 4.7-9. Terrestrial Biological Resources CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Additional Measures	Significance after Applying All Measures
TBR-1: Effects on sensitive natural communities		LTS	None	LTS
TBR-2: Effects on special-status species	AMM-TBR-1: Reporting Requirements AMM-TBR-2: Seasonal Restrictions AMM-TBR-3: Conduct Preconstruction Surveys AMM-TBR-4: Stage Outside Sensitive Habitats AMM-TBR-5: Minimize Footprint AMM-TBR-6: Install Exclusionary Fencing AMM-TBR-7: Biological Monitor AMM-TBR-8: Site Stabilization and Restoration AMM-TBR-12: Worker Awareness AMM-TBR-13: Closure of Trails for Bird Species AMM-TBR-14: Interpretive Signs AMM-TBR-15: No Dogs in Refuge AMM-TBR-16: Cleaning of Equipment AMM-TBR-17: Hazardous Materials Management /Fuel Spill Containment Plan AMM-TBR-18: Construction Site Maintenance AMM-TBR-19: Speed Limit AMM-TBR-20: Vehicle Staging and Fueling AMM-TBR-21: Vehicle and Equipment Maintenance AMM-TBR-22: Stormwater Management Plan AMM-TBR-23: Use of Clean Fill AMM-TBR-25: Nighttime Work Avoidance			
Salt marsh harvest mouse		S	MM-TBR-2a: Construction Avoidance Measures for Salt Marsh Harvest Mouse	LTS
Salt marsh wandering shrew		S	MM-TBR-2a: Construction Avoidance Measures for Salt Marsh Harvest Mouse	LTS

Table 4.7-9. Terrestrial Biological Resources CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Additional Measures	Significance after Applying All Measures
Western snowy plover	AMM-TBR-9: Pond Levels for Snowy Plover	S	MM-TBR-2b: Construction Avoidance Measures for Western Snowy Plover; M-TBR-2c: Additional Measures for Western Snowy Plover	LTS
Burrowing owl		S	M-TBR-2d: Pre-construction Surveys and Passive Relocation of Burrowing Owls	LTS
California Ridgway's rail		S	MM-TBR-2e: Construction Avoidance Measures for Ridgway's Rails	LTS
Nesting birds		S	MM-TBR-2f: Construction Avoidance Measures for Nesting Birds	LTS
Sensitive plants		S	M-TBR-2g: Conduct Focused Protocol-level Surveys for Congdon's Tarplant	LTS
TBR-3: Effects on wildlife movement, habitat connectivity, habitat fragmentation, and biodiversity		LTS (Alt 2,3,5) S (Alt 4)	None	LTS (Alts 2, 3, 5) S (Alt 4)
TBR-4: Effects on population and habitat trends	AMM-TBR-10: Least Tern Breeding Buffer AMM-TBR-11: Pond Levels for Least Tern AMM-TBR-24: Invasive Plant Species Monitoring	LTS (Alt 2,3) S (Alt 4,5)	MM-TBR-3: Hydrologic Upgrades to Alviso Railroad Spur Levee	LTS (Alts 2, 3) S (Alts 4, 5)
TBR-5: Policy and plan conflicts		LTS (Alt 2,3) S (Alt 4,5)	None (Alts 2, 3) None available (Alts 4, 5)	LTS (Alts 2, 3) S (Alts 4, 5)
LTS = less than significant S = significant B = Beneficial NA = not applicable				

4.8 Hazards and Hazardous Materials

This section discusses the potential impacts of the Shoreline Phase I Project resulting from the presence or introduction of hazards and hazardous materials.

4.8.1 Affected Environment

The following sections discuss the environmental and regulatory setting for hazards and hazardous materials for the Shoreline Phase I Study Area (see Figure 1.9-3 *Shoreline Project Phase I Area of Impact and Biological Buffer Area* in Chapter 1 *Study Information*). See Section 4.5 *Surface Water and Sediment Quality* for discussion of specific water quality contaminants that may be present in fluvial sediments (e.g., mercury).

4.8.1.1 Regulatory Setting

The following sections describe the Federal and State regulatory setting for hazardous, toxic, and radioactive waste in the study area.

4.8.1.1.1 Federal

Federal regulatory agencies that regulate hazardous, toxic, and radioactive waste include the USEPA, the Occupational Safety and Health Administration (OSHA), the Nuclear Regulatory Commission, the U.S. Department of Transportation, and the National Institutes of Health. At the Federal level, the principal agency regulating the generation, transport, and disposal of hazardous substances is the USEPA under the authority of the Resource Conservation and Recovery Act (RCRA). The USEPA regulates hazardous substance sites under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Applicable Federal regulations are contained primarily in Titles 29, 40, and 49 of the Code of Federal Regulations (CFR). The major Federal laws and guidelines governing hazardous substances are summarized below.

4.8.1.1.1.1 Pollution Prevention Act (42 USC 13101 et seq./40 CFR)

The Pollution Prevention Act focuses on reducing the amount of pollution, including hazardous and toxic substances, through cost-effective changes in production, operation, and raw materials use. Opportunities for source reduction are often not realized because existing regulations, and the industrial resources required for compliance, focus on treatment and disposal. Source reduction is fundamentally different and more desirable than waste management or pollution control.

Pollution prevention also includes other practices that increase efficiency in the use of energy, water, or other natural resources, and protect our resource base through conservation. Practices include recycling, source reduction, and sustainable agriculture.

4.8.1.1.1.2 Clean Water Act Section 311

Section 311 of the Clean Water Act (CWA) prohibits the discharge of oil and other hazardous substances into any navigable water of the United States and adjacent shoreline area unless it has been permitted by an international protocol or by the President.

4.8.1.1.1.3 Occupational Safety and Health Act (29 USC 651 et seq/29 CFR)

OSHA defines occupational health and safety standards with the goal of providing employees with a safe working environment. The California Occupational Safety and Health Administration (Cal/OSHA) is the agency responsible for administering this Federal act. OSHA regulations apply to the workplace and cover activities ranging from confined space entry to toxic chemical exposure. Employers are required to provide a workplace free of recognized hazards that could cause serious physical harm. The OSHA regulates workplace exposure to hazardous chemicals and activities through workplace procedures and equipment requirements.

4.8.1.1.1.4 Comprehensive Environmental Response, Compensation, and Liability Act (42 USC 9601 et seq./29, 40 CFR)

The CERCLA, also known as the Superfund Act, provides for the liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive hazardous waste disposal sites. The CERCLA authorized the National Priorities List (NPL), which identifies contaminated sites that are eligible for remedial action. The scope of the CERCLA is broad; it holds current and prior owners and operators of contaminated sites responsible, and its definition of a hazardous substance incorporates definitions from the Clean Air Act (CAA), the CWA, the Toxic Substances Control Act, and the RCRA [CERCLA Section 101(14)]. The USEPA is the agency responsible for administering the CERCLA.

4.8.1.1.1.5 Superfund Amendments and Reauthorization Act, Title III (42 USC 9601 et seq./29, 40 CFR)

The Superfund Amendments and Reauthorization Act (SARA) amended the CERCLA on October 17, 1986. The SARA stressed the importance of permanent remedies and innovative treatment technologies in cleaning up hazardous waste sites, required Superfund actions to consider the standards and requirements found in other Federal and State environmental laws and regulations, provided new enforcement authorities and settlement tools, increased state involvement in every phase of the Superfund program, increased the focus on human health problems posed by hazardous waste sites, encouraged greater citizen participation in making decisions on how sites should be cleaned up, and increased the size of the Superfund trust fund to $8.5 billion.

The SARA also required the USEPA to revise the hazard-ranking system so that it accurately assessed the relative degree of risk to human health and the environment posed by uncontrolled hazardous waste sites that may be placed on the National Priorities List (NPL).

4.8.1.1.1.6 Resource Conservation and Recovery Act (42 USC 6901 et seq./40 CFR)

The RCRA is a Federal statute designed to provide "cradle to grave" control of hazardous waste by imposing management requirements on generators and transporters of hazardous wastes and on owners and operators of treatment, storage, and disposal facilities. The USEPA is responsible for administering the RCRA. However, the USEPA has authorized the State of California to administer and enforce the RCRA Subtitle C program within the State under Section 3006 of RCRA in lieu of the Federal program. RCRA Subtitle C establishes standards for the generation, transportation, treatment, storage, and disposal of hazardous waste in the United States. In California, the California State Department of Toxic Substances Control (DTSC) is the primary authority enforcing the RCRA hazardous waste requirements.

4.8.1.1.1.7 Toxic Substances Control Act (15 USC 2601 et seq./40 CFR)

The Toxic Substances Control Act of 1976 (15 USC 2605) banned the manufacture, processing, distribution, and use of polychlorinated biphenyls (PCBs) other than in totally enclosed systems. The USEPA Region 9 PCB Program regulates remediation of PCBs in several states, including California. Title 40 of the CFR, Section 761.30(a)(1)(vi)(A), states that all owners of electrical transformers containing PCBs must register their transformers with the USEPA. Specified electrical equipment manufactured between July 1, 1978, and July 1, 1998, that does not contain PCBs must be marked by the manufacturer with the statement "No PCBs" [Section 761.40(g)]. Transformers and other items manufactured before July 1, 1978, and containing PCBs must be marked as such.

There are also Federal regulations under Section 112(r) of the CAA on the storage and use of acutely hazardous substances (40 CFR 68). Facilities that store or use acutely hazardous substances that exceed threshold quantities, as specified in the regulation, are required to prepare a risk-management plan before commencing operation. The risk-management plan describes the condition under which hazardous substances are used, identifies possible accidental release scenarios, and specifies safety measures to minimize significant off-site consequences.

4.8.1.1.2 State

The California Environmental Protection Agency (Cal/EPA) and the California Office of Emergency Services (OES) establish rules governing the use of hazardous substances. The State Water Resources Control Board (SWRCB) has primary responsibility to protect water quality and beneficial uses. The Cal/EPA was created in 1991 to better coordinate State environmental programs, reduce administrative duplication, and address the greatest environmental and health risks. The Cal/EPA unifies the State's environmental authority under a single accountable, cabinet-level agency. The Secretary for Environmental Protection oversees the following agencies: the California Air Resources Board (ARB), the Integrated Waste Management Board, the Department of Pesticide Regulation, the SWRCB, the DTSC, and the Office of Environmental Health Hazard Assessment. Applicable State laws are described in the following sections.

4.8.1.1.2.1 California Occupational Safety and Health Act (California Labor Code Section 6300–6718/8 Code of Regulations [CCR])

The California Occupational Safety and Health Act of 1973 was enacted by the California legislature to enforce effective standards, assist and encourage employers in maintaining safe and healthful working conditions, and provide for enforcement, research, information, education, and training in the field of occupational safety and health. The act gives specific guidelines for safe handling and protective measures for those who work with hazardous, toxic, and radioactive waste.

4.8.1.1.2.2 Hazardous Waste Control Act (California Health and Safety Code Section 25100 et seq. 22 CCR)

The California Hazardous Waste Control Act governs hazardous-waste management and cleanup in the State (Health and Safety Code, Chapters 6.5–6.98). The act mirrors the RCRA and imposes a “cradle to grave” regulatory system for handling hazardous waste in a manner that protects human health and the environment. It requires all businesses to report the quantity and locations of hazardous materials on an annual basis if the business stores (1) above 55 gallons of a liquid or 500 pounds of a solid hazardous material, (2) above 200 cubic feet of a compressed gas, or (3) a radioactive material that is handled in quantities for which an emergency plan is required. Businesses that meet these criteria must prepare a Hazardous Material Business Plan (HMBP), which includes spill prevention, containment, emergency response measures, and a contingency plan.

County Environmental Health Departments and Cal/EPA Certified Unified Program Agencies assume responsibility for enforcing local hazardous-waste reporting requirements. Sites that store, handle, or transport specified quantities of hazardous materials are inspected annually. The Cal/EPA DTSC regulates the generation, transportation, treatment, storage, and disposal of hazardous waste under the RCRA and the State Hazardous Waste Control Act.

4.8.1.1.2.3 California Code of Regulations, Title 22, Division 4.5

CCR Title 22 (Social Security), Division 4.5, is one of the primary laws implemented by the DTSC. The DTSC is one of six boards and departments within the Cal/EPA. The DTSC’s mission is to restore, protect, and enhance the environment and to promote public health, environmental quality, and economic vitality by regulating hazardous waste, conducting and overseeing cleanups, and developing and promoting pollution prevention. CCR Title 22 defines the identification and listing of hazardous waste, standards applicable to hazardous waste, and several other hazardous-waste requirements.

4.8.1.1.2.4 Bay Protection and Toxic Cleanup Program Legislation of 1989

The following objectives and purposes of the Bay Protection and Toxic Cleanup Program Legislation of 1989 that relate to hazardous, toxic, and radioactive waste include:

- Identify and characterize toxic hot spots;
- Plan for the prevention and control of further pollution at toxic hot spots; and
- Develop plans for remedial actions of existing toxic hot spots and prevent the creation of new toxic hot spots.

The Bay Protection and Toxic Cleanup Program is a comprehensive effort led by the SWRCB to programmatically link environmental monitoring and remediation planning. The Bay Protection and Toxic Cleanup Program efforts and main activities related to hazardous, toxic, and radioactive waste include the following:

- Development and implementation of regional monitoring programs designed to identify toxic hot spots. These monitoring programs include analysis for a variety of chemicals, toxicity tests, measurements of biological communities, and various special studies to support the program.
- Development of a consolidated database that contains information pertinent to describing and managing toxic hot spots.
- Preparation of criteria to rank toxic hot spots that are based on the severity of water and sediment quality impacts.
- Development of Regional and Statewide Toxic Hot Spot Cleanup Plans that include identification and priority ranking of toxic hot spots, identification of pollutant sources, identification of actions already initiated, strategies for preventing formation of new toxic hot spots, and cost estimates for recommended remedial actions.

4.8.1.2 Physical Setting (CEQA Baseline)

The existing condition for hazards and hazardous materials is described in the following sections.

The USACE conducted a records search in 2012 for the Alviso Ponds and Santa Clara County study area, which encompasses the Shoreline Phase I Study Area, and additional nearby ponds and areas subject to tidal influence or potential flood risk. The purpose of the records search was to identify recognized environmental conditions involving hazardous, toxic, or radioactive waste (HTRW) in the study area. For the purposes of this study, recognized environmental conditions are defined as a past, present, or likely future release of hazardous substances or petroleum products into the soil, groundwater, or surface water of a site.

The records search included approximately 95 Federal, State, tribal, and local databases to identify sites where the presence or likely presence of HTRW has been previously documented. The 2012 records search did not include any sampling or analysis of environmental media. The results of the records search identified over 2,000 potential environmental sites within the

Alviso Ponds and Santa Clara County study area. Of the potential sites identified, approximately 140 were located within the Shoreline Phase I Study Area.

For the purposes of this Feasibility Study, the USACE conducted a second review of the previously identified potential HTRW sites from the 2012 records search. The USACE utilized updated site information in the EnviroStor and GeoTracker databases maintained by DTSC and SWRCB respectively to determine possible impacts that the identified sites may have on future construction activities. Characteristics used to determine potential impacts on construction activities included the suspected mass and volume of contaminants, their mobility within the soil-groundwater-air matrix, and the likelihood of project construction measures affecting contaminated media. As a result of the second review of the information on the 140 total previously identified sites and the EnviroStor and GeoTracker database, only two sites have the potential to impact future construction activities and four sites are not likely to affect future construction activities in the proposed Shoreline Phase I construction areas (Table 4.8-1 *Hazardous Materials Sites within or adjacent to Potential Disturbance Areas*). Potential HTRW issues should be addressed prior to the commencement of levee construction activities.

Also see Section 4.5 *Surface Water and Sediment Quality* for a discussion of contaminants in surface waters and related sediments.

Please note that, throughout this section, the terms *12.5-foot NAVD 88 levee* and *15.2-foot NAVD 88 levee* are used to distinguish Alternative 2 levee footprint from the Alternative 3 levee footprint, respectively. Alternatives 4 and 5 are also at the 15.2-foot NAVD 88 levee height, but follow alternative levee alignments. Alternatives 2 and 3 run along the same alignment but since the Alternative 3 levee is 1.7 feet higher, the two alternatives will have different impacts (e.g. more filling would be required with Alternative 3 to raise the levee 1.7 feet higher). See Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* for a discussion of how these two levee heights and the three alternative alignments were selected for consideration in the final array of alternative plans.

Table 4.8-1. Hazardous Materials Sites within or adjacent to Potential Disturbance Areas

Site Name	Approx. Distance to Proposed Levee; Address; and Coordinates	Summary	Database(s)*	Link to Online Records (SWRCB and DTSC; use Ctrl to activate link)
Wastewater Facility Property	A) Adjacent to Proposed Levee Segment East of Artesian Slough; 37°26'43.09"N 121°56'23.50"W B) 700 Los Esteros Road, San José, CA	All of the listed sites below are on the Wastewater Facility property. All of these sites have HTRW concerns with the potential to affect future construction activities. Further coordination needs to take place with the Wastewater Facility in order to accurately locate and avoid all areas with HTRW concerns prior to construction. A) Inactive Legacy Lagoon Biosolids and Active Residual Solids Management Area Between the 1962 and 1974, biosolids were discharged to a series of lagoons on this site and allowed to accumulate. These accumulated biosolids remain onsite and are referred to as the legacy biosolids. Currently inactive lagoons that were used until the 1970s for solar drying occupy 214 acres of land. This site has been inactive in recent history. However, biosolids treatment is continuing in an area called the Residual Solids Management area. This area contains biosolids lagoons and drying beds used for solar drying of residual solids from processed wastewater. B) San José Wastewater Facility Operations Areas According to the GeoTracker website, approximately 20,000 gallons of diesel were removed from an excavation during activities pertaining to the construction of the South Bay Water Recycling Project (now known as Wastewater Facility). An additional 2.91 million gallons of groundwater containing dissolved diesel but no free product were extracted and treated form 9/9/1997 through 2/10/1998. No information regarding the former contaminant plume have been provided since 1998 on GeoTracker and the case remains open and inactive. However, the site was classified as “Category 1” in 2006, which means that the site is characterized by soil or groundwater contamination that does not pose an immediate human health threat and does not extend off-site past the public right of way onto neighboring properties. In addition, there are records of an inactive/unclosed, 96-acre landfill that is owned by the City of San José and is on the Wastewater Facility property. This landfill, called the Nine-Par Disposal Site, consists of marshlands and wetlands. The Wastewater Facility Plant Master Plan proposes leaving the former landfill site intact and does not propose its reuse.	ERNS, RCRA-LQG, FINDS, UST, SLIC, CHMIRS, HAZNET, EMI, Cortese, LUST, SLIC, SAN JOSÉ HAZMAT, SWEEPS UST, CHMIRS, VCP, ENF, HAZNET, ENVIROSTOR	A) http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=60001622 B) http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL18357777

Table 4.8-1. Hazardous Materials Sites within or adjacent to Potential Disturbance Areas

Site Name	Approx. Distance to Proposed Levee; Address; and Coordinates	Summary	Database(s)*	Link to Online Records (SWRCB and DTSC; use Ctrl to activate link)
Zanker Material Processing Facility	Adjacent to Proposed Levee Segment East of Artesian Slough; 675 Los Esteros Rd, San José, CA; 37°25'58.84"N 121°57'20.98"W	This site has HTRW concerns with the potential to affect future construction activities. Measures should be taken to avoid construction activities in this area if possible. The 50.53-acre site was formerly known as the Old Owens Corning Landfill. It has been in operation since 1956 and was a solid waste disposal site for the Owens Corning Fiberglass manufacturing facility in Santa Clara until July 1998 when Zanker Road Resource Management, Ltd completed the purchase of the site. Before 1998, the waste stream generally consisted of culled fiberglass products, including composite asphalt-coated paper and foil, refractory wastes, and wood debris. No designated, infectious, or hazardous wastes were disposed of at the site. Now, the currently permitted waste management unit consists of approximately 46 acres, of which approximately 31 acres have received refuse fill. The current permit expires in 2018.The City of San José completed an EIR for the site in 2008 and a subsequent initial study for minor changes to the site plan in 2013. As described in the recent initial study, a narrow open-space buffer around the site's landfill area is adjacent to the proposed levee footprint for Alternatives 4 and 5. A plume of volatile organic compounds (VOCs) in groundwater persists in the northernmost corner of the site (in the area proposed to be used as Staging Area #3). These impacts are limited to a buried sand channel located in the well G-4 area. It has been estimated that the source of the VOCs was likely an area to the east of well G-4, outside of the landfill. The primary contaminants of concern at the site are trichloroethene (detected at 72-280 micrograms per liter) and cis-1,2-dichloroethene (detected at 30-450 micrograms per liter). The groundwater extraction system, which has been in operation for approximately 12 years, is removing VOCs in groundwater as exhibited by a general downward trend in contractions for TCE. The approximate total volume of groundwater extracted from well G-4 since the system began operating in 2002 is 2,160,000 gallons. During the first half of 2014, less than 1,600 gallons of groundwater were extracted from well G-4. Moreover, the Facility conducts a self-monitoring program for groundwater and leachate twice per year per San Francisco Bay Regional Water Quality Control Board Waste Discharge Requirements under Order No. 98-123, adopted in 1998. A leachate collection and removal system consisting of a test pit sump and interior extraction trench operates to reduce impacts to groundwater quality.	N/A	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=L10007272651

Table 4.8-1. Hazardous Materials Sites within or adjacent to Potential Disturbance Areas

Site Name	Approx. Distance to Proposed Levee; Address; and Coordinates	Summary	Database(s)*	Link to Online Records (SWRCB and DTSC; use Ctrl to activate link)
Zanker Road Class III Landfill	Adjacent to Proposed Levee Segment East of Artesian Slough; 705 Los Esteros Rd, San José, CA; 37°26'21.30"N 121°56'56.69"W	This site has HTRW concerns that are not likely to impact future construction activities. The Wastewater Facility Plant Master Plan area surrounds this site. If Shoreline Phase I Project levee construction takes place on the northern end of the Zanker Road class III landfill property, measures should be taken to avoid construction activities within the permitted bounds of the landfill, if possible. This 70-acre landfill, known as the Zanker Road Resource Recovery Operation and Landfill, has been in operation since the 1930s and has been owned by Zanker Road Resource Management, Ltd since 1992. Until 1977, the landfill was owned by the Nine-Par Company; however, the accepted waste streams are unknown from the 1930 through 1977 due to a lack of regulation. The primary chemical of concern 1,4-dioxane in groundwater. In March 2014, 1,4- dioxane was detected in groundwater samples from all on-site wells. Concentrations ranged from 1.3-87 micrograms per liter. Although present and an indication of groundwater impact, likely originating in the former Nine Par Landfill that underlies the site, the current and previously reported 1,4-dioxane concentrations remain three orders-of-magnitude below the ESL ceiling value of 50,000 µg/L for nondrinking water source groundwater or estuarine habitat surface water. At these low concentrations, 1,4-dioxane does not pose a significant, long-term (chronic) threat to human health and the environment. Groundwater monitoring at the Landfill is done in accordance with Waste Discharge Requirements Order No. 87-032 (WDR 87-032), issued by the San Francisco Bay Regional Water Quality Control Board (RWQCB) in April 1987, and WDR 93-113, issued by the RWQCB in September 1993. As specified in its current operating permits, this landfill accepts nonhazardous solid waste, excluding putrescible garbage and solid waste, household wastes, liquid waste sludge, designated wastes, and hazardous wastes. The mixed wastes consist primarily of construction wastes, demolition debris, concrete, asphalt, dirt, metal, glass, and other materials such as wallboard, wood, and porcelain. No garbage, burning or smoldering wastes, hazardous wastes, infectious wastes, liquid wastes, putrescible wastes, friable asbestos, or sludge are accepted. The landfill's primary function is resource recovery, with the landfilling of residual non-recyclable material (i.e., waste) being a minor function.	CERCLIS, FINDS, WMUDS/SWAT	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=L10002780473
George Maciel Trucking	0.32 miles 1252 State St, San José, CA 37°25'40.93"N 121°58'26.33"W	This site has HTRW concerns that are not likely to impact future construction activities due to the localized nature of the contamination and the distance to the proposed levee location. However, this area should be avoided if possible. On July 8, 1999, one 10,000 gallon underground storage tank last containing diesel was removed. As of December 2013, the depth to groundwater was approximately 17 feet below ground surface. An extraction well was approved in September 2014 for installation in the former underground storage tank back-fill area in order to potentially drain the backfill of perched water and separate phase hydrocarbons.	N/A	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0608552020

Table 4.8-1. Hazardous Materials Sites within or adjacent to Potential Disturbance Areas

Site Name	Approx. Distance to Proposed Levee; Address; and Coordinates	Summary	Database(s)*	Link to Online Records (SWRCB and DTSC; use Ctrl to activate link)
Newby Island Landfill	0.2 miles 1601 Dixon Landing Road, Milpitas, CA 37°27'29.00"N 121°56'28.84"W	This site has potential HTRW concerns that are not likely to impact future construction activities as the site is not included in the Shoreline Phase I Project footprint and it is self-contained, permitted, and monitored. This site is northeast of Pond A18 on the north side of a slough that separates Pond A18 and surrounding wetlands from the landfill site. However, measures should be taken to avoid construction activities in this area if necessary. Originally known as Buena Island, Newby Island was reclaimed and used for agriculture purposes from 1870 to 1931. San José Scavenger Company bought the site and operated a burn dump until 1951 when it converted to a municipal landfill and continued operations to 1972. International Disposal Corporation of California became the present owner in 1972. International Disposal Corporation is operating at this site as Newby Island Sanitary Landfill, BFI Recyclery, and Newby Island Compost Facility. Other names that this site is known as: Newby Island Disposal Area, Browning Ferris-Newby Island, and international Disposal. These facilities are permitted and inspected monthly by City of San José, Code Enforcement, and monitored by the Santa Clara County Integrated Waste Management. This is an active, restricted access sanitary (nonhazardous) landfill site located at the west-end of Dixon Landing Road in Milpitas, California. No liquid or hazardous waste has knowingly been accepted at this site and the disposal of hazardous wastes, pesticides or any other toxic wastes is prohibited. This 342-acre site is adjacent to San Francisco Bay to the west, a mud slough and wetlands to the south, and Coyote Creek to the north. The landfill occupies reclaimed tidal marshlands of San Francisco Bay and is surrounded by a perimeter levee at an approximate elevation of 14 feet above mean sea level, which separates the site from Coyote Creek on the north and east and various sloughs on the south and west. There is a methane capture system that is separately fenced and gated. There is no record of releases to groundwater in the files; however, there is a groundwater monitoring network of wells located on site.	N/A	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=L10002276721http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=43490006 http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=80001840 http://www.envirostor.dtsc.ca.gov/public/hwmp_profile_report.asp?global_id=CAT080012479&starttab=

Table 4.8-1. Hazardous Materials Sites within or adjacent to Potential Disturbance Areas

Site Name	Approx. Distance to Proposed Levee; Address; and Coordinates	Summary	Database(s)*	Link to Online Records (SWRCB and DTSC; use Ctrl to activate link)
South Bay Asbestos Area (Alviso Asbestos Landfill)	0.5 miles (Represents closest contaminated area)	This site has HTRW concerns that are not likely to impact future construction activities because it is not included in the Proposed Project footprint, the contaminated areas have been contained, and the contaminated sites are located a long distance from the proposed levee location. However, measures should be taken to avoid construction activities in the remaining contaminated areas. During the 1950s, several landfills in the Alviso area accepted wastes from an asbestos cement pipe manufacturing facility. This waste was later used for raising the grade of the site and for constructing a ring-levee, resulting in asbestos contamination throughout the Alviso area and covering roughly 330 acres. The Site was listed on the Federal Superfund list in 1985. USEPA has been the lead regulatory agency overseeing work. The Site was divided into two operable units – the Ring Levee (OU-1) and the overall site/remainder of the site (OU-2). Remediation is complete for the areas included in the Ring Levee (OU-1) and no further action is required. Construction activities could take place in these areas if desired. OU-2 includes four truck yards, and three landfill areas (Marshland, Santos, and Sainte Claire). Asbestos-containing soil has been excavated and removed from the truck yards and the truck yards have been paved over. Thus, no further action is required at the truck yards and construction activities could take place in these areas if desired. Covers were installed at the three landfill areas within OU-2. However, asbestos will remain buried on-site at the landfill areas; thus, it is recommended that measures should be taken to avoid construction activities in these areas. There is are two deed restrictions in place in these areas: 1) on the title of the Bixby Technology Center (formerly Legacy Tech Park) portion of the former Santos Landfill; and, 2) on the property titles for the Summerset Mobile Estates (SME) portion of the former Santos Landfill and the Sainte Claire Landfill. The Marshland Landfill has been regulated by the California Regional Water Quality Control Board – San Francisco Bay Region as a Class III landfill.	NPL, CERCLIS, US ENG CONTROLS, US INST CONTROL, ROD, FINDS, DEED, ENVIROSTOR, WMUDS/SWAT	http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=43490060
CSJ Gold Street Storm Station	0.9 miles 3519 Gold Street, San José, CA 37°25'5.69"N 121°58'25.03"W	This site is closed and will not impact future construction activities. This site previously contained a leaking underground storage tank; however, remediation is complete. The case was officially closed on July 3, 2000.	LUST, SAN JOSÉ HAZMAT, SWEEPS UST	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0608500420
Spreckles Road Sanitary Pump	0.5 miles 3288 Spreckles Ave., San José, CA 37°25'59.23"N 121°58'1.66"W	This site is closed and will not impact future construction activities. This site previously contained a leaking underground storage tank; however, remediation is complete. This case was officially closed on January 25, 1996	LUST, SAN JOSÉ HAZMAT	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0608528407

Table 4.8-1. Hazardous Materials Sites within or adjacent to Potential Disturbance Areas

Site Name	Approx. Distance to Proposed Levee; Address; and Coordinates	Summary	Database(s)*	Link to Online Records (SWRCB and DTSC; use Ctrl to activate link)
WD Smith Trust	0.35 miles 800 Spreckles Ave., San José, CA 37°26'6.98"N 121°58'10.99"W	This site is closed and will not impact future construction activities. This site previously contained a leaking underground storage tank; however, remediation is complete. This case was officially closed on June 5, 1995.	CORTESE, LUST, SWEEPS UST	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0608501577

*Notes:

If a site is marked as N/A in the "Databases" column, this indicates that the site was not specifically identified by the 2012 records search. However, the results of the second review of the area conducted in 2014 indicated that the site may impact future construction activities in the area.

CERCLIS – The Comprehensive Environmental Response, Compensation, and Liability Information System contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies, and private persons pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The CERCLIS contains sites that are either proposed for or on the National Priorities List.

CHMIRS – The California Hazardous Material Incident Report System contains information on reported hazardous material incidents, i.e., accidental releases or spills. The source is the California Office of Emergency Services.

Cortese – The sites for the list are designated by the State Water Resource Control Board (LUST), the Integrated Waste Board (SWF/LS), and the Department of Toxic Substances Control (Cal-Sites).

DEED – The use of recorded land-use restrictions is one of the methods the DTSC uses to protect the public from unsafe exposures to hazardous substances and wastes.

DTSC – Department of Toxic Substances Control

EMI – Toxics and criteria pollutant emissions data collected by the California Air Resources Board and local air pollution agencies.

ENF – A listing of California Water Board Enforcement Actions.

ENVIROSTOR – The DTSC's Site Mitigation and Brownfields Reuse Programs (SMBRPs); identifies sites that have known contamination or sites for which there may be reasons to investigate further. Includes: Federal Superfund sites, the NPL; State Response, including Military Facilities and State Superfund; Voluntary Cleanup; and School sites. Includes identification of formerly contaminated properties that have been released for reuse, properties where environmental deed restrictions have been recorded to prevent inappropriate land uses, and risk characterization information that is used to assess potential impacts on public health and the environment at contaminated sites.

ERNS – The Emergency Response Notification System records and stores information on reported releases of oil and hazardous substances. The source of this database is the USEPA.

FINDS – The Facility Index System contains both facility information and "pointers" to other sources of information that contain more detail. These include the RCRIS; the Permit Compliance System (PCS); the Aerometric Information Retrieval System (AIRS); the FATES (FIFRA [Federal Insecticide Fungicide Rodenticide Act] and TSCA Enforcement System, the FTTS [FIFRA/TSCA Tracking System]; the CERCLIS; the DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes); Federal Underground Injection Control (FURS); the Federal Reporting Data System (FRDS); Surface Impoundments (SIA); the TSCA Chemicals in Commerce Information System (CICS); the PADS; the RCRA-J (medical waste transporters/disposers); the TRIS; and the TSCA. The source of this database is the USEPA/NTIS.

HAZNET – The data are extracted from the copies of hazardous waste manifests received each year by the DTSC. The annual volume of manifests is typically 700,000–1,000,000 annually, representing approximately 350,000–500,000 shipments. Data are from the manifests submitted without correction and therefore many contain some invalid values for data elements such as generator ID, TSD ID, waste category, and disposal method. The source is the Department of Toxic Substance Control.

LUST – The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the State Water Resources Control Board Leaking Underground Storage Tank Information System.

NPL – National Priorities List.

Table 4.8-1. Hazardous Materials Sites within or adjacent to Potential Disturbance Areas

Site Name	Approx. Distance to Proposed Levee; Address; and Coordinates	Summary	Database(s)*	Link to Online Records (SWRCB and DTSC; use Ctrl to activate link)

RCRA-LQG – Info is the USEPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites that generate, transport, store, treat, and/or dispose of hazardous waste as defined by the RCRA. Large-quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste, per month.

ROD – Record of Decision documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid the cleanup.

SAN JOSÉ HAZMAT – database maintained by the City of San José.

SLIC – from the California Regional Water Quality Control Board.

SWEEPS UST – Statewide Environmental Evaluation and Planning System. This underground storage tank list was updated and maintained by a company contacted by the SWRCB in the early 1990s. The list is no longer updated or maintained.

UST – underground storage tank.

US ENG CONTROLS – A listing of sites with engineering controls in place.

US INST CONTROL –A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post-remediation care requirements, intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

VCP – voluntary cleanup priority listing.

WMUDS/SWAT – The Waste Management Unit Database System is used for program tracking and inventory of waste management units. The source is the State Water Resources Control Board.

4.8.1.3 National Environmental Policy Act and Engineer Regulation 1105-2-100: *Planning Guidance Notebook* Baseline Condition

The NEPA and Planning Guidance Notebook baseline condition is used to compare effects among alternatives against the effects of the future No Action condition. For hazards and hazardous materials, the NEPA and the Planning Guidance Notebook baseline condition is determined by projecting how the condition might change between current condition discussed in Section 4.8.1 *Affected Environment* and the start of construction. Some local development projects and the beginning stages of SBSP Restoration Project Phase II efforts will occur near the study area between 2014 and 2017, but these activities are not anticipated to create new HTRW sites in or near the study area. For this reason, the NEPA and the Planning Guidance Notebook baseline condition considered below in Section 4.12.2 *Environmental Consequences* is the same as the physical setting described in Section 4.8.1.2 *Physical Setting (CEQA Baseline)*.

4.8.2 Environmental Consequences

4.8.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

Avoidance and minimization measures are those parameters that have been built into the design of the Proposed Project and are committed to as part of project implementation. These measures are generally included in the alternatives description of this report (Section 3.8 *Action Alternatives Component Details*), but, where appropriate, the specific measures related to the impact evaluations are also summarized in the resource chapters. The following AMMs would be implemented as part of the project design and would avoid or minimize adverse effects:

- **AMM-HAZ-1: Avoid Hazardous Sites** – All sites listed in Table 4.8-1 *Hazardous Materials Sites within or adjacent to Potential Disturbance Areas* that are designated as “having HTRW concerns that are not likely to or with the potential to affect future construction” should be avoided for inclusion in this Recommended Plan (Proposed Project). Moreover, construction will be avoided in all areas where the presence or potential presence of HTRW has been documented previously. Further coordination with the City of San José, the operator of the Wastewater Facility, will be conducted in order to accurately locate and avoid all areas with HTRW concerns prior to construction.
- **AMM-HAZ-2: Compliance with Federal, State, and Local Regulations –** Compliance with applicable regulations would reduce the potential for accidental release of hazardous materials during construction. The contractor would also be required to prepare a Storm Water Pollution Prevention Plan (SWPPP) and Spill Prevention Control and Countermeasure Plan (SPCCP) that details the contractors plan to prevent discharge from the construction site into drainage systems, lakes, or rivers. This plan would include Best Management Practices (BMPs) and a spill cleanup plan that are planned for implementation at each construction site
- **AMM-HAZ-3: Prepare Health and Safety Plan –** A worker health and safety plan would be prepared before the start of construction activities that identifies, at a

minimum, all contaminants that could be encountered during construction activities; all appropriate worker, public health, and environmental protection equipment and procedures to be used during project activities; emergency response procedures; the most direct route to the nearest hospitals; and a Site Safety Officer. The plan would describe actions to be taken should hazardous materials be encountered on site, including protocols for handling hazardous materials and preventing their spread, and emergency procedures to be taken in the event of a spill.

- **AMM-HAZ-4: Records Review Prior to Construction –** If significant time has elapsed between approval of this document and construction, a second records review should be completed to reduce the risk of encountering a site during construction.

4.8.2.2 Methodology for Impact Analysis and Significance Thresholds

Section 4.1 *Approach to the Environmental Analysis* discusses the general methodology for evaluating environmental impacts under the NEPA and the CEQA, with resource specific content discussed in this section.

Effects to the public and environment were identified by conducting a records review to determine the presence of recognized hazardous environmental conditions. The USACE also utilized updated site information in the EnviroStor and GeoTracker databases to determine possible impacts that the identified sites may have on future construction activities. The evaluation of potential impacts was based on the location of the HTRW site in relation to proposed levee construction and improvements. Characteristics used to determine potential impacts on construction activities included the following:

- Review of relevant documents and websites to obtain information regarding known HTRW sites in the study area; and,
- The suspected mass and volume of contaminants, their mobility within the soil-groundwater-air matrix, and the likelihood of traditional levee construction measures and other project activities impacting contaminated media.

The thresholds for determining the significance of impacts for this analysis are based on the environmental checklist in Appendix G of the State CEQA Guidelines. These thresholds also encompass the factors taken into account under the NEPA to determine the significance of an action in terms of its context and the intensity of its impacts. The alternatives under consideration were determined to result in a significant impact related to hazards and hazardous materials if they would do any of the following:

- **Impact HAZ-1:** Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials or through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;
- **Impact HAZ-2:** Produce hazardous emissions or involve the handling of hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school;

- **Impact HAZ-3:** Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment; or
- **Impact HAZ-4:** Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan.

4.8.2.3 Alternatives Evaluation

This section evaluates the impacts on hazards and hazardous materials resulting from the construction and operation activities for each of the alternatives.

4.8.2.3.1 No Action Alternative

Under the No Action Alternative, no construction would occur and therefore the potential for hazardous spills due to construction activities would be eliminated. However, without implementation of a project, the risk of flooding in the area would remain high. A levee failure could result in flooding that could upset stored hazardous materials and spread agricultural pesticides, oil, gasoline, and other hazardous materials in flood waters, creating hazardous conditions for the public and the environment. Contamination of groundwater and soils could result from the flooding of sites that store or generate hazardous waste. Floodwater that inundates and interacts with the Wastewater Facility sewage and accumulated sludge could disperse these materials in the environment and pose a chemical and/or biological hazard.

Flood damage to homes and other structures can render them dangerous as a result of structural damage and contamination. Floodwater interaction with structures could release lead and asbestos. Electrical systems could be damaged by flooding and could potentially cause fires. Natural gas systems could be damaged causing leaks that could result in poisoning through inhalation of fumes, or a sudden explosion if sparked. The likelihood of a significant amount of mold production is high after a flood event. Mold not only threatens the physical integrity of structures, but also poses its own health risks. Mold can cause lung infections, skin irritations, and other health dangers, especially for those with asthma, allergies, or suppressed immune systems. Lastly, the floodwater itself and ponds left behind could provide a wide breeding ground for mosquitoes, and could increase the incidence of mosquito-borne diseases.

Effects on the water supply system could be particularly severe in a flood event, as a single break in a water delivery pipe or main could contaminate the entire city’s water supply. All breaks and leaks would need to be repaired and the pipes of every home or structure would need to be flushed to remove contamination before residents and business could rely on safe water. Depending on the severity and location of the flood and contamination, this effort could take a significant amount of time.

The potential for such occurrences listed above is uncertain, and the magnitude and duration of any related risks cannot be predicted. Because the effects of a levee failure are unpredictable, a precise determination of significance is not possible and cannot be made. However, the relative potential risks associated with this type of event are not expected to change much over the evaluation period of 2017 to 2067. This is due to the likely continued use of the area primarily for industrial and commercial uses. However, homes located in the Alviso community could also potentially be affected.

4.8.2.3.2 Action Alternatives

This section describes the effects of hazards and hazardous materials resulting from the action alternatives.

Impact HAZ-1: Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials or through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment

Construction activities would involve the use of hazardous materials such as fuels and lubricants to operate construction equipment and vehicles such as excavators, compactors, haul trucks, and loaders. Construction contractors would be required to use, store, and transport hazardous materials in compliance with Federal, state, and local regulations during project construction and operation. However, fuels, and lubricants could be accidentally released into the environment at the construction site and along haul routes, causing environmental or human exposure to these hazards.

The implementation of environmental commitments, including the SWPPP and SPCCP (AMM-HAZ-2: Compliance with Federal and State regulations), and a worker health and safety plan including protocols for handling hazardous materials (AMM-HAZ-3: Prepare Health and Safety Plan), would ensure that the risk of accidental spills and releases into the environment would be minimal. Any hazardous substance encountered during construction would be removed and properly disposed of by a licensed contractor in accordance with Federal, State, and local regulations. Compliance with applicable regulations would reduce the potential for accidental release of hazardous materials during transport and construction activities.

Consequently, the risk of incidental release of hazardous materials during their transport and use in project construction activities is low and the effect is considered less than significant.

There is the potential that previously undocumented hazardous materials could be encountered at project sites. Excavation and construction activities at or near areas of currently unrecorded soil or groundwater contamination could result in the exposure of construction workers, the general public, and the environment to hazardous materials. Such a discovery would represent a significant impact; however, the discovery of previously undocumented hazardous materials as a result of construction activities is not anticipated and considered to be unlikely.

The discovery of undocumented hazardous material would be a significant impact to workers, the general public, and the environment. Mitigation would be required to address this impact (see Section 4.8.3 Mitigation Measures*).*

Impact HAZ-2: Emit hazardous emissions or involve the handling of hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school

There are no schools within a quarter mile of the project footprint. All hazardous materials would be used, stored, and transported in compliance with Federal, state, and local regulations during project construction and operation.

The risk of use of hazardous materials near schools is less than significant.

Impact HAZ-3: Be located on a site that is included on a list of hazardous materials sites complied pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment

No sites were identified in areas proposed for pond improvements. Thus, the primary consideration is sites within or adjacent to proposed FRM levee alignments. The sites listed below are near proposed activity areas (FRM levee alignments) for action alternatives and were evaluated by the USACE to determine whether the sites had the potential to affect alignment feasibility. Any construction activities that include the disturbance of soil or removal of groundwater may encounter HTRW and project alternatives need to consider the potential presence of contamination near the site. However, upon conclusion of the records search, none of the levee alignments are anticipated to result in HTRW issues. However, once construction of the chosen alignment begins, and if soil is planned to be moved around and/or hauled off site, a characterization of these soils would likely be necessary to determine disposal options for these soils or where they can be placed within the project boundaries. A Sampling and Analysis Plan would need to be developed based on the levee alignment and construction techniques chosen.

Potential HTRW issues should be addressed at the two sites listed below prior to the commencement of levee construction activities. The following two sites have HTRW concerns with the potential to affect future construction activities:

- Wastewater Facility
  - The FRM levee alignment that has been carried forward for environmental analyses (see Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* for other WPCP segments that weren't carried forward) is adjacent to the Wastewater Facility property, and Staging Areas #1 and #2 are located on the Wastewater Facility property. This facility actively treats wastewater and exhibits inactive and active biosolids treatment lagoons. As the owner of the property, the City of San José plans to retire and reuse about 500 acres of legacy sewage ponds and biosolids lagoons. The Wastewater Facility has documented historical and long-term use of hazardous materials in multiple hazardous materials databases, and has ongoing reporting of hazardous materials storage and usage. Prior to the commencement of construction activities adjacent to and on this property, especially near the biosolids treatment lagoons, potential HTRW issues should be

evaluated further. The Shoreline Phase I Project might be able to use information collected by the City in the future if the City completes full HTRW evaluations associated with reuse of the legacy sewage ponds and former biosolids lagoons as part of its reuse plan for those areas.

- Zanker Material Processing Facility
  - A plume of volatile organic compounds, specifically trichloroethene and cis-1,2-dichloroethene, in groundwater persists in the northernmost corner of this facility. These impacts are limited to a buried sand channel located in the well G-4 area. This well G-4 area is no more than 200 feet from the proposed Staging Area #3 location and the proposed FRM levee alignments listed in Alternatives 4 and 5. It has been estimated that the source of the VOCs was likely an area to the east of well G-4, outside of the landfill. The depth to water in well G-4 was measured to be 7.63 feet below the top of the well casing. This area should be avoided during construction of the FRM levee alignment. Moreover, any excavation to a depth that would encounter groundwater should be avoided even though the area proposed for Staging Area #3 will be used for dirt stockpiling only.

The following three sites have HTRW concerns that are not likely to affect future construction activities:

- Zanker Road Class III Landfill
  - Even though the landfill has only accepted nonhazardous waste since 1977, the accepted waste streams are unknown from the 1930 through 1977 due to a lack of regulation. Additionally, the proposed FRM levee alignment for all alternatives is roughly 300 feet from the permitted landfill boundary. Groundwater monitoring has shown elevated levels of total nitrogen in a well 1,000 feet from the proposed levee alignment and low-level detections of 1,4-dioxane in all monitoring wells. However, these detections do not pose an immediate threat to human health have had no effect on the current beneficial use of groundwater as a nondrinking water source and estuarine habitat surface water. Even though there is no documented threat to worker safety in this area, the construction team should be vigilant during any excavation and dewatering activities in this area.
- George Maciel Trucking
  - This site is located roughly 450 feet from the proposed FRM levee alignment as part of Alternative 5. Due to the localized nature of contamination in this area and the distance to the proposed levee location, this area will not affect future construction activities as a part of Alternatives 2, 3, and 4. Additionally, this site is not likely to affect future construction activities as part of Alternative 5; the construction team should be vigilant during any excavation and dewatering activities in this area.

- Newby Island Landfill
  - This active, restricted access sanitary (nonhazardous) landfill site is surrounded by a perimeter levee and is not included in the Proposed Project footprint. The FRM levee alignment is separated from the landfill's perimeter levee by Coyote Creek on the north and east and various sloughs on the south and west. The landfill is permitted and monitored, and there is no record of a release to groundwater. This site is not likely to affect future construction activities as part of any proposed Alternative.
- South Bay Asbestos Area (Alviso Asbestos Landfill)
  - This site has HTRW concerns that are not likely to impact future construction activities because it is not included in the Proposed Project footprint of any Alternative, the contaminated areas have been contained, and the contaminated sites are located a great distance from the proposed levee location. However, measures should be taken to avoid construction activities in the remaining contaminated areas.

The three sites listed below are closed leaking underground storage tank cases. Case closure indicates that unacceptable risks to human or ecological receptors are not expected at this site as a result of a site evaluation for the presence or absence of contamination. The following three sites have no HTRW concerns and will not affect future construction activities:

- CSJ Gold Street Storm Station;
- Spreckles Road Sanitary Pump; and,
- WD Smith Trust.

All existing sites are located on the landward side of the proposed FRM levee and would thereby provide these areas FRM and reduce the likelihood of interaction between hazardous materials and floodwater. The project would pose a beneficial long-term impact to hazardous waste sites within the study area.

Since the proposed FRM levee alignment is not located within any previously identified potential HTRW sites, a Phase II Environmental Site Assessment is not necessary at this time. However, if the locations of the proposed FRM levee alignment or staging areas change to include a previously identified potential HTRW site, this would be a significant impact.

Construction in close proximity to a site where the presence or potential presence of HTRW has been documented previously would be a significant impact to workers, the general public, and the environment. Mitigation would be required to address this impact (see Section 4.8.3 Mitigation Measures*).*

Impact HAZ-4: Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan

Slow moving construction vehicles would stay within active work areas and would use public roads infrequently. Construction work would be staged and conducted well away from public roads and would therefore not impact emergency access or evacuation plans.

Project impacts to emergency response and emergency evacuation would be less than significant.

4.8.2.3.2.1 Comparison of Action Alternatives

This section highlights any differences among the action alternatives in their effects on hazards and hazardous materials. Impacts on hazards and hazardous materials are expected to be similar for all action alternatives; however, the different FRM levee alignments differ in proximity to known hazardous materials sites (Table 4.8-2 *Hazardous Materials Consideration for Flood Risk Management* Alignment).

Table 4.8-2. Hazardous Materials Consideration for Flood Risk Management Alignment

Alternative	Hazardous Materials Considerations
2 – Alviso North, Artesian Slough Tide Gate, WCPC South with 12.5-foot levee and bench + Restoration of Ponds A9–A15 and A18	Least hazardous materials concern: • Construction would include staging areas on the Wastewater Facility and Zanker Materials Processing Facility properties, which have ongoing hazardous materials concerns. • Alignment is farthest away of known sites of past contamination.
3 – Alviso North, Artesian Slough Tide Gate, WCPC South with 15.2-foot levee and 30:1 ecotone + Restoration of Ponds A9–A15 and A18	Same as Alternative 2.
4 – Alviso Railroad, Artesian Slough Tide Gate, WCPC South with 15.2-foot levee and bench + Restoration of Ponds A9–A15 and A18	Intermediate hazardous materials concern: • Construction would include staging areas on the Wastewater Facility and Zanker Materials Processing Facility properties, which have ongoing hazardous materials concerns. • Close alignment to area that exhibits groundwater contamination at the Zanker Materials Processing Facility.
5 – Alviso South, Artesian Slough Tide Gate, WCPC South with 15.2-foot levee and bench + Restoration of Ponds A9–A15 and A18	Greatest hazardous materials concern: • Same as Alternative 4. • Closest alignment to the George Maciel Trucking former leaking underground storage tank site and known industrial area.

4.8.3 Mitigation Measures

Mitigation measures are measures that would be required to be implemented to avoid or minimize significant adverse effects of the Proposed Project. Mitigation measures are requirements that have not been specifically included as part of the overall project (or alternative) description.

Because there is a potential for significant impacts associated with the release of hazardous material from undocumented hazardous materials in soil or water disturbed during construction; or if work must be conducted at locations with identified HTRW sites, the following mitigation measure will be incorporated into construction activities. Supplemental environmental review may be necessary if any of the impacts are deemed more significant that disclosed in this document.

Implementing these mitigation measures would reduce potential project-related exposure impacts to a less-than-significant level. If an impact is identified during any phase of the Proposed Project, the following measures would be adopted as part of any alternative, if applicable:

- **M-HAZ-1: Discovery of Undocumented Hazardous Materials**

  It is unlikely that any HTRW will be encountered in areas that have no previous documentation of the presence or potential presence of HTRW. However, should HTRW be encountered unexpectedly during construction activities such as excavation and dewatering, the contractor must notify the appropriate Federal, state, and local agencies, and the site would be remediated in compliance with applicable Federal, state, and local laws. If an undocumented underground storage tank is encountered, a licensed contractor will be retained to remove the UST and any associated contaminated material.

  In the event that contamination is encountered, the contractor will notify appropriate agencies and remediate the site consistent with state and local regulations.

With implementation of mitigation measure M-HAZ-1, impacts associated with the discovery of unknown hazardous materials would be less than significant.

- **M-HAZ-3: Construction Near Hazardous Sites**

  All sites listed in Table 4.8-2 *Hazardous Materials Consideration for Flood Risk Management Alignment* that are designated as “having HTRW concerns that are not likely to or with the potential to affect future construction” should be avoided for inclusion in this Proposed Project (AMM-HAZ-1: Avoid Hazardous Sites). Construction will be avoided in all areas where the presence or potential presence of HTRW has been documented previously.

  If construction activities must occur in close proximity to sites where the presence or potential presence of HTRW has been documented previously, the USACE would re-evaluate the site to determine if a Phase II Environmental Site Assessment is necessary. If it is determined that a Phase II Environmental Site Assessment must be completed, the USACE would conduct a Phase II Environmental Site Assessment for the alignment of the FRM levee, staging areas, and other construction areas as appropriate to confirm the presence or absence of HTRW. The results will determine the existence of actionable concentrations of released hazardous materials. This would further reduce the risk of exposure to workers and the public during construction and assist in the remediation planning. If necessary, the assessment would include an analysis of soil or groundwater samples if an analysis had not yet been completed during previous investigations before construction activities begin. Prior to commencement of the Phase II Environmental Site Assessment, the USACE would develop a contingency plan to address the hazardous materials and work safety requirements for the proper handling, storage, treatment, and disposal of any contaminants present at an actionable level consistent with Federal, State, and local laws. Based on the results of the Phase II Environmental Site Assessment, additional measures, such as remediation, disposal, containment, and special safety precautions for workers, may be required consistent with Federal and State regulations.

If contamination is present, safety measures would be implemented to protect workers, and soil would be further characterized to determine the nature and extent of contamination, guide disposal options, and potentially limit placement and reuse of soil on site consistent with mitigation measure M-HAZ-01.

Implementation of mitigation measure M-HAZ-3 would reduce this impact to less than significant.

4.8.3.1 Residual Impacts and Additional Measures Necessary to Mitigate Significant Impacts

The mitigation measures listed above are sufficient to reduce project-related risk from hazardous materials to a less than significant level. No additional measures are necessary to reduce or minimize project impacts.

4.8.4 Cumulative Effects

An introduction to cumulative effects is included in Section 4.1.8 *Cumulative Impacts Setting* and includes a list of projects considered in this analysis. Development in the region has resulted in the designation of numerous hazardous waste sites throughout the area, representing a cumulatively significant impact. However, none of the action alternatives' incremental effects related to hazardous materials would be cumulatively considerable.

The Shoreline Phase I Project, in conjunction with other planned FRM projects in the area, would incrementally improve risk management and reduce the overall likelihood for interaction between known hazardous material sites and floodwater. Potential project-related effects associated with construction would be short term and are mitigatable. Because of this, the short-term project impacts are not expected to cause or contribute to cumulative exposure effects in or near the study area.

4.8.5 Summary

Table 4.8-3 *Hazards and Hazardous Materials NEPA Impact Conclusions* summarizes the project effects under the NEPA.

Table 4.8-3. Hazards and Hazardous Materials NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
HAZ-01: Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials or through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment	Negative	Minor	Short term	Possible	Limited
HAZ-02: Emit hazardous emissions or involve the handling of hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school	Negative	Minor	Short term	Unlikely	Limited
HAZ-03: Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment	Negative	Minor	Short term	Unlikely	Limited
HAZ-04: Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan	Negative	Minor	Short term	Unlikely	Limited

Table 4.8-4 *Hazards and Hazardous Materials CEQA Impact Conclusions* summarizes the project effects under the CEQA.

Table 4.8-4. Hazards and Hazardous Materials CEQA Impact Conclusions

Effect	Significance	Mitigation	Significance After Mitigation
HAZ-1: Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials or through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment	S	M-HAZ-1: Discovery of Undocumented Hazardous Materials	LTS
HAZ-2: Emit hazardous emissions or involve the handling of hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school	LTS	None	LTS
HAZ-3: Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment	S	M-HAZ-3: Construction Near Hazardous Sites	LTS
HAZ-4: Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan	LTS	None	LTS

LTS = less than significant
S = significant

During construction, the project could result in significant impacts if undocumented hazardous materials are discovered during earth-moving activities or if work needs to be conducted at locations with sites where the presence or potential presence of HTRW has been documented previously. The project proponents and the contractor would implement mitigation measures M-HAZ-1: Discovery of Undocumented Hazardous Materials and M-HAZ-3: Construction near Hazardous Sites to reduce these impacts to a less-than-significant level.

The project would have a long-term beneficial impact to hazardous waste sites as inland areas would have substantially reduced flood risk.

4.9 Transportation

This section identifies and evaluates issues related to transportation and traffic in the context of the Shoreline Phase I Project. Discussed are the network of roads (regional and local), transit service, and bicycle and pedestrian facilities and how project construction and operation could affect the transportation system.

4.9.1 Affected Environment

A traffic study was completed in 2013 in accordance with the criteria established by the City of Milpitas, the City of Fremont, the City of San José, and the Santa Clara Valley Transportation Authority (VTA). The physical setting included in this section describes the transportation condition at the time of the traffic study. The study area for transportation as shown on Figure 4.9-1 *Transportation Study Area and Vehicular Lane Configurations* is located west of I-880 south of Dixon Landing Road and north of SR 237 between the mouth of the Guadalupe River and the mouth of Coyote Creek and includes the community of Alviso and the Wastewater Facility.

The project consists of levee construction and pond restoration in and between Alviso and the surrounding area within Santa Clara County. The traffic analysis focused on several key intersections, some of which are outside the Shoreline Phase I Study Area but are important to the transportation system that serves the Shoreline Phase I Study Area.

- **SR 237** parallels the south side of the Shoreline Phase I Study Area and is a primary route for people traveling to the Alviso and northern San José areas. Project-related transportation effects that affect mobility on SR 237, such as construction traffic entering and exiting work areas, could affect intersections on SR 237 that are used to access surrounding urban areas. An intermittent bikeway runs adjacent to SR 237 following the north and/or south sides of the highway and provides limited bicycle access to the project area.
- **I-880** parallels the east boundary of the Shoreline Phase I Study Area, and the intersections studied on that freeway provide access to urban areas in west Milpitas as well as to the east side of the study area.
- **Dixon Landing Road**, which is near the northeast corner of the Shoreline Phase I Study Area, also provides access to urban areas in west Milpitas and west Fremont.

The following list identifies the key intersections studied and the agency having jurisdiction over each location:

1. Dixon Landing Road/McCarthy Boulevard (City of Fremont). This intersection provides access to areas on the east side of the study area.
2. I-880 Southbound Ramp/Dixon Landing Road (City of Milpitas). This intersection provides access to areas on the east side of the study area.
3. I-880 Northbound Ramp-California Circle/Dixon Landing Road (City of Milpitas). This intersection provides access to areas on the east side of the study area.
4. SR 237 Eastbound Ramp/Zanker Road (City of San José). This intersection provides access to the south side of the study area, the Wastewater Facility, and urban areas of San José south of SR 237.
5. SR 237 Westbound Ramp/Zanker Road (City of San José). This intersection provides access to the south side of the study area, the Wastewater Facility, and urban areas of San José south of SR 237.
6. SR 237 Eastbound Ramp/North First Street (City of San José). This intersection provides access to the south side of the study area, the community of Alviso, and other urban areas of San José south of SR 237.
7. SR 237 Westbound Ramp/North First Street (City of San José). This intersection provides access to the south side of the study area, the community of Alviso, and other urban areas of San José south of SR 237.

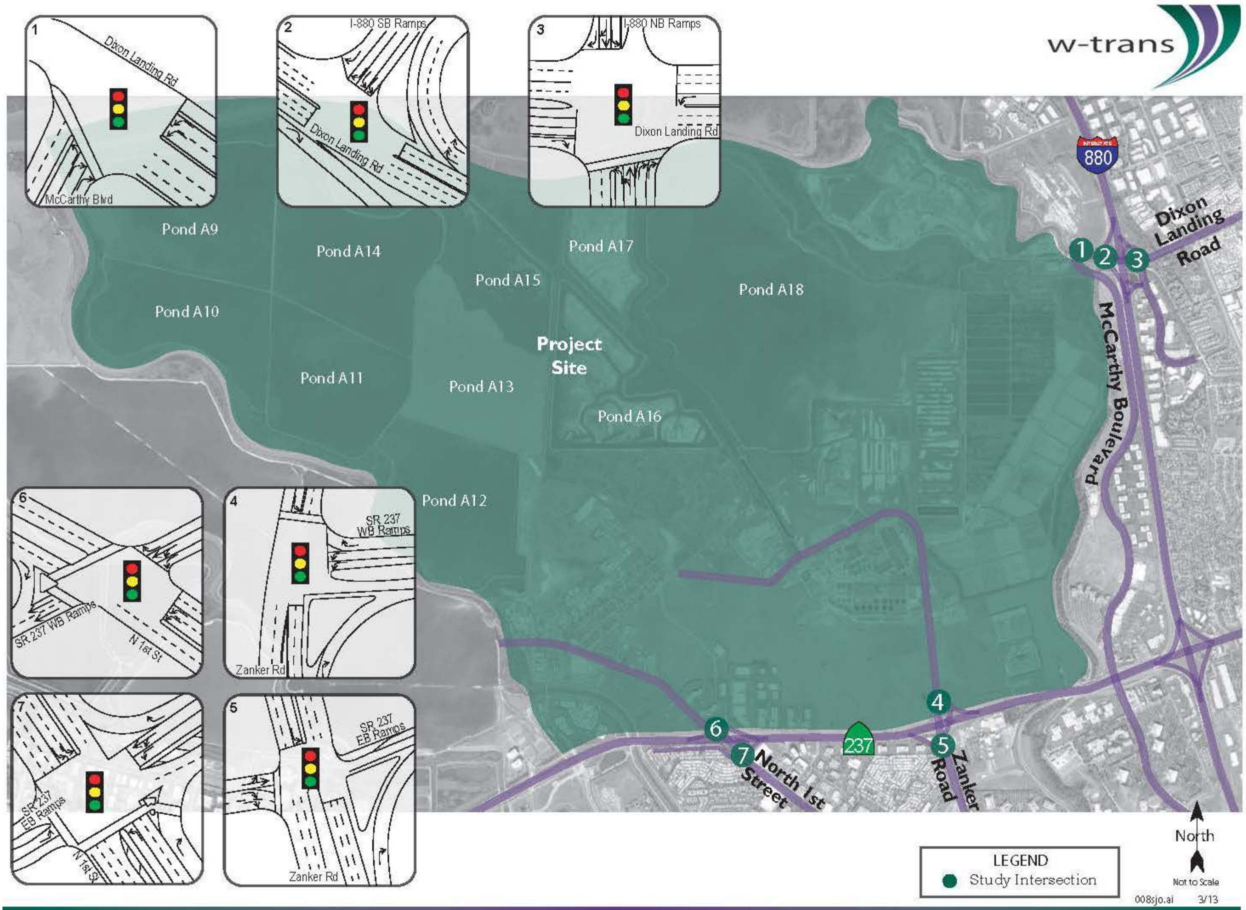


Figure 4.9-1. Transportation Study Area and Vehicular Lane Configurations

This Integrated Report also considers the operation of the following freeway segments designated as Congestion Management Program (CMP) facilities. All of these freeway segments are outside of but near or bordering the Shoreline Phase I Study Area and provide access to urban areas surrounding the study area.

- Interstate-880 (I-880) from Mission Boulevard (SR 262) to Dixon Landing Road
- I-880 from Dixon Landing Road to SR 237
- I-880 from SR 237 to Great Mall Parkway
- SR 237 from I-880 to McCarthy Boulevard
- SR 237 from McCarthy Boulevard to Zanker Road
- SR 237 from Zanker Road to North First Street
- SR 237 from First Street to Great America Parkway

4.9.1.1 Regulatory Setting

There are no Federal requirements for the project. This section includes transportation related State and local requirements.

4.9.1.1.1 State Regulations

State regulations governing transportation are described below.

4.9.1.1.1.1 Department of Transportation (Caltrans)

Caltrans manages interregional transportation, including management and construction of the California highway system. In addition, Caltrans is responsible for permitting and regulation of the use of State roadways. Roads that are likely to be used as access routes by construction workers and construction vehicles to the work sites include I-880, SR 237, and US 101. A Caltrans construction practice requires that permits be obtained for transportation of oversized loads and transportation of certain materials and for construction-related traffic disturbances.

4.9.1.1.2 Local Policies

The project would span multiple jurisdictions, with each municipality enforcing rules, regulations, and requirements pertaining to operation and maintenance for the transportation network within its respective jurisdiction. The project would be required to coordinate with and abide by the established plan goals and policies established by the City of Fremont, the City of Milpitas, the City of San José, and the VTA. Specific objectives and policies applicable to the project are summarized below.

4.9.1.1.2.1 City of Fremont

The City of Fremont is east of the Shoreline Phase I Study Area. The City of Fremont General Plan (City of Fremont 2011) transportation policies that are relevant to the project include the following:

- **Policy 3-4.2:** Adopt variable standards for traffic speed and travel delay that recognize the character of adjacent land uses, the functions of different streets, the different modes of transportation on a street or corridor, and other community development goals. The following standards shall apply:
  - For locations outside the City Center, Town Centers, and Warm Springs Bay Area Rapid Transit (BART) Station area, peak-hour levels of service for signalized intersections should generally be maintained at level of service (LOS) D for minor arterials and collector streets and LOS E for regional (Santa Clara County Congestion Management Agency [CMA] network) arterials.
- **Policy 3-6.2:** Protect residential neighborhoods from intrusion by truck traffic by maintaining and enforcing an efficient system of designated truck routes.
- **Policy 3-6.4:** Support measures that encourage through truck traffic to use interstate highways rather than local truck routes.

4.9.1.1.2.2 City of Milpitas

The City of Milpitas General Plan (City of Milpitas 2002) transportation policies that relate to the project include the following:

- **Policy 3.e-I-1:** Restrict trucks to designated non-restricted routes.
- **Policy 2.e-I-2:** Ensure that adequate pavement depth, lane widths, bridge capacities, loading areas, and turn radii are maintained on the permitted streets.

4.9.1.1.2.3 City of San José

The Envision San José 2040 General Plan (City of San José 2011) establishes goals, policies, and actions that guide development. Specific transportation goals and policies that are relevant to the project include the following:

- **Goal PR-1 – High-Quality Facilities and Programs:** Provide park lands, trails, open space, recreation amenities, and programs, nationally recognized for their excellence, which enhance the livability of the urban and suburban environments; preserve significant natural, historic, scenic, and other open-space resources; and meet the parks and recreation services needs of San José's residents, workers, and visitors.
- **Goal PR-3 – Provide an Equitable Park System:** Create a balanced park system that provides all residents access to parks, trails, and open space.
- **Policy PR-1.11:** Develop an integrated parks system that connects new and existing large parks together through a network of interconnected trails and/or bike lanes/routes.
- **Policy PR-6.7:** In design and construction, consider the role of parks, trails, and open space in preserving, enhancing, or restoring existing ecosystems/wildlife habitat, where appropriate.
- **Policy PR-7.1:** Encourage non-vehicular transportation to and from parks, trails, and open spaces by developing trail and other pleasant walking and bicycle connections to existing and planned urban and suburban parks facilities.
- **Policy TR-5.3:** The minimum overall roadway performance during peak travel periods should be LOS D except for designated areas.
- **Policy TR-6.1:** Minimize potential conflicts between trucks and pedestrian, bicycle, transit, and vehicle access and circulation on streets with truck travel.
- **Policy TR-6.3:** Encourage through truck traffic to use freeways, highways, and county expressways and encourage trucks having an origin or destination in San José to use primary truck routes designated in the Envision General Plan.

Recognizing the function that trails play in the City's multi-modal transportation system, Trail Network Policies are included above in this discussion of the Envision General Plan. The City has established an ambitious goal to be a national leader in the development of an urban trail system as it acknowledges that trails provide significant environmental and recreational benefits. Further discussion of the trail system in the project area is provided in Section 4.11 *Recreation*.

4.9.1.2 Physical Setting (CEQA Baseline)

The transportation network in the transportation study area includes vehicular traffic networks (interstate highways, State highways, and surface streets) and public transit systems (buses and railways), bicycle and pedestrian access, and air traffic systems.

4.9.1.2.1 Vehicular Traffic Networks

The study area for transportation and traffic includes a network of regional and local roadways that would be used for access by construction workers' vehicles and other construction vehicles, including trucks that would transport construction materials and equipment, excavated spoils, and fill materials to and from the work areas.

4.9.1.2.1.1 Regional Access

The State and interstate highways that provide regional access to Shoreline Phase I Study Area and connect to local roadway network are summarized as follows:

- **I-880** is a major north-south regional corridor that serves the communities in the South Bay, extending between I-980 in Oakland and SR 17 in San José. In the vicinity of the study area, I-880 has six lanes in each direction, five of which are mixed flow lanes, and the sixth one is a high-occupancy vehicle (HOV) carpool lane during morning and evening commute periods. The proposed access to the work sites would be provided from I-880 via the interchange at Dixon Landing Road. According to the most recent data published by Caltrans, the annual average bidirectional daily traffic on I-880 north of SR 237 is 205,000 vehicles per day (Caltrans 2011).
- **SR 237** is a six-lane east-west State highway, extending between I-680 in Milpitas and SR 85 in Sunnyvale. Within the transportation study area, SR 237 has three lanes in each direction, two of which are mixed flow lanes, and the third one is a combined toll lane and carpool lane. According to the most recent data published by Caltrans, the average annual bidirectional daily traffic on SR 237 between North First Street and Zanker Road is 124,000 vehicles per day (Caltrans 2011).

4.9.1.2.1.2 Local Access

The Shoreline Phase I Study Area is served by a network of roads that include arterial, collector, and local streets. Through traffic is generally served by arterial streets, while collector streets connect arterials to local streets and land uses. Local streets provide direct access to land uses. The roadways that could be affected by the project are summarized as follows:

- **Dixon Landing Road** is a four-to-six-lane east-west arterial in Milpitas that extends between McCarthy Boulevard to the west and North Milpitas Boulevard to the east, where it becomes Dixon Road.
- **Zanker Road** is a north-south arterial, extending between the transportation study area and US 101 to the south. North of SR 237, Zanker Road is primarily a two-lane facility and continues as Los Esteros Road as the road curves to the west.
- **North First Street** is a two-to-six-lane north-south arterial, extending between Liberty Street in Alviso and downtown San José. The roadway south of SR 237 is generally a transit corridor with light-rail service.
- **McCarthy Boulevard** is a four-to-six-lane north-south roadway extending between Dixon Landing Road to the north and Montague Expressway to the south. McCarthy Boulevard would provide direct access to the work sites for construction workers and trucks via a private gated access located on the west side of the roadway approximately 900 feet south of Dixon Landing Road.

4.9.1.2.2 Public Transit Systems

The VTA operates bus and light-rail service in Santa Clara County. Additional regional service is provided by BART, Altamont Commuter Express, Amtrak, and CalTrain. Below is a summary of the transit systems that currently provide service within the transportation study area.

4.9.1.2.2.1 VTA Transit

The following bus routes are available to commuters:

- **Bus Route 47** provides service between McCarthy Ranch and Great Mall/Main Transit Center via SR 237 and Calaveras Boulevard with headways of approximately 30 minutes.
- **Bus Route 58** provides service between West Valley Community College and Alviso and operates along North First Street terminating in Alviso with headways of approximately 30 minutes.
- **Bus Route 104** is an express route that provides weekday service between Penitencia Creek Transit Center and Palo Alto via SR 237, US 101, and Montague Expressway, with a 30-to-45-minute headway.

- **Bus Route 120** is an express route that provides weekday service between the Fremont BART station and Lockheed Martin Transit Center via Mission Boulevard, I-880, SR 237, and US 101 with an approximately 60-minute headway.
- **Bus Route 140** is an express route that provides weekday service between the Fremont BART station and Mission College via Mission Boulevard, I-880, and Tasman Drive with an approximately 45-minute headway.
- **Bus Route 181** is an express route that provides service between the Fremont BART station and San José Diridon Transit Center via I-880 and First Street with an approximately 15-to-60-minute headway.

In addition, the **VTA Light Rail (LRT)** routes near the transportation study area include VTA Line 901 between Alum Rock and Santa Teresa and VTA Line 902 between Mountain View and Winchester. Several LRT station are located on VTA Lines 901 and 902 along Tasman Drive approximately 3 miles south of the Shoreline Phase I Study Area.

4.9.1.2.2.2 BART

BART provides heavy-rail rapid transit service within Alameda, Contra Costa, San Francisco, and San Mateo Counties. The Fremont BART station, located close to the Walnut Avenue and Civic Center Drive intersection, is the southernmost station within the BART system and is approximately 11 miles north of the Shoreline Phase I Study Area. Two lines provide service to the Fremont station with the lines terminating in Richmond and Daly City. The VTA Transit bus lines 120, 140, and 181 serving the Shoreline Phase I Study Area connect to the Fremont BART station.

BART is expanding farther south to the Warm Springs District, and this project is currently under construction. The new Warm Springs BART station will be approximately 6 miles north of the Shoreline Phase I Study Area near the intersection of South Grimmer Boulevard and Warm Springs Boulevard. Additionally, construction is underway to extend BART to Milpitas and San José.

4.9.1.2.2.3 Amtrak and Altamont Commuter Express

Amtrak and Altamont Commuter Express serve the Great America and Fremont Centerville train station with passenger rail service. Amtrak provides daily service between San José and the Sacramento area. The Altamont Commuter Express provides commuter service between Stockton and San José with 10 stations. Three westbound trains are provided in the morning, and three eastbound trains are provided in the evening. The Centerville train station is located at Fremont Boulevard near Peralta Boulevard, approximately 11 miles north of the Shoreline Phase I Study Area. The Great America station is located at Lafayette Street, approximately 3 miles south of the Shoreline Phase I Study Area.

4.9.1.2.3 Pedestrian and Bicycle Facilities

Pedestrian facilities include sidewalks, crosswalks, pedestrian signals, curb ramps, curb extensions, and various streetscape amenities such as lighting and benches. Within the project vicinity, there is continuous sidewalk on the south side of Dixon Landing Road, and there is intermittent sidewalk on the north side. There is continuous sidewalk on the east side of North First Street north of SR 237 and intermittent sidewalk on the west side. There are no sidewalks on either side of Zanker Road north of SR 237.

The *Highway Design Manual* (Caltrans 2006) classifies bikeways into three categories:

- **Class I Multi-Use Path:** a completely separated right-of-way for the exclusive use of bicycles and pedestrians with cross flows of motorized traffic minimized. The City of San José commonly refers to Class I facilities as "trails."
- **Class II Bike Lane:** a striped and signed lane for one-way bicycle travel on a street or highway.
- **Class III Bike Route:** signed only for shared use with motor vehicles within the same travel lane on a street or highway.

Within the transportation study area, Class I bicycle paths exist north and south of and parallel to SR 237, starting at the Zanker Road/SR 237 westbound ramp and continuing east toward the northern stretch of Coyote Creek Trail. This approximately 5-mile stretch along SR 237 was designated in 2009 as part of the National Recreation Trail system. In addition, the same reach along the north side of SR 237 has been designated as part of the San Francisco Bay Trail and the Juan Bautista de Anza National Historic Trail.

Class II bike lanes connect to the Class I path at Zanker Road and progress west to First Street and south crossing Montague Expressway. Class II bike lanes also exist along Dixon Landing Road west of the I-880 southbound ramp. According to the City of Milpitas Bikeway Master Plan Update (Alta Planning + Design 2012), Class II bike lanes are planned along Dixon Landing Road east of the I-880 southbound ramp as well.

4.9.1.2.4 2013 Intersection Level of Service

Under the 2013 condition, all of the study intersections are operating at an acceptable level of service of LOS C or better during both peak hours. The level of service results for the study intersections are summarized in Table 4.9-1 *2013 Levels of Service at Intersections during the Peak Hour*, and detailed level of service calculations are included in Appendix A4 *Transportation Level of Service Calculations*.

Table 4.9-1. 2013 Levels of Service at Intersections during the Peak Hour

Intersection	AM Peak		PM Peak	
	Delay	LOS	Delay	LOS
Dixon Landing Rd./McCarthy Blvd.	9.0	A	13.9	B
I-880 SB Ramp/ Dixon Landing Rd.	16.5	B	14.5	B
I-880 NB Ramp–California Cir./ Dixon Landing Rd.	17.9	B	22.9	C
SR 237 WB Ramps/Zanker Road	13.0	B	16.2	B
SR 237 EB Ramps/Zanker Road	21.1	C+	13.6	B
SR 237 WB Ramps/North First Street	19.4	B–	19.6	B–
SR 237 EB Ramps/North First Street	44.7	D	21.3	C+

Note: Delay is measured in average seconds per vehicle
Key: LOS = Level of Service; SB = Southbound; NB = Northbound; EB = Eastbound; WB = Westbound

4.9.1.2.5 2013 Freeway Segments Level of Service

The LOS for the CMP freeway segments in Santa Clara County was determined from the *VTA 2011 Monitoring and Conformance Report* (VTA 2012). Under the 2013 condition, the following mixed-flow freeway segments operate at an unacceptable LOS F during the specified peak hour:

- I-880 southbound, SR 237 to Great America Parkway (AM and PM)
- SR 237 eastbound, McCarthy Boulevard to I-880 (PM)
- SR 237 westbound, I-880 to McCarthy Boulevard (AM)
- SR 237 westbound, McCarthy Boulevard to Zanker Road (AM)
- SR 237 eastbound, North First Street to Zanker Road (PM)
- SR 237 westbound, Zanker Road to North First Street (PM)
- SR 237 eastbound, Great America Parkway to North First Street (PM)
- SR 237 westbound, North First Street to Great America Parkway (PM)

Under the 2013 condition, the following HOV freeway segments operate at an unacceptable LOS F during the specified peak hour:

- SR 237 westbound, McCarthy Boulevard to Zanker Road (AM)

All of the remaining freeway segments operate at an acceptable LOS E or better during both peak hours. The 2013 freeway levels of service for the study segments are presented in Table 4.9-2 *2013 Levels of Service on Freeway Segments in the Valley Transportation Authority's Congestion Management Program*.

Table 4.9-2. 2013 Levels of Service on Freeway Segments in the Valley Transportation Authority's Congestion Management Program

Freeway Segment	Direction	Peak Hours	Lanes		Density		LOS	
			Mixed	HOV	Mixed	HOV	Mixed	HOV
I-880 Dixon Landing Rd. to SR 237	NB	AM	4	1	22	18	C	B
		PM	4	1	38	24	D	C
	SB	AM	4	1	48	38	E	D
		PM	4	1	24	17	C	B
I-880 SR 237 to Great Mall Pkwy.	NB	AM	3	—	24	—	C	—
		PM	3	—	36	—	D	—
	SB	AM	3	—	74	—	F	—
		PM	3	—	81	—	F	—
SR 237 I-880 to McCarthy Blvd.	EB	AM	3	—	10	—	A	—
		PM	3	—	86	—	F	—
	WB	AM	3	—	122	—	F	—
		PM	3	—	16	—	B	—
SR 237 McCarthy Blvd. to Zanker Rd.	EB	AM	2	1	29	7	D	A
		PM	2	1	47	23	E	C
	WB	AM	2	1	93	73	F	F
		PM	2	1	45	13	D	B
SR 237 Zanker Rd to North First St.	EB	AM	2	1	42	15	D	B
		PM	2	1	62	27	F	D
	WB	AM	2	1	58	40	E	D
		PM	2	1	61	14	F	B
SR 237 North First Street to Great America Parkway	EB	AM	2	1	37	20	D	C
		PM	2	1	87	28	F	D
	WB	AM	2	1	37	33	D	D
		PM	2	1	82	16	F	B

Source: VTA 2012

Key: LOS = Level of Service; EB = Eastbound; WB = Westbound; NB = Northbound; SB = Southbound

Density measured in passenger cars per mile per lane (pcpmpl)

"—" indicates freeway segment with no HOV lane

Bold indicates unacceptable operation based on the VTA's LOS E standard

The levels of service for the CMP freeway segments in Alameda County were determined from the City of Fremont General Plan (City of Fremont 2011). Under the 2013 condition, the freeway segments operate at an acceptable LOS D or better during both peak hours. The 2013 condition levels of service for the study segment are presented in Table 4.9-3 *2013 Levels of Service on Freeway Segments in the Alameda County Transportation Commission's Congestion Management Program*.

Table 4.9-3. 2013 Levels of Service on Freeway Segments in the Alameda County Transportation Commission's Congestion Management Program

Freeway Segment	Direction	Peak Hours	2013 Condition	
			V/C	LOS
I-880 Mission Blvd. (SR 262) to Dixon Landing Rd.	NB	AM	0.49	B
		PM	0.79	D
	SB	AM	0.76	D
		PM	0.49	B

Source: City of Fremont 2011
Key: V/C = Volume-to-Capacity Ratio; LOS = Level of Service

4.9.1.3 National environmental Policy Act and Engineer Regulation 1105-2-100: *Planning Guidance Notebook* Baseline Condition

For transportation, the NEPA and the Planning Guidance Notebook baseline condition is determined by projecting how the resource condition might change over the period of analysis. Under the current condition (2018), severe traffic congestion occurs throughout the transportation study area, and regional growth in travel demand is expected to increase because of both employment growth and population growth in the Bay Area (USDOT and VTA 2009). The BART Berryessa Extension Project, expected to be completed by 2016 and in operation within the following 2 years, will extend the existing service and could have some local effect on traffic congestion between 2013 and 2018.

Between 2007 and 2017[1], the VTA expects a 2-percent-per-year ridership increase. However, the VTA has no plans for expanding bus or rail service beyond the Warm Springs Extension Project but intends to support increased ridership through increases in efficiency (VTA 2010).

There are no other projects anticipated to impact the physical setting for the transportation network in the study area during this 3-year window, so otherwise, the Shoreline Phase I Study Area transportation condition is anticipated to remain constant. Given the VTA's expectation to absorb forecasted ridership increase through efficiency improvements, the condition is not anticipated to be different between the current condition and the baseline year. Therefore, the analysis contained in Section 4.11.2 *Environmental Consequences* assumes that the NEPA and the Planning Guidance Notebook baseline condition is consistent with the physical setting described in Section 4.11.1.2 *Physical Setting (CEQA Baseline)*.

[1] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

4.9.2 Environmental Consequences

4.9.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

Avoidance and minimization measures are those parameters that have been built into the design of the project and are committed to as part of project implementation. The following AMMs would be implemented as part of the project design and would avoid or minimize adverse effects by limiting impacts on local roads and to rail operations:

- **AMM-TRN-1: Work Hours –** Truck delivery and regular construction work hours would be outside the AM and PM peak traffic hours, so project-related trips would occur predominantly outside the peak traffic hours and would minimize impacts on the area transportation system.
- **AMM-TRN-2: Coordination with Railroad –** The USACE would coordinate the construction and use of temporary railroad crossings with rail owners and transit operators to ensure that project activities are conducted during off-peak hours with minimal effects on railroad operations.
- **AMM-TRN-3: Traffic Control Plan –** A traffic-control plan would be prepared for local agency review consistent with local agency requirements.

4.9.2.2 Methodology for Impact Analysis and Significance Thresholds

This section summarizes the approach to analysis, intersection and freeway segments level of service criteria, project alternatives, CEQA significance criteria, and project impact significance thresholds.

An alternative would be considered to have a significant effect if it would:

- **Impact TRN-1:** Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulations system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit; or conflict with congestion management program standards and goals for freeway segments listed in Section 4.9.1 *Affected Environment*.
- **Impact TRN-2:** Substantially increase hazards related to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., slow-moving construction equipment)
- **Impact TRN-3:** Result in inadequate emergency access to areas that are near the project and that rely on the same transportation facilities
- **Impact TRN-4:** Conflict with the City of San José, Santa Clara County, or Alameda County adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities

4.9.2.2.1 Jurisdictional Specific Impact Thresholds

The significance criteria applied to determine project impacts for individual study intersections for each jurisdiction are summarized below.

City of Fremont

Significant traffic impacts at signalized intersections are defined to occur when the addition of project-generated trips causes one of the following:

- A deterioration of intersection operations from LOS D or better to LOS E or F, or
- A delay increase of 4 or more seconds to intersections operating at LOS E or F.

City of Milpitas

Significant traffic impacts at signalized intersections are defined to occur when the addition of project-generated trips causes one of the following:

- A deterioration of intersection operations from LOS D or better to LOS E or F, or
- A delay increase of 4 or more seconds and a volume-to capacity (V/C) ratio increase of 0.01 or more to intersections operating at LOS E or F.

City of San José

Significant traffic impacts at signalized intersections are defined to occur when the addition of project-generated trips causes one of the following:

- A deterioration of intersection operations from LOS D or better to LOS E or F,
- A critical delay increase of 4 or more seconds and a V/C ratio increase of 0.01 or more to intersections operating at LOS E or F, or
- An increase in the V/C ratio by 0.01 or more at an intersection operating at an unacceptable LOS E or F when the change in critical delay is negative.

Santa Clara Valley Transportation Authority

Significant traffic impacts at signalized CMP intersections are defined to occur when the addition of project-generated trips causes one of the following:

- A deterioration of intersection operations from LOS E or better to LOS F, or
- An increase in average control delay for critical movements by 4 seconds or more and an increase in the critical V/C ratio by 0.01 or more for intersections operating at LOS F.

Valley Transportation Authority Congestion Management Program (Freeway Segment)

Under the VTA standards, significant traffic impacts at CMP freeway segment are defined to occur when the addition of project-generated trips causes:

- A deterioration of freeway segment operations from LOS E or better to LOS F, or
- An increase in new project trips of more than 1 percent of the freeway capacity for freeway segments operating at LOS F.

Alameda County Transportation Commission Congestion Management Program (Freeway Segment)

The Alameda County Transportation Commission (ACTC), formerly known as the Alameda County Congestion Management Agency, standards define significant traffic impacts on CMP freeway segments as occurring when the addition of project-generated trips causes:

- A deterioration of freeway segment operations from LOS E or better to LOS F, or.
- An increase in the V/C ratio of 0.01 for freeway segments operating at LOS F.

4.9.2.2.2 Approach to the Transportation Analysis

Potential traffic impacts due to the project were evaluated based on a quantitative level of service analysis. While CMP level of service standards apply to permanent traffic-generating projects and not to temporary traffic-generating activities such as this project, in order to fully inform the reader and decision-makers about potential impacts during construction, a quantitative analysis has been prepared.

In addition to potential impacts on traffic flow in the affected areas, impacts on alternative transportation (transit, bicycle, or pedestrian facilities) were also evaluated.

4.9.2.2.3 Intersection Level of Service

Level of service is used to rank traffic operation on various types of facilities based on traffic volumes and roadway capacity using a series of letter designations ranging from A to F. Generally, LOS A represents free-flow conditions, and LOS F represents forced flow or breakdown conditions. A unit of measure that indicates a level of delay generally accompanies the level of service designation.

The study intersections were analyzed using methodologies published in the *Highway Capacity Manual* (HCM; TRB 2000). This source contains methodologies for various types of intersection control, all of which are related to a measurement of delay in average number of seconds per vehicle.

All of the study intersections are controlled by traffic signals, so they were evaluated using the signalized methodology from the HCM. This methodology is based on factors including traffic volumes, green time for each movement, phasing, whether or not the signals are coordinated, truck traffic, and pedestrian activity. Average stopped delay per vehicle in seconds is used as the basis for evaluation in this level of service methodology. For the purpose of this study, delays were calculated using optimized signal timing.

Intersection operating conditions were evaluated using the Traffix software (version 7.7). The ranges of delay associated with the various levels of service at signalized intersections are summarized in Table 4.9-4 *Definitions of Levels of Service at Intersections*.

Table 4.9-4. Definitions of Levels of Service at Intersections

LOS	Description
LOS A	Delay of 0 to 10 seconds. Most vehicles arrive during the green phase, so do not stop at all.
LOS B	Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to stop.
LOS C	Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping.
LOS D	Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop.
LOS E	Delay of 55 to 80 seconds. Most, if not all, vehicles must stop, and drivers consider the delay excessive.
LOS F	Delay of more than 80 seconds. Vehicles may wait through more than one cycle to clear the intersection.

Source: TRB 2000
Key: LOS = Level of Service

The study intersections within the transportation study area identified as being in the CMP were analyzed based on thresholds published by VTA which also serves as the CMA. The ranges of delay associated with the various levels of service at signalized CMP intersections are summarized in Table 4.9-5 *Valley Transportation Authority's Definitions of Levels of Service at Intersections in Its Congestion Management Program*.

Table 4.9-5. Valley Transportation Authority's Definitions of Levels of Service at Intersections in Its Congestion Management Program

LOS	Average Control Delay (seconds per vehicle)	Description
A	Delay ≤ 10 or less	Operations with very low delay occurring with favorable progression and/or short cycle lengths
B+	10 < delay ≤ 12	Operations with low delay occurring with good progression and/or short cycle lengths
B	12 < delay ≤ 18	
B–	18 < delay ≤ 20	
C+	20 < delay ≤ 23	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.
C	23 < delay ≤ 32	
C–	32 < delay ≤ 35	
D+	35 < delay ≤ 39	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, and high V/C ratios. Many vehicles stop and individual cycle failures are frequent occurrences.
D	39 < delay ≤ 51	
D–	51 < delay ≤ 55	
E+	55 < delay ≤ 60	Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences
E	30 < delay ≤ 75	
E–	75 < delay ≤ 80	
F	Delay > 80	Operations with delays unacceptable to most drivers occurring due to over-saturation, poor progression, or very long cycle lengths.

Source: VTA 2011
Key: LOS = Level of Service; V/C = volume to capacity

4.9.2.2.4 Freeway Segments Level of Service

4.9.2.2.4.1 Santa Clara County Freeway Segments Level of Service

Freeways in the transportation study area identified as being in the CMP in Santa Clara County area were analyzed using the data published in the VTA's *2011 Annual Monitoring and Conformance Report* (VTA 2012), which is based on the density of traffic flow using methods described in the 2000 HCM. Density is expressed in passenger cars per mile per lane. Vehicle density is calculated using the following formula:

$$D = V/(N \times S)$$

where:

D = density, in vehicles per mile per lane (vpmpl)
V = peak-hour volume, in vehicles per hour (vph)
N = number of travel lanes
S = average travel speed, in miles per hour (mph)

The CMP requires that mixed-flow lanes and auxiliary lanes be analyzed separately from HOV carpool lanes. The CMP specifies that a capacity of 2,300 vehicles per hour per lane (vphpl) be used for segments three lanes or wider in one direction, a capacity of 2,200 vphpl be used for segments two lanes wide in one direction, and a capacity of 1800 vphpl be used on HOV lanes. The VTA CMP ranges of densities for freeway segment levels of service are summarized in Table 4.9-6 *Santa Clara County's Definitions of Levels of Service for Freeway Segments*.

Table 4.9-6. Santa Clara County's Definitions of Levels of Service for Freeway Segments

Level of Service	Density	Description
A	Density < 11.0	Free-flow operations
B	11.0 < density < 18.0	Reasonably free flow, and free flow speeds are maintained
C	18.0 < density < 26.0	Flow with speeds and or near the free-flow speed
D	26.0 < density < 46.0	Level at which speed begins to decline with increasing flow
E	46.0 < density < 58.0	Operation at capacity
F	58.0 < density	Breakdown in vehicular flow

Source: VTA 2012

4.9.2.2.4.2 Alameda County Freeway Segments Level of Service

Freeways in the transportation study area identified as being in the Metropolitan Transportation System in Alameda County were analyzed based on methodologies and thresholds published by the ACTC. The ACTC bases operation analysis on the volume-to-capacity ratio of the roadway segment. The capacities of the study freeways were obtained from the City of Fremont General Plan, as were projected future traffic volumes. The projected changes in traffic volumes associated with the development of the project were applied to these future traffic volumes to determine the conditions with the project in place. LOS F occurs when the volume-to-capacity ratio exceeds 1.00, but, for freeway facilities, the ACTC has defined three different LOS F thresholds based on the average travel speed: LOS F30, LOS F20, and LOS F10 for speeds of 30 mph, 20 mph, and 10 mph, respectively. The relationship between level of service and volume-to-capacity ratio is presented in Table 4.9-7 *Alameda County Transportation Commission's Definitions of Levels of Service for Freeway Segments*.

Table 4.9-7. Alameda County Transportation Commission's Definitions of Levels of Service for Freeway Segments

Level of Service	Volume-to-Capacity (V/C) Ratio
A	<0.35
B	<0.58
C	<0.75
D	<0.90
E	<1.00
F	>1.00, Varies

Source: Alameda County Transportation Commission 2011

4.9.2.2.5 Traffic Operation Standards

4.9.2.2.5.1 Intersection

The study intersections are located within the areas managed by different jurisdictions including the City of Fremont, the City of Milpitas, the City of San José, and the VTA. Therefore, each jurisdiction's respective traffic operation standards were applied to the study intersections in its community. The City of Milpitas has adopted as acceptable LOS D for non-CMP intersections. The City of Fremont has adopted a standard of LOS D at signalized intersections. The City of San José accepts LOS D at intersections during peak travel periods. The VTA has adopted LOS E as acceptable for CMP intersections.

4.9.2.2.5.2 Freeway Segment

The VTA has adopted LOS E as its performance standard for CMP facilities. For the ACTC, the performance standard for a CMP facility is also LOS E. An exception is made for roads that are operated at LOS F under their study's 1991 baseline condition. These roads were "grandfathered" in at LOS F. In the vicinity of the project, the study freeway segment of I-880 from Dixon Landing Road to SR 262 is a grandfathered segment.

4.9.2.2.6 Project Construction Schedule and Alternatives

The proposed Shoreline Phase I Project includes FRM levee construction and ecosystem restoration. Based on the construction schedule, the FRM levee is anticipated to be constructed between 2018 and 2021, with the peak construction occurring in 2019. Pond A12 and Pond A18 transitional habitat is anticipated to be constructed between 2019 and 2021, with construction peaking in 2020Other ecosystem restoration activities would be ongoing concurrently.

For traffic analysis purposes, years 2019 (for the 2018–2021 levee and Pond A12 and Pond A18 transitional habitat construction) and 2024 (for the 2023–2025 Pond A18 transitional habitat construction) were considered based on the assumption that construction-related traffic would be at maximum during the selected periods. During other construction periods restricted to in-pond preparation and breaches (2025–2026 and 2030–2031), this study assumes that project activities would not cause traffic impacts, since work would be conducted by onsite permanent staff and no additional materials would be transported by trucks into the facility. The project alternatives are described in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*.

4.9.2.2.7 Traffic Operation Analysis Scenarios

Operating conditions at the study intersections were evaluated for the weekday AM and PM peak periods only in order to capture the highest potential impacts from the action alternatives when volumes are typically highest on the local transportation network. The morning peak hour occurs between 7:00 AM and 9:00 AM and reflects conditions during the home-to-work or home-to-school commute, while the PM peak hour occurs between 4:00 PM and 6:00 PM and typically reflects the highest level of congestion during the homeward-bound commute. Traffic operations were evaluated for the following scenarios:

- Baseline 2014/2017 condition (CEQA and NEPA Baseline)
- Future 2019 No Action
- Future 2019 with project
- Future 2024 No Action
- Future 2024 with project

4.9.2.2.7.1 Baseline Traffic Volumes

For the baseline condition traffic analysis, turning movement counts for the study intersections were collected from various sources, including previous traffic studies conducted for projects near the Shoreline Phase I Study Area as well as VTA and City of San José staff. To eliminate discrepancies associated with traffic counts collected on different days, the traffic volume data were balanced by raising lower volumes to provide a conservative and reasonable match to the highest traffic volumes observed. The baseline traffic volumes are shown on Figure 4.9-2 *Baseline Traffic Volumes in the Transportation Study Area*.

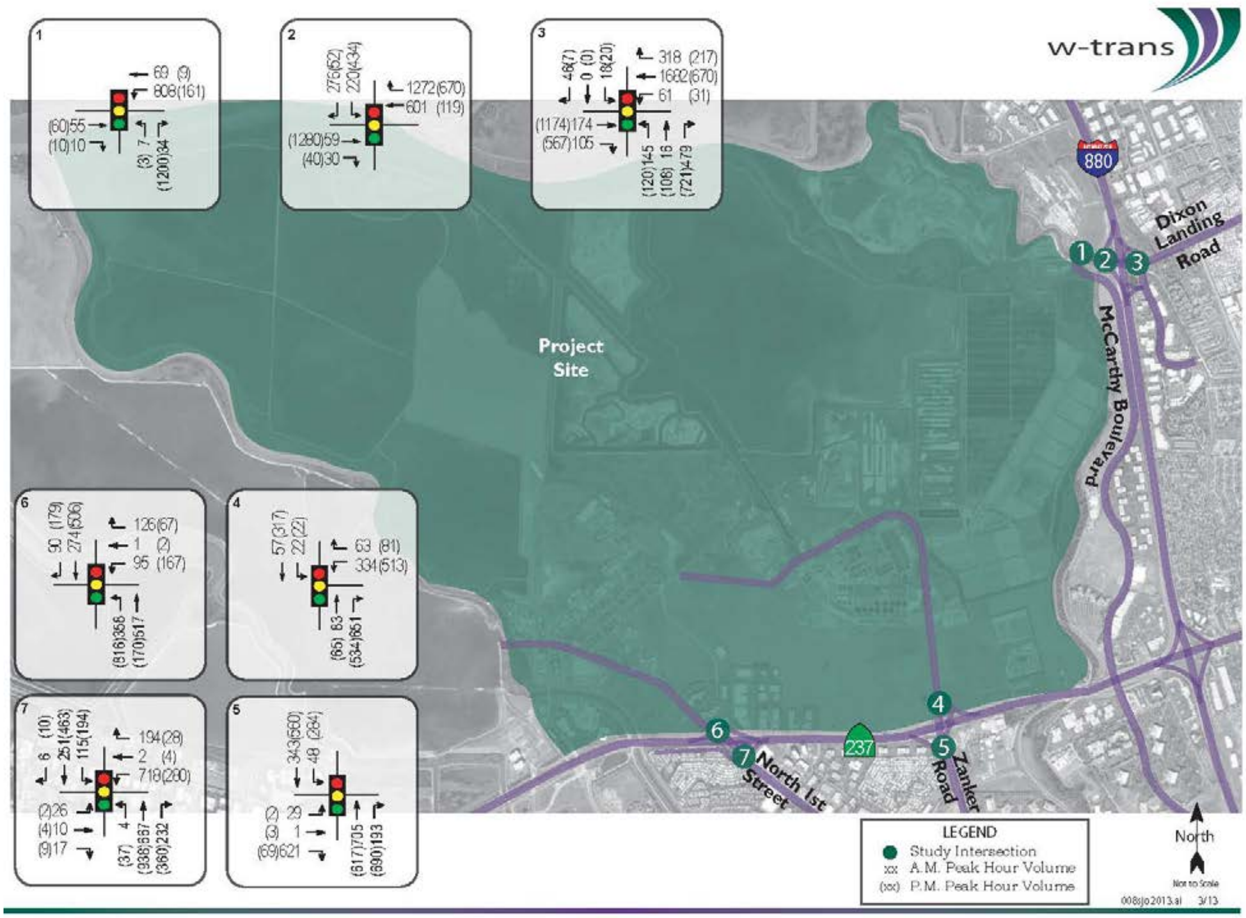


Figure 4.9-2. Baseline Traffic Volumes in the Transportation Study Area

4.9.2.2.7.2 Future Traffic Volumes

Future traffic volumes were estimated for horizon Years 2019 and 2024, the respective peak construction years for the levee and for Pond A12 (2019) and Pond A18 (2024) restoration (i.e., transitional habitat construction). Horizon-year traffic volumes were projected for only those intersections where the action alternatives would add construction-related traffic. Horizon-year volumes were estimated by applying growth rate factors to baseline turning movement counts. The growth factors for study intersections along Dixon Landing Road were estimated from the *Creekside Landing Development Project Traffic Impact Analysis* (DKS Associates 2008), while the growth factors for CMP intersections were estimated from the VTA Countywide Transportation Demand Model traffic volumes for horizon Years 2019 and 2024. These traffic volumes (2019 and 2024) are shown on Figure 4.9-3 *Future (2019) Traffic Volumes in the Transportation* Study Area and Figure 4.9-4 *Future (2024) Traffic Volumes in the Transportation* Study Area, respectively.

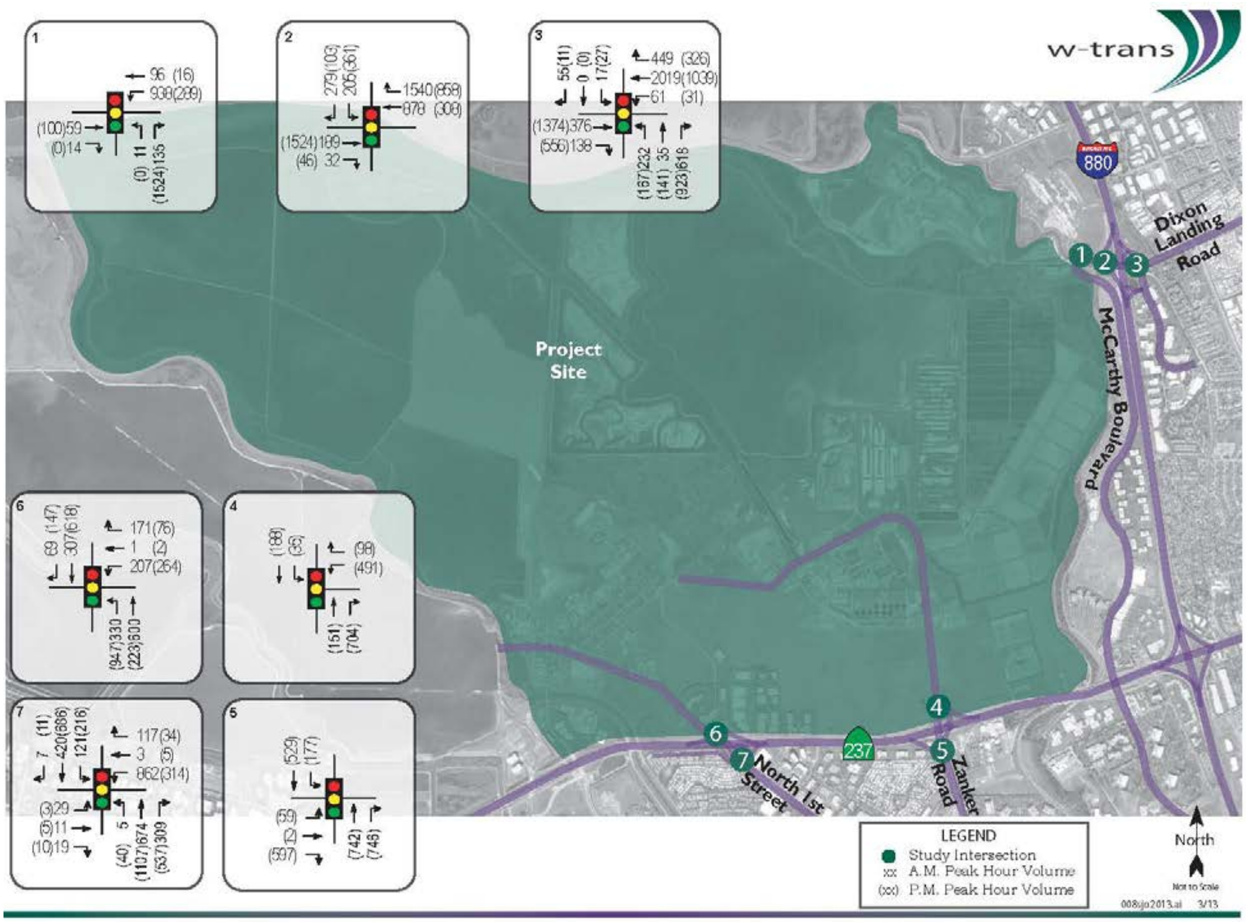


Figure 4.9-3. Future (2019) Traffic Volumes in the Transportation Study Area

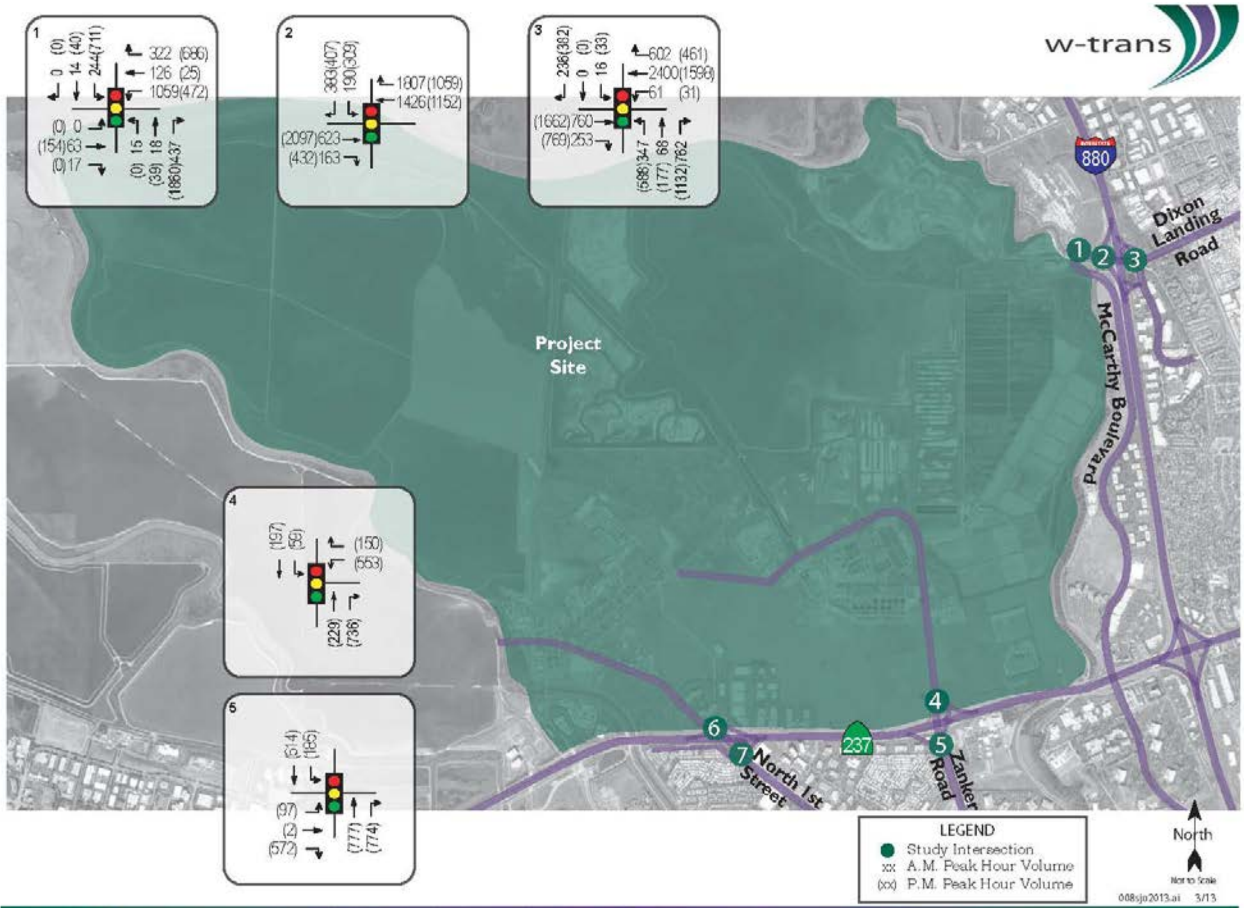


Figure 4.9-4. Future (2024) Traffic Volumes in the Transportation Study Area

4.9.2.2.7.3 Future Transportation Improvements

For the horizon Year 2019 traffic analysis, no approved and funded transportation network improvements were assumed to be constructed prior to the levee and Pond A12 completion; therefore, the baseline roadway network was used for the Year 2019 analysis.

For the horizon Year 2024 traffic analysis that includes the Pond A18 transitional habitat portion of the ecosystem restoration, roadway improvements were assumed at the intersection of Dixon Landing Road and McCarthy Boulevard based on information provided by the City of Fremont staff. The proposed improvement would extend Fremont Boulevard from its current terminus near Lakeview Drive to the south to form the northern leg of the Dixon Landing Road/McCarthy Boulevard intersection. These improvements would convert the Dixon Landing Road/McCarthy Boulevard intersection as follows:

- Northbound direction: One left-turn lane, one through lane, and one right-turn lane
- Southbound direction: Two left-turn lanes, one through lane, and one shared through/right-turn lane
- Eastbound direction: One left-turn lane and one shared through/right-turn lane
- Westbound direction: One left-turn lane, one shared through/left-turn lane, and two right-turn lanes

The derived traffic volumes, traffic signal timing parameters, and lane characteristics were entered into Traffix version 7.7 software to perform the level of service analysis based on the HCM (TRB 2000) analysis procedures.

4.9.2.2.8 Construction Staging Areas

The action alternatives would have up to two construction staging areas on either side of Artesian Slough. East of Artesian Slough, two potential staging sites have been proposed at the sludge ponds along the northeast edge of Pond A18 (Staging Areas #1 and #2). See Figure 3.8-2 *Potential Staging Areas* in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* for a map and additional information on proposed staging areas. The choices for staging area(s) west of Artesian Slough would be (1) on Zanker Landfill property (Staging Area #3) and/or (2) along the eastern boundary of Pond A12 north of the Alviso Marina parking lot (Staging Area #4). The fill brought in for levee and pond restoration would be stored at either the staging areas or dropped directly on the levee or the pond where work is being completed. Although most of the soil would be hauled off site for use on a daily basis, staging areas (not including the Zanker Material Recovery Facility property) could also provide short-term storage of heavy equipment and other materials. Since all of the construction activities would occur within the project boundary, no lane or road closures would occur on any roadways as a result of construction or operation of the project.

4.9.2.2.9 Construction Traffic Routes and Traffic Generation

Construction traffic would be temporary in nature, lasting for the duration of the construction activity (see the discussion in Section 4.9.2.2.6 *Project Construction Schedule and Alternatives*). Construction traffic would consist of truck trips to deliver fill material and equipment and worker trips to construct the levee and restore the ponds. For the levee and Pond A18, all of the fill material would be hauled in by trucks from Santa Clara County borrow locations. For Pond A12, all of the fill material would be available on site near the surrounding areas; however, trucks would still be used to transport equipment and move material on site. The following sections discuss the potential routes that the trucks and workers would take to access the Shoreline Phase I Study Area as well as their trip generations.

4.9.2.2.9.1 Truck Hauling Routes and Trip Generation

Regional access to the Shoreline Phase I Study Area would be via I-880 and SR 237, while local access would be via Dixon Landing Road, McCarthy Boulevard, Zanker Road, and North First Street. Three potential truck hauling access routes using local roadways to enter and exit the study area are anticipated as follows and would be included in the project traffic control plan:

- Trucks would enter the staging area(s) on the east side of Artesian Slough (Staging Areas #1 and #2) via Dixon Landing Road and a private access road off of McCarthy Boulevard and would exit via Zanker Road.
- Trucks would access Pond A18 directly via Zanker Road, travel north along Los Esteros Boulevard, and use an established easement north of the Wastewater Facility to drop off the fill material. Trucks would exit the site via Zanker Road.

- Trucks would access the staging area(s) west of Artesian Slough (Staging Areas #3 and #4) via North First Street through Alviso and the Marina parking lot.

These three construction truck access routes are shown on Figure 4.9-5 *Truck Access Routes 1 and 2* and Figure 4.9-6 *Truck Access Route 3*. When traveling on public roads, trucks would travel the posted speed limit.

Construction-related average daily truck trips for the project alternatives are based on an Emissions Estimate Summary. The truck trips were assumed to be distributed evenly throughout the daytime hours, thereby avoiding both peak traffic periods. Daily truck trips were converted into equivalent passenger-car trips (PCE) using HCM 2000 methodology. The passenger-car equivalent factor of 1.5 was applied to the average truck trips based on the assumption that the majority of the trips would take place over level terrain. The factor was used to determine the average daily PCE trips. The trip generation projections for the project alternatives are summarized in Table 4.9-8 *Construction Truck Trips Generated by the Action Alternatives*.

Table 4.9-8. Construction Truck Trips Generated by the Action Alternatives

	Levee		Pond Restoration			
			Pond A12		Pond A18	
Alternative (feet in NAVD 88)	Daily Truck Trips	PCE Daily Trips	Daily Truck Trips	PCE Daily Trips	Daily Truck Trips	PCE Daily Trips
Alviso North with 12.5-foot Levee and Bench	322	485	156	235	32	50
Alviso North with 15.2-foot Levee and 30:1 Ecotone	320	480	360	540	220	330
Alviso Railroad with 15.2-foot Levee and Bench	315	475	156	235	32	50
Alviso South with 15.2-foot Levee and Bench	310	465	156	235	32	50

PCE = Passenger Car Equivalent, HCM 2000, Exhibit 11-10

This construction-related truck trip generation table is for comparison purposes only; truck trips have not been included in the traffic analysis since they will be restricted to non-peak hours.

The trucks required to transport the fill material would have a 6-hour workday schedule based on preliminary engineering design planning; therefore, this study assumes that all truck deliveries would occur between 9:00 AM and 3:00 PM. This being the case, all truck traffic would occur outside the weekday AM and PM peak commute traffic hours. Therefore, a quantitative peak-hour traffic analysis for the construction truck traffic was not conducted for the study intersections. However, the construction truck access routes shown on Figure 4.9-5 *Truck Access Routes 1 and 2* and Figure 4.9-6 *Truck Access Route 3* include the requirement that construction-related truck trips shall occur outside the weekday AM and PM peak commute traffic hours.

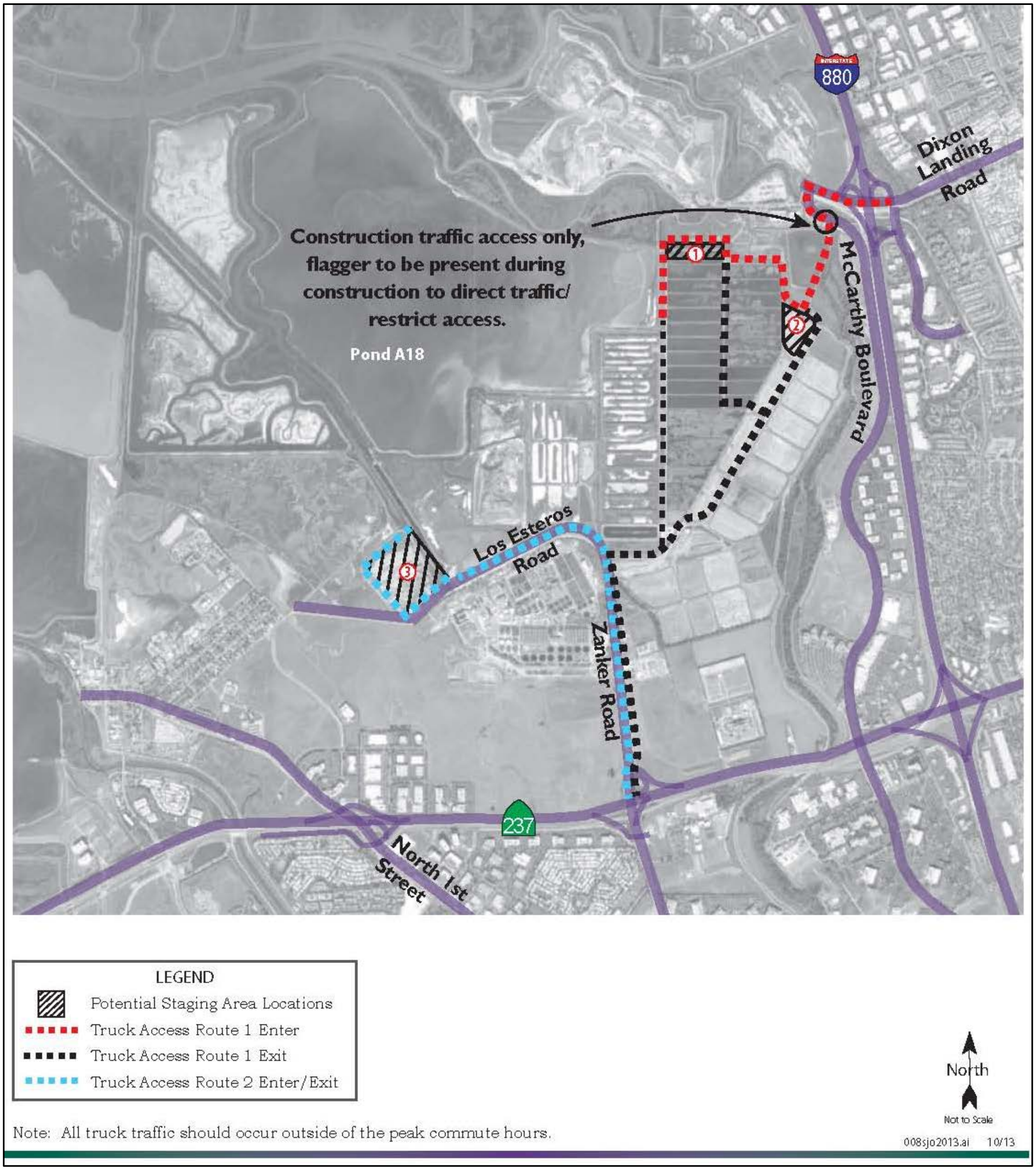


Figure 4.9-5. Truck Access Routes 1 and 2

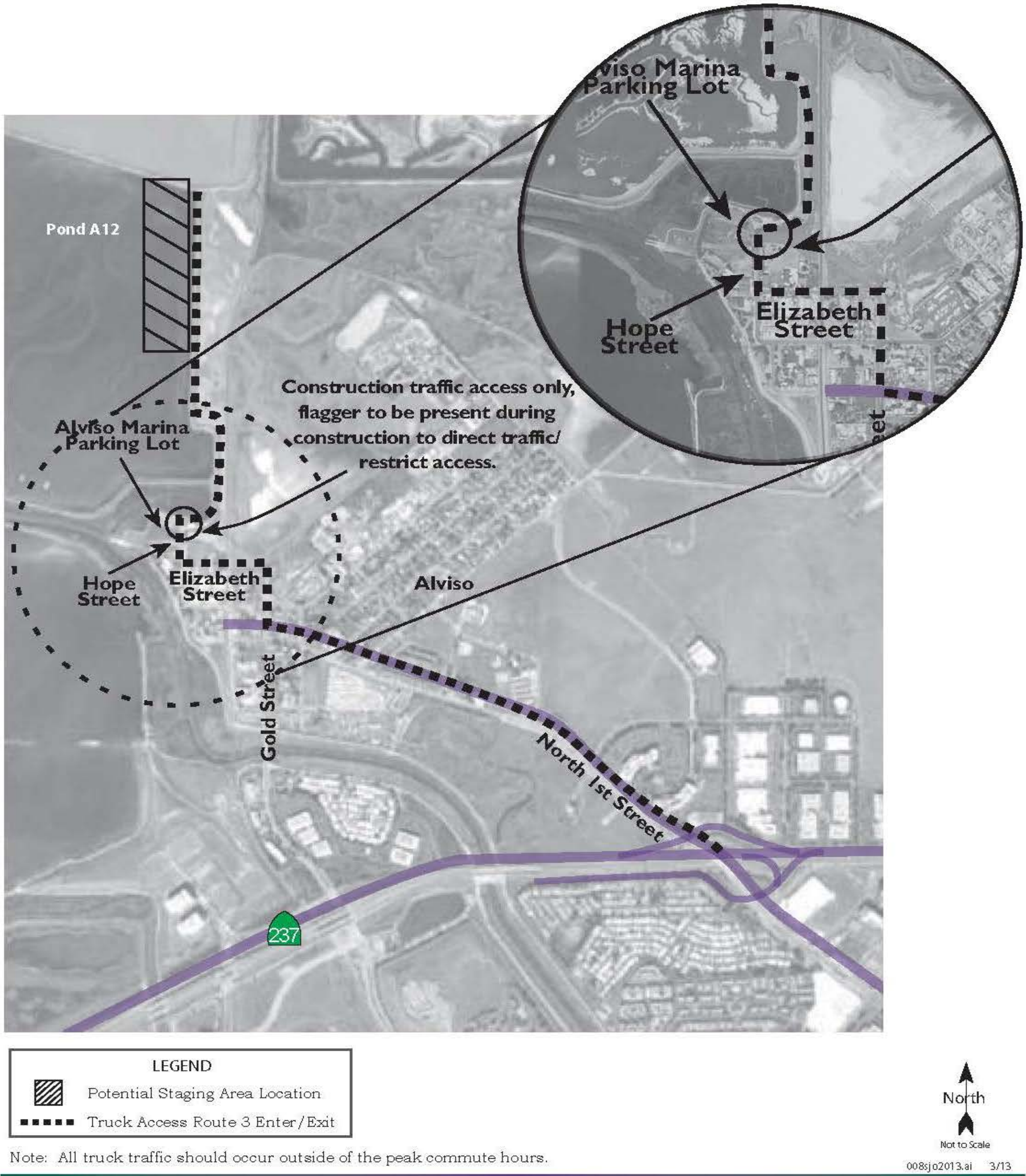


Figure 4.9-6. Truck Access Route 3

4.9.2.2.9.2 Worker Routes and Trip Generation

Regional access to the Shoreline Phase I Study Area would be via I-880 and SR 237, while local access would be via Dixon Landing Road, McCarthy Boulevard, Zanker Road, and North First Street. The following two workers access routes are proposed:

- For levee construction and Pond A18 restoration on the east side of Artesian Slough, workers would travel west on Dixon Landing Road, turn left onto McCarthy Boulevard, and enter the Shoreline Phase I Study Area via a private access road off McCarthy Boulevard. All workers would exit the site via Zanker Road.
- For levee construction and Pond A12 restoration on the west side of Artesian Slough, workers would enter and exit the staging area (Staging Area #4) via North First Street through Alviso and the Marina parking lot.

Construction workers would typically have a 9-hour work schedule between 8:00 AM and 5:00 PM so that worker-related trips may occur within the normal commute peak hours. Therefore, to provide a conservative approach in evaluating the project's construction worker-related impacts on study intersections, this study assumes that the morning inbound and evening outbound worker trips may occur during the peak commute hours. This study assumes that, during the peak construction phase for each of the project alternatives, a maximum of 20 workers would be required on site at any given time, regardless of the project alternative. The worker trip generation for the action alternatives is summarized in Table 4.9-9 *Construction Worker Trips in the AM and PM Peak Hours during Project Construction*.

Table 4.9-9. Construction Worker Trips in the AM and PM Peak Hours during Project Construction

Daily Worker Trips	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
40	20	0	0	20

Construction-related worker trips have been included in the traffic analysis.

4.9.2.2.10 Traffic Distribution and Assignment

Trip distribution percentages were developed based on baseline traffic patterns, regional access to the Shoreline Phase I Study Area, and residency of the labor pool in Alameda and Santa Clara Counties. All the construction-related worker trips generated by the project were assumed to access the site regionally via I-880 and SR 237.

Given the assumption that the levee construction would likely start at the east end of the transportation study area and then proceed west across Artesian Slough, this study assumes that, during the peak construction year for the levee (2019), all workers would enter the staging area(s) east of Artesian Slough (Staging Areas #1 and #2) via Dixon Landing Road and McCarthy Boulevard and would exit via Zanker Road. Once the levee construction work is completed on the east side, all construction workers would enter and exit the staging area(s) west of Artesian Slough (Staging Areas #3 and #4) via North First Street to construct the levee and restore Pond A12.

During the peak construction year for Pond A18 (2024), all construction workers would enter the staging area(s) east of Artesian Slough (Staging Areas #1 and #2) via Dixon Landing Road and McCarthy Boulevard and would exit via Zanker Road.

Trips generated by the project were assigned to the roadway system and study intersections based on the assumptions discussed above. The trip distribution and project-added traffic volumes for the peak construction year for levee and Pond A12 restoration (2019) and the peak construction year for Pond A18 restoration (2024) are shown on Figure 4.9-7 *Trip Distribution and Traffic Volumes with the Shoreline Phase I Project in 2019* and Figure 4.9-8 *Trip Distribution and Traffic Volumes with the Shoreline Phase I Project in 2024*, respectively.

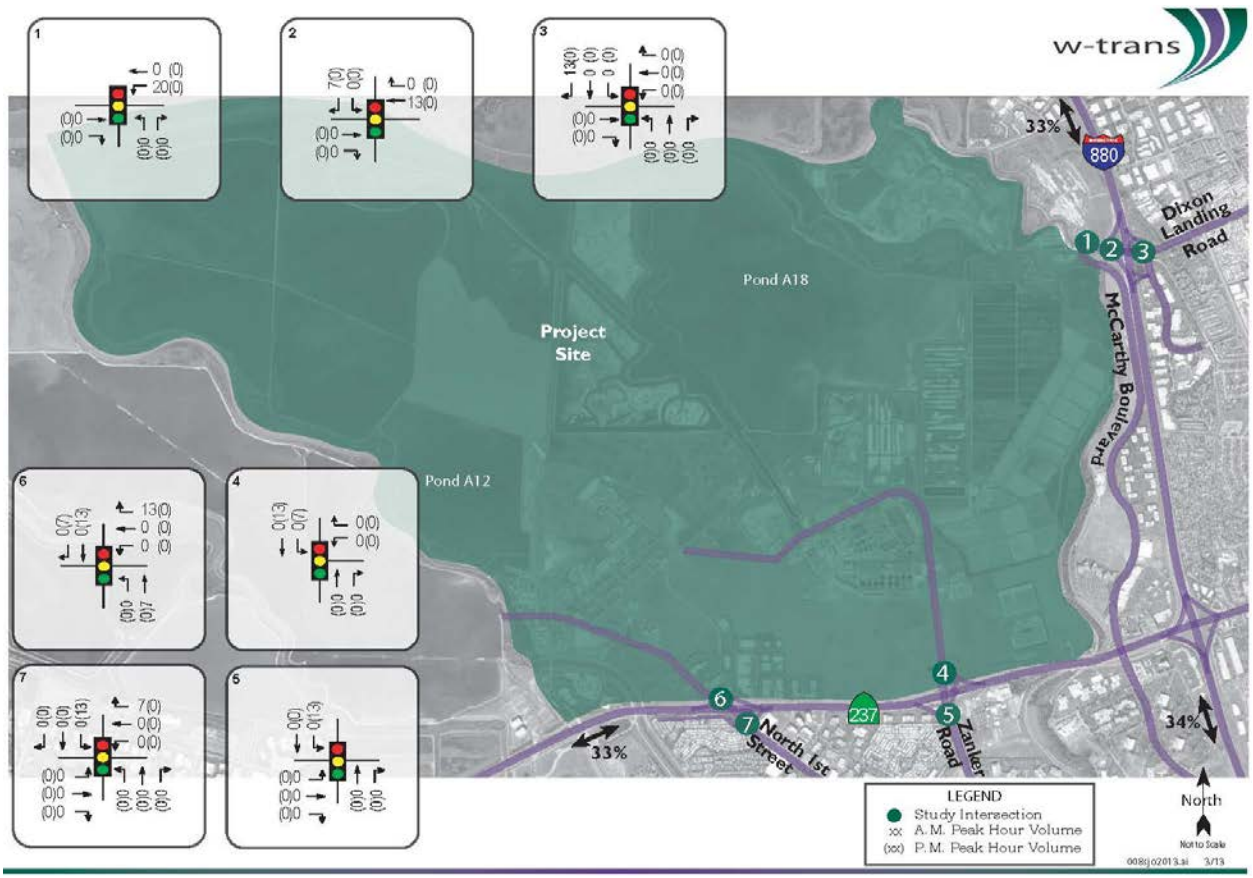
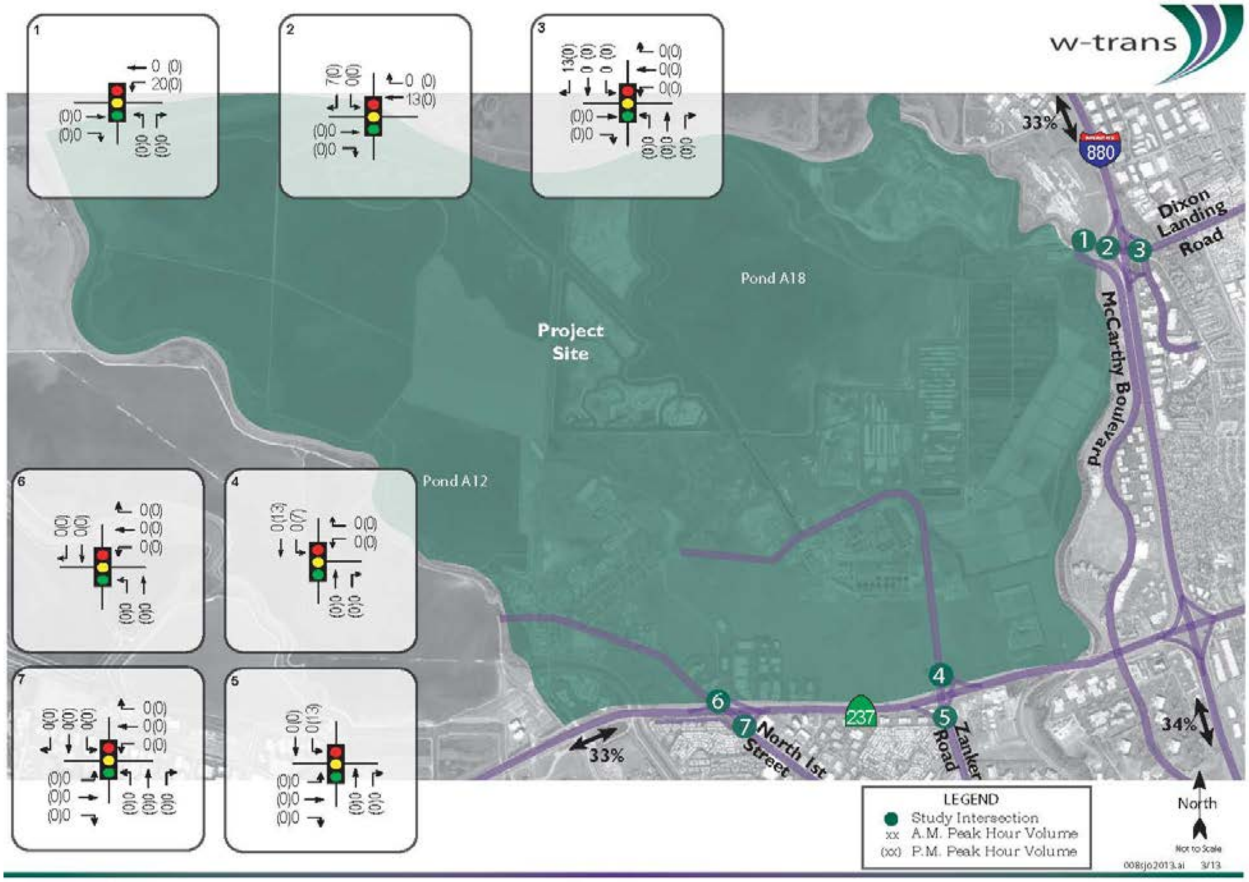


Figure 4.9-7. Trip Distribution and Traffic Volumes with the Shoreline Phase I Project in 2019


w-trans
Project Site
Pond A18
Pond A12
880
237
33%
34%
Dixon Landing Road
McCarthy Boulevard
North 1st Street
Zanker Road
LEGEND
Study Intersection
xx A.M. Peak Hour Volume
(xx) P.M. Peak Hour Volume
North
Not to Scale

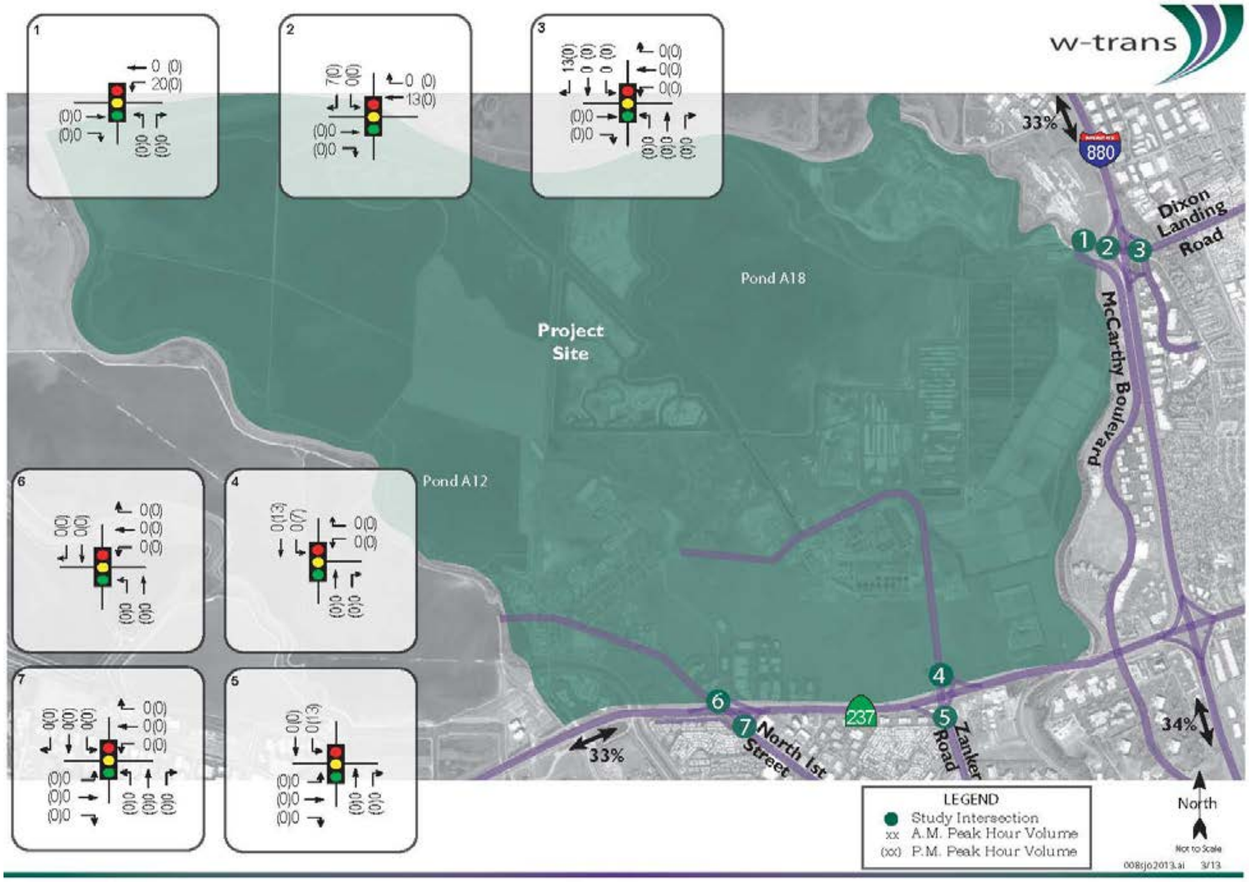


Figure 4.9-8. Trip Distribution and Traffic Volumes with the Shoreline Phase I Project in 2024

4.9.2.3 Alternatives Evaluation

This section evaluates the impacts of the Shoreline Phase I Project on transportation facilities.

4.9.2.3.1 No Action Alternative

Future traffic conditions with the No Action Alternative were evaluated for 2019 and 2024. This is consistent with the peak traffic periods used for the with-project assessment, as discussed in Section 4.9.2.2.6 *Project Construction Schedule and Alternatives*, and is assumed to represent the maximum levels of transportation impacts in any one period; during all other construction phases, traffic would not exceed these peak periods.

4.9.2.3.1.1 Future (2019) No Action Condition

With the Future 2019 No Action condition, future volume projections were used to determine the levels of service at the study intersections; this condition does not consider construction-related worker trips.

All of the study intersections would operate at an acceptable LOS D or better during both peak hours. The level of service results for the study intersections are summarized in Table 4.9-10

Levels of Service at Intersections with the No Action Alternative in 2019, and level of service calculations are included in Appendix A4 *Transportation Level of Service Calculations*. LOS D or better is consistent with the City of San José, City of Milpitas, and City of Fremont adopted plans and policies.

Table 4.9-10. Levels of Service at Intersections with the No Action Alternative in 2019

Intersection	AM Peak		PM Peak	
	Delay (seconds)	LOS	Delay (seconds)	LOS
1. Dixon Landing Rd./McCarthy Blvd.	13.5	B	—[a]	—[a]
2. I-880 SB Ramp/Dixon Landing Rd.	14.5	B	—[a]	—[a]
3. I-880 NB Ramp–California Cir./ Dixon Landing Rd.	21.5	C	—[a]	—[a]
4. SR 237 WB Ramps/Zanker Rd.	—[a]	—[a]	13.3	B
5. SR 237 EB Ramps/Zanker Rd.	—[a]	—[a]	18.8	B–
6. SR 237 WB Ramps/North First St.	19.8	B–	20.7	C+
7. SR 237 EB Ramps/North First St.	44.9	D	21.8	C+

Delay is measured in average seconds per vehicle; LOS = level of service; EB = eastbound; WB = westbound; NB = northbound; SB = southbound

[a] The project would not add trips during the peak period indicated, so level of service was not evaluated.

4.9.2.3.1.2 Future (2024) No Action Condition

With the Future 2024 No Action condition, future volume projections along with the improvements at the Dixon Landing Road/McCarthy Boulevard–Fremont Boulevard intersection were used to determine the level of service at the study intersection; this condition does not consider construction-related worker trips.

With the Future 2024 No Action condition, all of the study intersections would operate at an acceptable LOS D or better during both peak hours. The level of service results for the study intersections are summarized in Table 4.9-11 *Levels of Service at Intersections with the No Action Alternative in 2024*, and the level of service calculations are included in Appendix A4 *Transportation Level of Service Calculations*. LOS D or better conditions are consistent with the City of San José, City of Milpitas, and City of Fremont adopted plans and policies.

Table 4.9-11. Levels of Service at Intersections with the No Action Alternative in 2024

Intersection	AM Peak		PM Peak	
	Delay	LOS	Delay	LOS
1. Dixon Landing Rd./McCarthy Blvd.–Fremont Blvd.	15.2	B	—[a]	—[a]
2. I-880 SB Ramp/Dixon Landing Rd.	13.3	B	—[a]	—[a]
3. I-880 NB Ramp–California Cir./ Dixon Landing Rd.	52.4	D	—[a]	—[a]
4. SR 237 WB Ramps/Zanker Rd.	—[a]	—[a]	14.2	B
5. SR 237 EB Ramps/Zanker Rd.	—[a]	—[a]	18.5	B–
6. SR 237 WB Ramps/North First St.	—[a]	—[a]	—[a]	—[a]
7. SR 237 EB Ramps/North First St.	—[a]	—[a]	—[a]	—[a]

Delay is measured in average seconds per vehicle; LOS = level of service; EB = eastbound; WB = westbound; NB = northbound; SB = southbound

[a] The project would not add trips during the peak period indicated, so level of service was not evaluated.

4.9.2.3.2 Action Alternatives

This section describes the effects on transportation resulting from the action alternatives.

Impact TRN-1: Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulations system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit; or conflict with congestion management program standards and goals for freeway segments listed in Section 4.9.1 **Affected Environment.**

Construction Effects: Future (2019) Condition

Project construction would cause temporary increases in traffic volumes on area roadways and would cause short-term degradation of traffic level of service at intersections and freeway segments.

With the Future 2019 plus action alternative condition, future volume projections were used along with the construction-related worker trips to estimate the additional delay associated with the proposed levee and Pond A12 restoration project. Hours of construction are restricted to outside AM and PM peak traffic hours to minimize impacts to peak hour traffic (AMM-TRN-1: Work Hours). With the addition of construction traffic, all the study intersections would continue to operate at an acceptable LOS D or better. The level of service results for the study intersections are summarized in Table 4.9-12 *Levels of Service at Intersections with the Action Alternatives in 2019*, and level of service calculations are included in Appendix A4 *Transportation Level of Service Calculations*. LOS D or better conditions are consistent with the City of San José, City of Milpitas, and City of Fremont adopted plans and policies, so the action alternatives would not have a significant impact at the study intersections in 2019.

Table 4.9-12. Levels of Service at Intersections with the Action Alternatives in 2019

Intersection	Baseline Condition		Future 2019 No Action Alternative		Future 2019 with Action Alternatives	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
	Delay/LOS	Delay/LOS	Delay/LOS	Delay/LOS	Delay/LOS	Delay/LOS
1. Dixon Landing Rd./McCarthy Blvd.	9.0/A	—[a]	13.5/B	—[a]	13.3/B	—[a]
2. Dixon Landing Rd./I-880 SB Ramp	16.5/B	—[a]	14.5/B	—[a]	14.6/B	—[a]
3. Dixon Landing Rd./I-880 NB Ramp-California Cir.	17.9/B	—[a]	21.5/C	—[a]	21.9/C	—[a]
4. SR 237 WB Ramps/Zanker Rd.	—[a]	16.2/B	—[a]	13.3/B	—[a]	13.6/B
5. SR 237 EB Ramps/Zanker Rd.	—[a]	13.6/B	—[a]	18.8/B–	—[a]	19.0/B–
6. SR 237 WB Ramps/North First St.	19.4/B–	19.6/B–	19.8/B-	20.7/C+	20.1/C+	20.9/C+
7. SR 237 EB Ramps/North First St.	44.7/D	21.3/C+	44.9/D	21.8/C+	44.9/D	22.0/C+

Delay is measured in average seconds per vehicle; LOS = level of service; EB = eastbound; WB = westbound; NB = northbound; SB = southbound

[a] The project would not add trips during the peak period indicated, so level of service was not evaluated.

Freeway Segment Analysis

VTA CMP guidelines require freeway segment analysis if the project would add trips equal to or greater than 1 percent of the freeway segment's capacity. ACTC CMP guidelines require freeway segment analysis if the project would generate more than 100 new PM peak-hour trips. Freeway segments of I-880 and SR 237 were assessed to determine whether freeway analysis is required for the project. For analysis purposes, this study assumes that all the project trips would use the mixed-flow lanes. The construction-related worker trips generated by the action alternatives would be less than 100 PM peak-hour trips and would not add more than 1 percent of the established capacity to any roadway segment; this change is consistent with the VTA's CMP standards for freeway segments. The action alternatives would have a less-than-significant impact on the study freeway segments with the future 2019 plus action alternative condition. The freeway segments assessment is summarized in Table 4.9-13 *Trips Added by the Action Alternatives in 2019.*

The project would result in less-than-significant impacts on transportation plans, congestion-management programs, or goals for freeway segments during construction in 2019.

Table 4.9-13. Trips Added by the Action Alternatives in 2019

Freeway Segment	Direction	Peak Hour	Lanes (Mixed-flow)	Capacity	Project Trips	Capacity Utilization <1%	Capacity Utilization <100 Trips
I-880 Dixon Landing Rd. to SR 237	NB	AM	4	9200	13	Yes	
		PM	4	9200	7	Yes	
	SB	AM	4	9200	7	Yes	
		PM	4	9200	0	Yes	
I-880 SR 237 to Great Mall Pkwy.	NB	AM	3	6900	7	Yes	
		PM	3	6900	0	Yes	
	SB	AM	3	6900	0	Yes	
		PM	3	6900	7	Yes	
SR 237 I-880 to McCarthy Blvd.	EB	AM	3	6900	7	Yes	
		PM	3	6900	13	Yes	
	WB	AM	3	6900	13	Yes	
		PM	3	6900	13	Yes	
SR 237 McCarthy Blvd. to Zanker Rd.	EB	AM	2	4600	7	Yes	
		PM	2	4600	13	Yes	
	WB	AM	2	4600	13	Yes	
		PM	2	4600	13	Yes	
SR 237 Zanker Rd. to North First St.	EB	AM	2	4600	7	Yes	
		PM	2	4600	13	Yes	
	WB	AM	2	4600	13	Yes	
		PM	2	4600	7	Yes	
SR 237 North First St to Great America Parkway	EB	AM	2	4600	7	Yes	
		PM	2	4600	0	Yes	
	WB	AM	2	4600	0	Yes	
		PM	2	4600	7	Yes	
I-880 Mission Blvd. (SR 262) to Dixon Landing Rd.	NB	AM	5	10,000	0		Yes
		PM	5	10,000	7		Yes
	SB	AM	5	10,000	7		Yes
		PM	5	10,000	0		Yes

EB = eastbound; WB = westbound; NB = northbound; SB = southbound
Percentage of Capacity Utilized = number of project trips/freeway segments capacity

Construction Effects: Future (2024) Condition

With the Future 2024 plus action alternative condition, future volume projections were used along with the construction-related worker trips to estimate the additional delay associated due to the proposed Pond A18 restoration. With the addition of construction traffic, all of the study intersections would continue to operate at an acceptable LOS D or better during the AM and/or

PM peak hours. LOS D or better conditions are consistent with the City of San José, City of Milpitas, and City of Fremont adopted plans and policies, so Pond A18 restoration is anticipated to have a less-than-significant impact at the study intersections in 2024. The level of service results for the study intersections are summarized in Table 4.9-14 *Levels of Service at Intersections with the Action Alternatives in 2024*, and LOS calculations are included in Appendix A4 *Transportation Level of Service Calculations*.

Table 4.9-14. Levels of Service at Intersections with the Action Alternatives in 2024

	Baseline Condition		Future 2024 No Action Alternative		Future 2024 with Action alternatives	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Intersection	Delay/LOS	Delay/LOS	Delay/LOS	Delay/LOS	Delay/LOS	Delay/LOS
1. Dixon Landing Rd./McCarthy Blvd.–Fremont Blvd.	9.0/A	—[a]	15.2/B	—[a]	15.2/B	—[a]
2. Dixon Landing Rd./I-880 SB Ramp	16.5/B	—[a]	13.3/B	—[a]	13.5/B	—[a]
3. Dixon Landing Rd./I-880 NB Ramp–California Cir.	17.9/B	—[a]	52.4/D	—[a]	53.8/D	—[a]
4. SR 237 WB Ramps/Zanker Rd.	—[a]	16.2/B	—[a]	14.2/B	—[a]	14.5/B
5. SR 237 EB Ramps/Zanker Rd.	—[a]	13.6/B	—[a]	18.5/B-	—[a]	18.7/B-
6. SR 237 WB Ramps/North First St.	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
7. SR 237 EB Ramps/North First St.	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]

Delay is measured in average seconds per vehicle; LOS = level of service; EB = eastbound; WB = westbound; NB = northbound; SB = southbound

[a] The project would not add trips during the peak period indicated, so level of service was not evaluated.

Freeway Segment Analysis

The construction-related worker trips generated by the action alternatives would be less than 100 PM peak hour trips and would add less than 1 percent of the segment's volume capacity to any roadway segment; this change is consistent with the VTA's CMP standards for freeway segments. Therefore, the action alternatives would have a less-than-significant impact on the study freeway segments with the future 2024 condition.

The project would result in less-than-significant impacts on transportation plans, congestion-management programs, or goals for freeway segments during construction in 2024.

Operation and Maintenance Effects

There would be no additional impacts on the study roadways from long-term maintenance and operation of the action alternatives. Trips generated from operation and maintenance are anticipated to remain similar to what would be required to maintain the managed pond dikes and Refuge ponds under the baseline condition.

The project would result in less-than-significant impacts on transportation plans, congestion-management programs, or goals for freeway segments during long-term operation and maintenance.

Impact TRN-2: Substantially increase hazards related to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., slow-moving construction equipment)

The project would not change any design features of existing roads; there would be no impact from design feature–related impacts. Slow-moving construction vehicles would stay within active work areas and would not normally use public roads. A traffic control plan will be prepared to ensure trucks and other construction vehicles can safely enter and exit public roads when accessing the construction site (AMM-TRN-3: Traffic Control Plan). In some exceptional cases, construction vehicles might use roads in the Refuge near Pond A12 to travel to active work areas. This type of onsite traffic would be limited to specific work areas and to the daily construction time window and would not affect mobility or safety conditions on Refuge roads.

The project would result in less-than-significant impacts on hazards related to design features or incompatible uses.

Impact TRN-3: Result in inadequate emergency access to areas that are near the project and that rely on the same transportation facilities

Slow-moving construction vehicles would stay within active work areas and would not normally use public roads. A traffic control plan would be prepared by the contractor to ensure vehicles have safe ingress and egress from public road (AMM-TRN-3: Traffic Control Plan). Construction work would be staged and conducted well away from public roads and would therefore not impact emergency access.

The project would result in less-than-significant impacts on emergency access.

Impact TRN-4: Conflict with the City of San José, Santa Clara County, or Alameda County adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities

The action alternatives would not generate additional pedestrian, bicycle, or transit-oriented trips; the traffic-control plan would include provisions to maintain pedestrian, bicycle, and transit facilities, if needed. Also see Section 4.11 *Recreation* for a discussion of trails. The action alternatives are anticipated to generate construction-related truck and worker traffic that would be temporary in nature and would last only for the duration of the construction activity. All construction activities would occur within the project boundaries, and no lane or road closures would occur on any public roadways as a result of construction or operation of the action alternatives. Because the project would not conflict with current pedestrian, bicycle, or bus transit facilities, this impact would be less than significant.

A temporary railroad crossing would be required for trucks to deliver fill material for the FRM levee. Short-term closure of the railroad line would be needed during construction of the temporary crossings. The USACE would coordinate with Union Pacific Railroad and rail transit providers to confirm peak rail traffic hours and cooperatively establish speed and traffic restrictions for rail and truck activities (AMM-TRN-2: Coordinate with Railroad). See Section 4.16 *Public Utilities and Service Systems* for more information about the temporary Union Pacific Railroad closure.

The project would result in less-than-significant impacts on public and alternative transportation.

4.9.2.3.2.2 Comparison of Action Alternatives

Impacts on transportation would be similar from all action alternatives. Alternative 3 would require a greater amount of fill to construct the larger levee and ecotone; however, truck trips to transport levee and transitional habitat materials are assumed to remain outside of peak traffic periods (6-hour transportation window from 9 AM to 3 PM, with possible additional transport of materials, if necessary, after peak traffic hours end at 6 PM) and, therefore, are not considered in the peak-period traffic analysis discussed above. However, transportation of materials after 6 p.m. would be limited to Staging Areas #1 and #2 (see Figure 3.8-2 *Potential Staging Areas* in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*), as these are within the Wastewater Facility properties, and separated from all residences by a major highway, I-880. Since the fill requirements for the WPCP South segment are much higher than the Alviso segment (due to length of segment), additional time for materials transport may be necessary to meet construction schedules. Construction worker trips are assumed to be the primary activity during peak traffic periods, and estimated trips are similar among the action alternatives. Table 4.9-15 *Summary of Action Alternative Impacts on Transportation* summarizes the 2019 and 2024 project effects for all action alternatives.

Table 4.9-15. Summary of Action Alternative Impacts on Transportation

Timeframe	Summary of Impacts
2019 with Project	• All study intersections would operate at LOS D or better during the AM and PM peak hours. • One study intersection that would be affected by additional trips would operate at LOS D during the AM peak hour (SR 237 EB Ramps/North First St.). The remainder of the intersections that would have additional trips would operate at LOS B or C. Compared to the baseline condition, the LOS D segment would have a 0.2-second increase in delay. However, this increase would not be caused by the action alternatives because the increase would also occur as part of the No Action Alternative scenario. • For the freeway segments studied, none of the alternatives would add more than 100 PM peak-hour trips or add more than 1% of the established capacity to any roadway segment.
2024 with Project	• All study intersections would operate at LOS D or better during the AM and PM peak hours. • One study intersection that would be affected by additional trips would operate at LOS D during the AM peak hour (Dixon Landing Rd./I-880 NB Ramp–California Cir.). The remainder of the intersections that would have additional trips would operate at LOS B. Compared to the baseline condition, the LOS D segment would have a 35.9-second increase in delay. However, most of this delay would also occur under the No Action Alternative scenario, with the action alternatives accounting for 1.4 seconds of the increase (the No Action Alternative delay would be 52.4 seconds and the action alternatives scenario delay would be 53.8 seconds). • For the freeway segments studied, none of the alternatives would add more than 100 PM peak-hour trips or add more than 1% of the established capacity to any roadway segment.

LOS = level of service; EB = eastbound; St. = street, NB = northbound; I-880 = Interstate 880; Cir. = circle

4.9.3 Mitigation Measures

No mitigation measures are required. All impacts to traffic and transportation would be less than significant.

4.9.3.1 Residual Impacts and Additional Measures Necessary to Mitigate Significant Impacts

Since no mitigation measures are required, there are no residual impacts that require mitigation.

4.9.4 Cumulative Effects

The cumulative study area for traffic is the South San Francisco Bay area. Past development in the region has generated significant traffic and congestion which is cumulatively considerable. The Shoreline Phase I Project would not generate any substantial changes to long-term traffic in and near the transportation study area as defined for the Shoreline Phase I Study. Therefore, the project's incremental effects on cumulative transportation impacts to the transportation study area would be limited to the construction period, when the project would generate construction trips. As discussed in Section 4.9.2.3.2 *Action Alternatives*, 2019 and 2024 analyses of effects on transportation study area intersections and freeway segments account for area growth, past and present projects, and reasonably foreseeable future projects and therefore represents both project-specific effects and the project's contribution to cumulative effects. Based on the above analysis, the Shoreline Phase I Project would not result in a cumulative contribution to adverse transportation conditions locally. Because it would not result in a cumulative contribution locally, the project's incremental effects also would not be cumulatively considerable for the greater Bay Area.

4.9.5 Summary

Table 4.9-16 *Transportation NEPA Impact Conclusions* summarizes the project effects under the NEPA.

Table 4.9-16. Transportation NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
TRN-1: Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulations system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit; or conflict with congestion management program standards and goals for freeway segments listed in Section 4.9.1 *Affected Environment*	Negative	Minor	Short term	Possible	Local
TRN-2: Substantially increase hazards related to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., slow-moving construction equipment)	Negative	Minor	Short term	Unlikely	Local
TRN-3: Result in inadequate emergency access to areas that are near the project and that rely on the same transportation facilities	Negative	Minor	Short term	Unlikely	Local
TRN-4: Conflict with the City of San José, Santa Clara County, or Alameda County adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities	Negative	Minor	Short term	Unlikely	Local

Table 4.9-17 *Transportation CEQA Impact Conclusions* summarizes the project effects under the CEQA.

Table 4.9-17. Transportation CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
TRN-1: Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulations system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit; or conflict with congestion management program standards and goals for freeway segments listed in Section 4.9.1 *Affected Environment*	AMM-TRN-1: Work Hours	LTS	None	LTS
TRN-2: Substantially increase hazards related to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., slow-moving construction equipment)	AMM-TRN-3: Traffic Control Plan	LTS	None	LTS
TRN-3: Result in inadequate emergency access to areas that are near the project and that rely on the same transportation facilities	AMM-TRN-3: Traffic Control Plan	LTS	None	LTS
TRN-4: Conflict with the City of San José, Santa Clara County, or Alameda County adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities	AMM-TRN-2: Coordination with Railroad	LTS	None	LTS

LTS = less than significant
S = significant

The action alternatives would not conflict with pedestrian, bicycle, or transit facilities. The action alternatives would result in less-than-significant impacts on transportation, including transportation study area intersections and freeway segments.

4.10 Air Quality/Greenhouse Gases

4.10.1 Affected Environment

4.10.1.1 Regulatory Setting

Air quality in the South Bay area is regulated by the USEPA, the ARB, and the Bay Area Air Quality Management District (BAAQMD). Each of these agencies develops rules, regulations, policies, and/or goals in response to requirements established by legislation such as the Federal CAA. Regulatory setting and applicable air quality regulations, plans, and standards are discussed below.

4.10.1.1.1 Federal Regulations

4.10.1.1.1.1 Clean Air Act

At the Federal level, the USEPA has been charged with implementing national air-quality programs. The USEPA's air-quality mandates are drawn primarily from the CAA, which was enacted in 1970. The most recent major amendments made by Congress were in 1990. The CAA required the USEPA to establish national ambient air quality standards (NAAQS). The USEPA has established primary and secondary NAAQSs for the following criteria air pollutants: ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), PM_{10} (particulate matter 10 micrometers in diameter or less), $PM_{2.5}$ (particulate matter 2.5 micrometers in diameter or less), and lead (Pb). The USEPA also has programs for identifying and regulating toxic air contaminants (TACs) or hazardous air pollutants (HAPs). Title III of the Clean Air Act Amendments of 1990 (CAAA) directed the USEPA to promulgate national emissions standards for HAPs. The CAAA also required the USEPA to promulgate vehicle or fuel standards containing reasonable requirements that control toxic emissions. Performance criteria were established to limit mobile-source emissions of toxics, including benzene, formaldehyde, and 1,3-butadiene. In addition, Section 219 of the CAAA required the use of reformulated gasoline in selected areas with the most severe ozone nonattainment condition to further reduce mobile-source emissions.

With respect to greenhouse gases (GHGs), the U.S. Supreme Court ruled on April 2, 2007, that carbon dioxide (CO_2) is an air pollutant as defined under the CAA and that the USEPA has the authority to regulate emissions of GHGs. There are, however, no Federal policies, laws, or regulations concerning GHG emissions applicable to the Shoreline Phase I Study Area at this time.

4.10.1.1.2 State Regulations

4.10.1.1.2.1 California Clean Air Act

The ARB is the agency responsible for coordination and oversight of State and local air-pollution-control programs in California and for implementing the California Clean Air Act (CCAA). The CCAA, which was adopted in 1988, required the ARB to establish California ambient air quality standards (CAAQS). The ARB has established CAAQS for sulfates, hydrogen sulfide, vinyl chloride, visibility-reducing particulate matter (PM), and the above-mentioned criteria air pollutants. The CAAQS are generally more stringent than the NAAQS. Differences in the standards are explained by the health effects studies considered during the standard-setting process and the interpretation of the studies. In addition, the CAAQS protect sensitive individuals by incorporating a margin of safety.

The CCAA requires that all local air districts in California endeavor to achieve and maintain CAAQS by the earliest practical date. The act directs local air districts to focus particular attention on reducing the emissions from transportation and area-wide emission sources and provides districts with the authority to regulate indirect sources.

The ARB is the lead agency for coordinating State Implementation Plans, which are comprehensive plans that describe how an area will attain NAAQS. State Implementation Plans are a compilation of new and previously submitted plans, programs (such as monitoring, modeling, permitting, etc.), district rules, State regulations and Federal controls.

4.10.1.1.2.2 Toxic Air Contaminant Identification and Control Act (AB 1807) and Air Toxics Hot Spots Information and Assessment Act (AB 2588)

TACs in California are regulated primarily through Assembly Bill (AB) 1807 and AB 2588. AB 1807 sets specific criteria and procedures for the ARB to identify and control air toxics, while AB 2588 requires reporting of the types and quantities of air toxics routinely released into the air from stationary sources. Research, public participation, and scientific peer review must occur before ARB can designate a substance as a TAC. The ARB list of TACs includes almost 200 substances, many of which are also Federally identified HAPs. The ARB published the *Air Quality and Land Use Handbook: A Community Health Perspective*, which provides guidance concerning land-use compatibility with TAC sources (ARB 2005). Although not a law or adopted policy, the handbook offers recommendations for identifying sensitive receptors near uses associated with TACs, uses such as high-traffic roads, commercial distribution centers, rail yards, ports, refineries, dry cleaners, gasoline stations, and industrial facilities.

4.10.1.1.2.3 California Global Warming Solutions Act of 2006 (AB 32)

Adopted in 2006, AB 32 establishes the first-ever comprehensive program of regulatory and market mechanisms to achieve reductions in GHGs that are quantifiable, real, and cost-effective. The act requires that greenhouse gas emissions in California be reduced to 1990 levels by 2020; to 80 percent below 1990 levels by 2050; and directs responsibility for monitoring and reducing emissions to the ARB.

In 2008, the ARB approved a Climate Change Scoping Plan which defined climate change priorities for a five year period and set the groundwork to reach the 2020 and 2050 emission goals. The First Update to the Climate Change Scoping Plan was approved by ARB on May 22, 2014 and focuses on energy, transportation, agriculture, water, waste management, natural and working lands, short-lived climate pollutants, green buildings, and the cap- and-trade program (ARB 2014).

4.10.1.1.2.4 Dutton (Senate Bill 97)

Senate Bill 97 was signed in 2007 and adds stipulations (Section 21083.05) to the Public Resources Code. As directed by this bill, the Office of Planning and Research prepared and developed CEQA guideline amendments for the mitigation and effects of GHG emissions; these guidelines were then submitted to The Resources Agency. The Resources Agency officially adopted the guideline amendments in March 2010. The CEQA guideline amendments provide public agencies with planning guidance regarding analysis and mitigation of the effects of GHGs.

4.10.1.1.3 Local Regulations

Regional and county air districts are primarily responsible for developing local air quality plans and regulating stationary emission sources and facilities. The Shoreline Phase I Study is within the jurisdiction of the BAAQMD.

4.10.1.1.3.1 Bay Area Air Quality Management District

The BAAQMD attains and maintains the air quality condition throughout the San Francisco Bay Area including Alameda, Santa Clara, and San Mateo Counties through a comprehensive program of planning, regulation, enforcement, technical innovation, and promotion of the understanding of air quality issues. In 2012, the BAAQMD released updated BAAQMD CEQA Guidelines (BAAQMD 2012). This is an advisory document that provides lead agencies, consultants, and project applicants with uniform procedures for addressing air quality in environmental documents. The handbook contains the following applicable components:

- Criteria and thresholds for determining whether a project may have a significant adverse air quality impact
- Specific procedures and modeling protocols for quantifying and analyzing air quality impacts
- Methods available to mitigate air quality impacts
- Information for use in air quality assessments and environmental documents that will be updated more frequently, information such as air quality data, regulatory setting, climate, and topography

4.10.1.1.3.2 Air Quality Plans

The CAA and CCAA require plans to be developed for areas designated as nonattainment (with the exception of areas designated as nonattainment for the State PM_{10} standard) and for areas designated as maintenance for national standards. Currently, there are two plans for the San Francisco Bay Area: (1) the San Francisco Bay Area Ozone Attainment Plan for the One-Hour National Ozone Standard (ABAG 2001), developed to meet Federal ozone air quality planning requirements, and (2) the 2010 Clean Air Plan developed to meet requirements related to the CAAQS. The plan is the first of its type to look at multiple pollutants such as ozone, PM, air toxics, and GHGs in an integrated manner. This integrated strategy assesses the sources of these pollutants to identify opportunities for maximum reduction.

4.10.1.1.3.3 Local Toxic Air Contaminant Programs

Under BAAQMD regulations, all sources with the potential to emit TACs are required to obtain permits from the BAAQMD. Permits may be granted to these operations if they are constructed and operated in accordance with applicable regulations, including new source review standards and air toxics control measures. If the BAAQMD determines that a project would emit toxics in excess of the BAAQMD's threshold of significance for TACs, sources must implement best available control technology (BACT) to reduce emissions. If a source cannot reduce the risk below the threshold of significance even after BACT has been implemented, the BAAQMD will deny the permit required by the source. This helps to prevent new problems and reduces emissions from existing older sources by requiring them to apply new technology when retrofitting with respect to TACs.

The BAAQMD's air quality permitting process applies only to stationary sources. Non-stationary sources (e.g., on-road vehicles) are not subject to air quality permits. In addition, for feasibility and practicality reasons, mobile sources are not required to implement BACT for toxic emissions, even if they have the potential to expose adjacent properties to elevated levels of TACs. Emissions controls on such sources are subject to regulations implemented on the Federal and State level.

4.10.1.1.3.4 Odor

Because offensive odors rarely cause any physical harm, neither the Federal or State governments have adopted any rules or regulations. However, the BAAQMD has adopted Regulation 7 (Odorous Substances) that specifically addresses citizen complaints. As described by the regulation, receipt of 10 or more complainants within a 90-day alleging that a person has caused odors perceived at or beyond the property line of the reporting person that are deemed to be objectionable by the complainants in the normal course of their work, travel, or residence triggers the limits of odorous substances as defined by the Regulation. When the limits of this regulation become effective as a result of citizen complaints described above, the limits would remain effective until no citizen complaints have been received by the Association of Public Safety Communications Officials (APCO) for 1 year. The limits of this regulation would apply again when the APCO receives odor complaints from five or more complainants within a 90-day period.

4.10.1.2 Local and Regional Conditions (CEQA Baseline)

The Shoreline Phase I Study Area is located in the San Francisco Bay Area Basin (SFBAAB). Ambient concentrations of air pollutant emissions in the SFBAAB are determined by the emissions released by pollutant sources and the atmosphere's ability to transport and dilute these emissions. Terrain, wind, atmospheric stability, and the presence of sunlight are natural factors that affect transport and dilution. Consequently, the existing air quality condition in the area is determined in part by natural factors, including topography, meteorology, and climate (EDAW et al. 2007).

Climate in the area is dominated by the strength and location of a semi-permanent, subtropical high-pressure cell over the northeastern Pacific Ocean and the moderating effects of the adjacent oceanic heat reservoir (EDAW et al. 2007). Climate characteristics include mild summers and winters with moderate rainfall, breeze, and humidity. The high-pressure cell is strongest and farthest north in the summer, bringing morning fog and mild temperatures. The high-pressure cell is weakest and farthest south in the winter, allowing occasional rainstorms (EDAW et al. 2007).

Moderate winds in the area affect air quality by dispersing pollutants downwind from their sources, thereby reducing pollutant concentrations. Inversion layers, created when warm layers of air trap cooler air near the ground, obstruct dispersion by forming a "ceiling" over the area and trapping air pollutants close to the ground. These inversions are present in the Shoreline Phase I Study Area during summer mornings and afternoons, and combined with longer days with plentiful sunshine provide the energy necessary to fuel photochemical reactions between nitrogen oxides (NO_x) and reactive organic gases (ROG), resulting in ozone formation (EDAW et al. 2007).

During the winter, temperature inversions dominate during the night and early-morning hours and frequently dissipate by the afternoon. In the winter months, pollution problems are mainly from CO and NO_x. CO transport is limited, and high concentrations occur on winter days with strong surface inversions and light winds (EDAW et al. 2007).

4.10.1.2.1 Criteria Air Pollutants

Indicators of the ambient air quality condition include the following air pollutants: ozone, CO, NO_2, sulfur dioxide SO_2, respirable and fine PM, and lead. These are commonly referred to as criteria air pollutants because they are the most common air pollutants known to be harmful to human health (EDAW et al. 2007). Table 4.10-1 *Attainment Status for Criteria Air Pollutants in the San Francisco Bay Area Basin* provides a summary of the attainment and nonattainment status of criteria air pollutants for the study area.

Table 4.10-1. Attainment Status for Criteria Air Pollutants in the San Francisco Bay Area Basin

	Status			
Criteria Air Pollutant	Nonattainment	Attainment	Unclassified	Unclassifiable/ Attainment
California Ambient Air Quality Standards				
Ozone	X			
Suspended Particulate Matter (PM_{10})	X			
Fine Particulate Matter ($PM_{2.5}$)	X			
Carbon Monoxide (CO)		X		
Nitrogen Dioxide (NO_2)		X		
Sulfur Dioxide (SO_2)		X		
Sulfates (SO_x)		X		
Lead (Pb)		X		
Hydrogen Sulfide (H_2S)			X	
Visibility-Reducing Particulates			X	
National Ambient Air Quality Standards				
8-hour Ozone	X			
Suspended Particulate Matter (PM_{10})			X	
Fine Particulate Matter ($PM_{2.5}$)	X			
CO		X		
NO_2				X
SO_2		X		

Source: ARB 2010a

Each criteria air pollutant is described below, including source types, health effects, and current attainment designations and monitoring data for the Shoreline Phase I Study Area.

4.10.1.2.1.1 Ozone

Ozone is the primary component of smog and is a photochemical oxidant, which is a substance that has an oxidation reaction in the presence of sunlight. Ozone is formed through a series of complex chemical reactions between emissions of ROGs and NO_x. ROGs are volatile organic compounds that are photochemically reactive, and resulting emissions are due to incomplete combustion and the evaporation of chemical solvents and fuels. NO_x includes compounds of nitrogen and oxygen gases that result from fuel combustion (EDAW et al. 2007).

Ozone in the upper atmosphere (stratosphere) is beneficial because it shields the earth from harmful ultraviolet radiation emitted by the sun. In contrast, ozone located in the lower atmosphere (troposphere) poses major health and environmental risks. Meteorology and terrain play a major role in ozone formation. Ozone is generally formed when conditions include warm temperatures, clear skies, and low or stagnant wind speeds, making summer the peak ozone season. Peak ozone concentrations often arise far downwind of precursor emissions because of the reaction time involved. For this reason, ozone is a considered a regional pollutant that affects large areas. Ozone concentrations found in urban and rural areas usually reflect the interplay of emissions of ozone precursors, transport, meteorology, and atmospheric chemistry (Godish 1991).

Adverse health effects from ozone exposure relate primarily to the respiratory system. Scientific studies indicate that ambient levels of ozone affect both sensitive individuals, such as asthmatics and children, and healthy adults. Altered lung functions caused by increasing respiratory rates and pulmonary resistance and damaging respiratory mechanics occur at exposure to ambient levels of ozone ranging from 0.10 to 0.40 parts per million (ppm) for 1 to 2 hours. Symptomatic reactions linked to ambient levels of ozone above 0.12 ppm include throat dryness, chest tightness, headache, and nausea. Additional adverse health effects include increased permeability of respiratory epithelia, which leads to increased responsiveness of the respiratory system to challenges, and hindrance of the immune system's ability to protect against infection (Godish 1991).

4.10.1.2.1.2 Carbon Monoxide

CO is a gas that is colorless, odorless, and poisonous. It is produced by incomplete burning of carbon in fuels. Mobile sources account for the majority of the nationwide CO emissions, totaling 77 percent, while the remaining 23 percent is produced by wood-burning stoves, incinerators, and industrial sources (EDAW et al. 2007).

CO enters the bloodstream through the lungs by combining with hemoglobin, replacing the oxygen that is normally transported to the cells. This occurs because CO combines with hemoglobin much more readily than oxygen does and results in drastic reductions in the amount of oxygen available to cells. This displacement of oxygen causes adverse health effects, including dizziness, headaches, and fatigue. CO exposure is especially harmful to those who suffer from cardiovascular and respiratory diseases (USEPA 2006).

High concentrations of CO usually occur during winter, when weather conditions are cold and stagnant. CO issues tend to be localized.

4.10.1.2.1.3 Nitrogen Dioxide

NO_2 is a highly reactive gas that is present in all urban areas and is brownish in color. Human-made sources of NO_2 are primarily combustion machines such as boilers, gas turbines, and reciprocating internal combustion engines. These machines emit mostly nitric oxide (NO), which then forms NO_2 through an oxidation reaction in the atmosphere (USEPA 2008). NO and NO_2 are collectively referred to as NO_x. Concentration of NO_2 in a given area is not necessarily representative of the local NO_x emissions because NO_2 is formed and depleted by reactions associated with ozone.

The most common route of exposure to NO_2 is through inhalation. Because of its comparatively low solubility in water, the primary site of toxicity is the lower respiratory tract. The concentration of inhalation plays a larger role in the severity of adverse health effects than the duration of exposure. Acute symptoms that may be experienced during or soon after exposure include coughing, difficulty with breathing, vomiting, headache, and eye irritation. After 4 to 12 hours of exposure, an individual may experience chemical pneumonitis or pulmonary edema with breathing abnormalities, cough, cyanosis, chest pain, and rapid heartbeat. In addition, prolonged respiratory impairment with symptoms such as chronic bronchitis and decreased lung functions have been linked to severe, symptomatic NO_2 intoxication after acute exposure.

4.10.1.2.1.4 Sulfur Dioxide

SO_2 is a colorless gas that is produced by stationary sources such as those that combust coal and oil, steel mills, refineries, and paper mills. Exposure to SO_2 through inhalation causes irritation with constriction of the bronchioles occurring at levels of 5 ppm or more. When SO_2 comes into contact with mucous membranes, sulfurous acid is produced, causing a direct irritant. The concentration of inhalation plays a larger role in the severity of adverse respiratory effects than the duration of exposure. Symptoms of edema of the lungs or glottis and respiratory paralysis may be experienced by individuals exposed to high SO_2 concentrations.

4.10.1.2.1.5 Particulate Matter

PM is a mixture of small particles and liquid droplets consisting of many components, including organic chemicals, acids, metals, and dust particles. Respirable PM with an aerodynamic diameter of 10 micrometers or less is defined as PM_{10}. Sources that produce PM_{10} include mobile and stationary sources such as construction operations, fires, windblown dust, and atmospheric PM_{10} formed by condensation and/or conversion of SO_2 and ROG (USEPA 2008). Fine PM, including a subgroup of smaller particles with an aerodynamic diameter of 2.5 micrometers or less, is known as $PM_{2.5}$ (ARB 2007).

Adverse health effects associated with PM_{10} are wide-ranging and depend on the specific composition of the PM to which an individual is exposed. Effects may be associated with metals, PAHs, and other toxic substances adsorbed onto fine PM (also known as the “piggybacking” effect) or with fine dust particles of silica or asbestos. Both long-term and short-term exposure to high concentrations of PM_{10} may result in adverse health effects such as breathing and respiratory symptoms, exacerbation of existing respiratory and cardiovascular diseases, carcinogenesis, changes to the immune system, and premature death (USEPA 2008). $PM_{2.5}$ exposure may cause increased health risk because the smaller particles may contain especially harmful substances and are capable of being deposited deep in the lungs.

4.10.1.2.1.6 Lead

Lead is a gray-white metal substance that is present in manufactured products as well as found naturally in the environment. Adverse health effects resulting from inhalation of lead-contaminated air include brain and kidney damage and learning disabilities (ARB 2010b).

Historically, lead emissions originated primarily from mobile and industrial sources. Because of high levels of lead in the atmosphere, the USEPA began setting national regulations in the early 1970s to gradually reduce the lead content in gasoline, which prompted the introduction of unleaded gasoline in 1975 for automobiles equipped with catalytic converters. This gradual eradication of leaded gasoline was final in 1995, when the use of leaded gasoline in highway vehicles was banned by the USEPA (USEPA 2008). As a result of this ban, emissions of lead from transportation sources had a remarkable decline of 95-percent between 1980 and 1999, while lead in the atmosphere declined 94-percent in the same period. Lead levels in human blood also declined dramatically, reported as a 78-percent decrease between 1976 and 1991 (EDAW et al. 2007).

Presently, airplanes are the primary source of the transportation-associated lead emissions and contribute 13 percent of current total lead emissions (USEPA 2008). Higher levels of lead in the atmosphere are usually found in close proximity to lead smelters, while other sources include waste incinerators, utilities, and lead acid battery manufacturers. California, in its entirety, is designated as an attainment area for lead, because average ambient air measurements of lead are below the Federal and State ambient air quality standards. Even though ambient lead levels are not in violation of standards, emissions from stationary sources still pose “hot spot” problems in some areas. For this reason, the ARB had identified lead as a TAC, in addition to being a criteria air pollutant.

4.10.1.2.2 Emissions Inventory

The current emissions inventory for the SFBAAB is shown in Table 4.10-2 *Air Pollutant Emissions in the San Francisco Bay Area Air Basin in 2008* (ARB 2008a). This inventory lists the amounts of air pollutants, organized by source, that are discharged into the atmosphere of an area in a given period. The data presented indicate that mobile-sourced air pollutants are the largest contributors to the estimated annual emissions average because they account for approximately 48-percent of the total ROGs, 88-percent of the total CO, 85-percent of the total NO_x, 24-percent of the total SO_x, and 10-percent of the total PM_{10} emissions for the San Francisco Bay Area (ARB 2008a).

Table 4.10-2. Air Pollutant Emissions in the San Francisco Bay Area Air Basin in 2008

Source Type/Category	Estimated Annual Average Emissions (tons per day)				
	ROG	CO	NO_X	SO_X	PM_{10}
Stationary Sources					
Fuel Combustion	3.2	40.1	45.3	12.1	5.4
Waste Disposal	36.0	1.9	0.6	0.2	0.1
Cleaning and Surface Coating	34.9	0.0	0.0	—	0.0
Petroleum Production and Marketing	21.4	0.3	0.6	25.6	1.0
Industrial Processes	11.1	1.9	4.1	8.1	9.8
Subtotal (stationary sources)	106.6	44.3	50.6	45.9	16.3
Area-Wide Sources					
Solvent Evaporation	71.5	—	—	—	—
Miscellaneous Processes	16.5	161.9	16.9	0.6	175.5
Subtotal (area-wide sources)	87.9	161.9	16.9	0.6	175.5
Mobile Sources					
On-Road Motor Vehicles	112.3	1066.7	206.7	0.9	10.1
Other Mobile Sources	70.8	474.8	173.8	14.0	10.2
Subtotal (mobile sources)	183.1	1541.5	380.5	14.9	20.3
Total for Air Basin	377.6	1747.7	448.0	61.5	212.1

Source: ARB 2008a
Key:
— = not applicable
CO = carbon monoxide
NO_x = nitrogen oxide
PM_{10} = fine particulate matter less than or equal to 10 micrometers in diameter
ROG = reactive organic gas
SO_x = sulfates

4.10.1.2.3 Monitoring Station Data and Attainment Area Designations

Several monitoring stations in the SFBAAB measure criteria air pollutants. These measurements are summarized in Table 4.10-3 *Annual Ambient Air Quality Data (2011–2013)*. Monitoring station data are used by the ARB and the USEPA to designate areas according to attainment status set by the agencies for criteria pollutants. Designation categories include nonattainment, attainment, and unclassified, which is used when an area cannot be classified based on available information as meeting or not meeting standards. California includes an additional subcategory of the nonattainment designation, named nonattainment-transitional, which is given to nonattainment areas that are improving and nearing attainment. The designations are used to identify areas with air quality problems and to begin planning efforts for improvement (ARB 2007b, 2008b; USEPA 2008).

Table 4.10-3. Annual Ambient Air Quality Data (2011–2013)

Criteria Air Pollutants Type	2011	2012	2013
Ozone			
Maximum concentration (1 hour/8 hours, ppb)	115/84	102/90	96/79
Number of days exceeding 8-hour standard (national/State) [a]	4/10	4/8	4/3
Number of days exceeding 1-hour standard (State) [a]	5	3	3
PM_{10}			
Highest 24-hour average concentration ($\mu g/m^3$)	73	60	58
Number of days exceeding standards (national/State)	0/3	0/2	0/6
Highest annual average concentration ($\mu g/m^3$)	20.2	18.8	22.3
$PM_{2.5}$			
Highest 24-hour average concentration ($\mu g/m^3$)	54.2	38.4	57.7
Number of days exceeding standards (national)	8	3	13
Highest annual average concentration ($\mu g/m^3$)	10.1	9.1	12.4
Nitrogen Dioxide (NO_2)			
Maximum concentration (1 hour, ppb)	93	124	73
Number of days State standard exceeded (1 hour) [a]	0	0	0
Highest annual average concentration (ppb)	16	15	17

Source: BAAQMD 2014

Key:

$\mu g/m^3$ = micrograms per cubic meter

ppb = parts per billion

ppm = parts per million

[a] Measured days are days in which an actual measurement was greater than the level of the State daily standard or the national daily standard. Measurements are typically collected every 6 days. Calculated days are the estimated number of days that a measurement would have been greater than the level of the standard had measurements been collected every day. The number of days above the standard is not necessarily the number of violations of the standard for the year.

4.10.1.2.4 Greenhouse Gases

Certain gases in the earth's atmosphere, classified as GHGs, play a critical role in determining the earth's surface temperature. These gases include both natural components of the atmosphere, such as water vapor and CO_2, and artificial components such as chlorofluorocarbons.

Solar radiation consists primarily of various wavelengths of electromagnetic radiation. Absorption of electromagnetic radiation increases the temperature of an object, while radiation of electromagnetic radiation by an object lowers its temperature. Thus, emission and absorption of electromagnetic radiation play important roles in heat transfer in the environment. Radiation of electromagnetic radiation by substances at ordinary temperatures is generally in the mid-infrared range, which is invisible to the eye and is sometimes called thermal radiation.

Some solar wavelengths are able to pass efficiently through the Earth's atmosphere to its surface, primarily in wavelengths such as visible light and parts of the infrared and ultraviolet ranges. A portion of this incoming radiation is absorbed by the earth's surface, thereby warming it, and a smaller portion of this radiation is reflected back into space. The absorbed radiation keeps the Earth's surface much warmer than it would otherwise be so that it gives off larger amounts of thermal radiation than it otherwise would. This additional emission of radiation has a cooling effect on the Earth's surface, thereby balancing out the warming effect from the absorbed solar radiation.

The emitted thermal radiation passes through most atmospheric gases easily, but GHGs absorb some of this radiation, preventing it from leaving the atmosphere and in the process warming the atmosphere. Thus, the presence of GHGs shifts the balance of incoming and outgoing radiation, resulting in the Earth's atmosphere being considerably warmer than it would be in the complete absence of these gases.

Of the GHGs present in the Earth's atmosphere, the ones causing the greatest greenhouse impact are CO_2, methane, ozone, nitrous oxide, and certain fluorinated compounds. Human-caused emissions of these GHGs have increased in ambient concentrations above natural levels, which have in turn intensified the greenhouse effect.

Increases in GHG concentrations in the atmosphere have thus contributed to a trend of largely unnatural warming of the earth's climate over the last 150 years, known as global climate change or global warming (Ahrens 2003). It is highly unlikely that the past 50 years of global climate change can be explained without the contribution from human actions (IPCC 2007). Increases in CO_2 concentrations in the atmosphere have had the greatest effect on intensifying the greenhouse effect in this period due to CO_2 being by far the most abundant of these gases in the atmosphere.

Human activities associated with the industrial/manufacturing, utility, transportation, residential, and agricultural sectors are the main GHG contributors to global climate change (CEC 2006). In California, the transportation sector is the largest emitter of GHGs, followed by electricity generation (CEC 2006). Partial alleviation of atmospheric CO_2 concentrations occurs in CO_2 sinks or reservoirs, which include vegetation and the ocean. Vegetation and the ocean absorb CO_2 through photosynthesis and dissolution, respectively; these are two of the most common processes of CO_2 sequestration from the atmosphere.

The United States produces the largest amount of CO_2 emissions per capita of any country in the world. High population concentrations have positioned California as the 12^{th-}largest source of climate-change-associated pollutants in the world (BCDC 2011). The San Francisco Bay Area makes up a large portion of California's overall GHG emissions on a per-capita metric-tons-per-year basis (BCDC 2009).

The BAAQMD completed a baseline inventory of GHG emissions in the San Francisco Bay Area for 2007 and estimated that 102 million metric tons of CO_2 equivalents were emitted in the San Francisco Bay Area that year (BAAQMD 2008). CO_2 equivalent is a measure for comparing CO_2 with other GHGs (which generally have a higher global warming potential) based on the amount of those other gases multiplied by the appropriate global warming potential factor, commonly expressed as metric tons of CO_2 equivalents. Table 4.10-4 *Carbon Dioxide Equivalent Emissions by Pollutant in the San Francisco Bay Area in 2007* shows the emissions breakdown by pollutant.

GHGs are global pollutants, and this fact makes climate change a global problem. While pollutants with localized air quality effects have relatively short atmospheric lifetimes (approximately 1 day), GHGs have much longer atmospheric lifetimes (ranging from 1 year to several thousand years). The longer atmospheric lifetimes allow GHGs to persist in the atmosphere long enough to be distributed around the globe.

Table 4.10-4. Carbon Dioxide Equivalent Emissions by Pollutant in the San Francisco Bay Area in 2007

Pollutant	Percentage (%)	Carbon Dioxide Equivalent (metric tons/year)
Carbon Dioxide	91.4	93.7
Methane	2.4	2.5
Nitrous Oxide	2.2	2.3
Hydrofluorocarbon, Perfluorocarbon, Sulfur Hexafluoride	3.9	4.0
Total	100	102.6

Source: BAAQMD 2008

4.10.1.2.5 Toxic Air Contaminants

TAC concentrations are also used as ambient air quality indicators. TACs are air pollutants that may be hazardous to human health and may cause or contribute to increased mortality or serious illness. Although TACs usually occur in minute quantities in the ambient air, their high toxicity or health risk may pose a threat to public health even at lower concentrations. TACs that may cause cancer generally present risks at any concentration of exposure. For this reason, there is no threshold below which adverse health effects are not expected to occur (EDAW et al. 2007).

The majority of the estimated health risk from TACs can be attributed to those with PM components from diesel-fueled engines (ARB 2006). Diesel PM differs from other TACs because it is a complex combination of hundreds of substances, while other TACs are single substances. Although diesel PM is emitted by diesel-fueled internal combustion engines, the composition of the emissions depends on engine type, operating condition, fuel composition, lubricating oil, and the presence of an emission-control system. Diesel PM does not have ambient monitoring data, as other TACs do, because an accepted measurement procedure does not currently exist. The ARB has, however, made preliminary statewide concentration estimates of diesel PM emissions for 2010 [Table 4.10-5 *Estimated Statewide Diesel Particulate Matter Emissions from Diesel-Fuel Equipment and Vehicles (2010)*]. This method uses the ARB's PM_{10} database of emission inventories, ambient PM_{10} monitoring data, and results from studies on chemical speciation of ambient data. These data, along with receptor-modeling techniques, were used to estimate outdoor concentrations of diesel PM. The compounds that pose the greatest known ambient risk based on air quality data, or concentration estimates in the case of diesel PM, are acetaldehyde, benzene, 1,3- butadiene, carbon tetrachloride, hexavalent chromium, para-dichlorobenzene, formaldehyde, methylene chloride, perchloroethylene, and diesel PM (EDAW et al. 2007).

Table 4.10-5. Estimated Statewide Diesel Particulate Matter Emissions from Diesel-Fuel Equipment and Vehicles (2010)

Category	Number of Engines	Diesel Particulate Matter (tons per year)	Percentage of Total Diesel Particulate Matter Emissions (%)
Stationary			
Prime	4,400	360	1.6
Emergency Standby	12,300	143	0.6
Mobile			
On-Road	643,900	5,200	22.9
Off-Road (excluding portable equipment)	521,300	15,900	70.0
Off-Road Portable	53,600	1,100	4.9
Total	1,235,500	22,700	100

Source: ARB 2000

4.10.1.2.6 Odor

The human nose is the lone odor-sensing device. A person's ability to detect odors is subjective and varies among the population. Subtle odors may be noticed by some individuals, while others may not have similar sensitivities. Additionally, odors that are considered offensive to some individuals may be acceptable by others. Humans tend to detect odors that are unfamiliar more easily than those that are common. This is because of odor fatigue, which occurs when a person becomes desensitized to an odor and recognition of the odor occurs only when there is an alteration in odor intensity (EDAW et al. 2007).

Two properties that are present in any odor are quality and intensity. Quality refers to the nature of the smell experience. Describing an odor as flowery or sweet is an example of an odor quality. Intensity refers to the strength of an odor; this is dependent on the concentration of odor in the air. As odors become diluted, the resulting concentration decreases. The intensity of an odor decreases as concentration decreases and is eventually difficult to detect or recognize. When an odor falls below the detection threshold, the concentration is considered to be unnoticeable by the average human (EDAW et al. 2007).

Sources of existing odor in the Shoreline Phase I study area include managed ponds at the Refuge, the Wastewater Facility, industrial processes and landfills. In the managed ponds, odors can be generated when hydrogen sulfide is produced as algae and other organic material in the ponds naturally decompose. Odors are also generated when the ponds dry and the mud bottoms are exposed to air, thereby exposing algae or brine shrimp. No odor complaints have been received in the Alviso pond complex since the USFWS took over pond management (EDAW et al. 2007). The Wastewater Facility plans to address odor problems as it implements capital improvements at the plant, resulting in an improved condition throughout the life of the Shoreline Phase I Project.

Odors are typically regarded as an annoyance rather than a health hazard, but manifestations of a person's reaction to foul odors can range from psychological (e.g., irritation, anger, or anxiety) to physiological (e.g., circulatory and respiratory effects, nausea, vomiting, and headache) (EDAW et al. 2007).

4.10.1.3 National environmental Policy Act and Engineer Regulation 1105-2-100: *Planning Guidance Notebook* Baseline Condition

For air quality, the NEPA and the Planning Guidance Notebook baseline condition is determined by projecting how the condition might change between the current condition discussed in Section 4.10.1 *Affected Environment* and the start of construction. Regional air quality has been showing slow improvement over the years, any difference between the current condition and year 2017[2] is anticipated to be minor. For this reason, the NEPA and the

[2] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

Planning Guidance Notebook baseline condition considered in Section 4.10.2 *Environmental Consequences*.

4.10.2 Environmental Consequences

4.10.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

Avoidance and minimization measures are those parameters that have been built into the design of the Proposed Project and are committed to as part of project implementation. These measures are generally included in the alternatives description of this report (Section 3.8 *Action Alternatives Component Details*), but, where appropriate, the specific measures related to the impact evaluations are also summarized in the resource chapters. The following AMMs would be implemented as part of the project design and would avoid or minimize adverse effects associated with air quality:

- **AMM-AIR-1: Dust-Control Measures –** The contractor will implement standard dust-control methods recommended by the BAAQMD including:
  - All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.
  - All haul trucks transporting soil, sand, or other loose material off site shall be covered.
  - All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
  - All vehicle speeds on unpaved roads shall be limited to 15 mph.
  - All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.
  - Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure CCR Title 13, Section 2485). Clear signage shall be provided for construction workers at all access points.
  - All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation.
  - A publicly visible sign shall be posted with a telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.
- **AMM-AIR-2: Limit Idling Time** – The contractor shall limit the idling time of diesel-powered construction equipment to 2 minutes.

- **AMM-AIR-3: Prepared SWPPP** – The contractor shall prepare a SWPPP. The compliance with SWPPP water quality standards will also minimize the generation of dust.
- **AMM-AIR-4: Greenhouse Gas BMPs** – The contractor will utilize alternatively fueled construction equipment for at least 15-percent of the fleet, use local building materials for at least 10-percent of the total, and recycle or reuse at least 50-percent of construction waste or demolition materials
- **AMM-AIR-5: Cleaner Construction Equipment** – Ensure that construction vehicles use newer and cleaner construction equipment (e.g., Tier 4), or diesel particulate filters are installed on older construction equipment.
- **AMM-AIR-6: Use Electrical Power where Possible** – Use electricity from the grid, rather than portable diesel-powered generators, where possible.

4.10.2.2 Methodology for Impact Analysis and Significance Thresholds

The air quality analysis concentrated on construction emissions associated with constructing the FRM levee and transitional habitats associated with Ponds A12 and A18 because, although they are temporary in nature, these short-term emissions would have the greatest potential for impacts on the surrounding communities. The information presented in this impact analysis presents the most conservative case, which assumes that the FRM levee and Pond A12 and Pond A18 transitional habitat would be constructed simultaneously in the 2018–2021 timeframe. Other ecosystem-restoration activities (in-pond preparation and levee breaches) were not modeled because these activities are similar to regular, ongoing maintenance in the study area and would not result in emissions above those already occurring. Furthermore, these other activities would be phased, so emissions related to ecosystem-restoration activity would be spatially dispersed over a number of years after the construction of the levee.

Long-term operational impacts would be minimal and would consist of occasional pump operations and maintenance activities similar to the existing condition.

Significance criteria are based on the State CEQA Guidelines and the BAAQMD guidance. For the purposes of this Integrated Document, impacts on air quality would be significant if implementation of a proposed project alternative would:

- **Impact AIR-1:** Violate any air quality standard or contribute substantially to an existing or projected air quality violation
- **Impact AIR-2:** Expose sensitive receptors to substantial pollution concentrations
- **Impact AIR-3:** Conflict with or obstruct implementation of the applicable air quality plan
- **Impact AIR-4:** Create objectionable odors affecting a substantial number of people
- **Impact AIR-5:** Conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases

In June 2010, the BAAQMD adopted significance thresholds for agencies to use to assist with environmental review of projects. These thresholds were designed to establish the level at which BAAQMD believed air pollutant emissions would cause significant impacts. The BAAQMD's recommended significance thresholds were included in its updated CEQA Guidelines (updated May 2012). In March 2012, the Alameda County Superior Court ruled that BAAQMD needed to comply with the CEQA prior to adopting the Guidelines. The Superior Court did not determine whether the thresholds were valid on the merits, but found that the adoption of the thresholds was a project under the CEQA. The court issued a writ of mandate ordering BAAQMD to set aside the thresholds and cease dissemination of them until BAAQMD complied with the CEQA. On appeal, the First Appellate District Court of Appeal reversed the trial court's decision. The Court of Appeal's decision was appealed to the California Supreme Court, which granted limited review, and the matter is currently pending. In view of the trial court's order which remains in place pending final resolution of the case, BAAQMD is no longer recommending that their thresholds be used as a general measure of project's significant air quality impacts; however, BAAQMD noted that lead agencies may rely on its updated CEQA Guidelines (updated May 2012) for assistance in calculating air emissions, obtaining information regarding health impacts of air pollutants, and identifying potential mitigation measures.

The BAAQMD recommended thresholds in its updated CEQA Guidelines (updated May 2012) including BAAQMD's Justification Report which explains the agency's reasoning for adopting the thresholds. The BAAQMD's recommended thresholds are supported by substantial evidence and are appropriate for use to determine significance in the environmental review of this project. Specifically, the BAAQMD thresholds are well-founded, grounded on air quality regulations, scientific evidence, and scientific reasoning concerning air quality and greenhouse gas emissions. The BAAQMD recommended significance thresholds are provided in Table 4.10-6 *BAAQMD* Construction Air Quality Thresholds of Significance below and are used for purpose of this analysis.

For dust emission related to construction activities, the BAAQMD CEQA Guidelines do not have quantified significance thresholds but instead relied on the implementation of effective and comprehensive control measures for fugitive dust during construction. If the required controls are implemented during a project, then short-term construction emissions would be reduced to a less-than-significant level. These measures have been adopted by the project as AMM-AIR-1: Dust-Control Measures.

USEPA's General Conformity Rule, established under Section 176(c)(4) of the CWA, provides a specific process for ensuring that Federal actions will conform to State Implementation Plans to achieve National Ambient Air Quality Standards. The rule sets *de minimis* thresholds, depending on the nonattainment status of the region where a Federal action will occur. The Bay Area Air Basin is designated moderate nonattainment for USEPAs 1997 1-hour ozone standard. As specified in 40 CFR 93.153, the *de minimis* threshold for Federal actions in moderate ozone nonattainment areas is 100 tons per year for NO_x and VOCs.

Table 4.10-6. BAAQMD Construction Air Quality Thresholds of Significance

Pollutant	Average Daily Emissions (pounds per day)
ROG	54
NO_x	54
PM_{10} (Exhaust)	82
$PM_{2.5}$ (Exhaust)	54
PM_{10}/$PM_{2.5}$ (Fugitive Dust)	BMPs
Local CO	None
Accidental Release of Acutely Hazardous Air Pollutants	None
Odors	None

Source: BAAQMD 2010b.

4.10.2.3 Alternatives Evaluation

Five alternatives, including the No Action Alternative, have been developed for the Proposed Project.

4.10.2.3.1 No Action Alternative

With the No Action Alternative, the proposed levees and ecosystem restoration features would not be constructed. Therefore, there would be no construction emissions from this alternative. Existing operational emissions, which are minimal, would continue.

4.10.2.3.2 Action Alternatives

4.10.2.3.2.1 Construction Effects

Alternative 2

The Alviso section of the Alternative 2 would construct a 12.5-foot NAVD 88 levee on the north alignment (i.e., along the northern edge of the NCM). The remainder of the FRM levee would follow an existing non-engineered levee and berm system between the Wastewater Facility and Pond A18. The following paragraphs describe the potential impacts associated with criteria pollutants, greenhouse gas emissions, toxic air contaminants, odors, and conflicts with air quality plans from construction activities associated with Alternative 2.

Construction would include using heavy equipment, which could create dust and result in short-term vehicle emissions. FRM levee and Pond A12 and Pond A18 transitional habitat construction would include work over a 3-year period (2018–2021). The transitional habitats constructed at Ponds A12 and A18 would be a 50-foot-wide refugial bench (transitional habitat) constructed on the bay side of the FRM levee. Construction equipment would be continually moving throughout the construction area. Only two or three pieces of equipment would be operating simultaneously in any given area, but multiple areas could be under construction at the same time. Construction activities would use equipment such as a grader, a scraper, and a compactor, and dump trucks would be moving soil to or from areas as needed.

Impact AIR-1: Violate any air quality standard or contribute substantially to an existing or projected air quality violation

Construction of Alternative 2 would result in a temporary increase in emissions of ROG, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, and CO_2. Construction emissions were quantified using the California Emissions Estimator Model (CalEEMod) and are presented in Table 4.10-7 *Estimated Maximum Daily Construction Emissions for Alternative 2 (in pounds per day)* and Table 4.10-8 *Estimated Annual Construction Emissions for Alternative 2*.

Both ROG and NO_x would exceed BAAQMD emission thresholds for maximum pounds per day from the large amount of material to be moved and placed to form the new levees and transition habitat. The total annual emissions of NO_x and ROG (26.89 tons and 2.50 tons per year, respectively) are below USEPA's *de minimis* threshold for Federal actions in moderate ozone nonattainment areas of 100 tons per year.

Table 4.10-7. Estimated Maximum Daily Construction Emissions for Alternative 2 (in pounds per day)

Year/Measurement	ROG	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_2
2017	70	773	496	0.9	47	36	90,137
2018	51	563	379	0.8	35	27	75,730
2019	46	467	341	0.8	37	26	69,283
2023	6	47	53	0.1	8	5	11,598
2024	5	41	43	0.1	8	5	10,934
Peak Day	70	773	496	0.9	47	36	90,137
Significance Threshold	54	54	None	None	82*	54*	None
Significance	S	S	LTS	LTS	LTS	LTS	LTS

* Thresholds for PM_{10} and $PM_{2.5}$ are for emissions from exhaust from construction equipment. The emissions listed in the table combine particulate matter from construction exhaust and fugitive dust.

Table 4.10-8. Estimated Annual Construction Emissions for Alternative 2

Year	ROG	NO_x	CO	SO_2	Fugitive PM_{10}	Exhaust PM_{10}	PM_{10} Total	Fugitive $PM_{2.5}$	Exhaust $PM_{2.5}$	$PM_{2.5}$ Total	Bio-CO_2	NBio-CO_2	Total CO_2	CH_4	N_2O	CO_2e
Year	tons/yr										MT/yr					
2017	2.1637	24.0580	15.7866	0.0275	1.3715	0.9514	2.3229	0.7220	0.8753	1.5973			2,537.2541			2,552.7656
2018	2.4962	26.8881	18.3834	0.0360	2.8632	1.0548	3.9181	1.5247	0.9704	2.4952			3,259.6235			3,279.8470
2019	2.3015	23.7574	17.6432	0.0358	1.5726	0.9163	2.4889	0.8208	0.8430	1.6638			3,194.2750			3,214.2601
2020	2.1876	21.5419	17.5613	0.0364	1.3734	0.8247	2.1981	0.7117	0.7587	1.4704			3,167.0816			3,187.0999
2021	1.5842	14.6885	12.6573	0.0281	2.4971	0.5798	3.0768	1.3252	0.5334	1.8586			2,449.7311			2,465.3373
2022	0.6594	5.3665	5.6136	0.0122	1.2358	0.2217	1.4575	0.6620	0.2040	0.8660			1,062.8273			1,069.4528
Total	11.3926	116.3002	87.6455	0.1760	10.9136	4.5487	15.4623	5.7664	4.1848	9.9512			15,670.7926			15,768.7627

Fugitive-dust emissions are addressed in the dust-control measures described in Section 4.10.2.1 *Avoidance and Minimization Measures Incorporated into the Alternatives* (AMM-AIR-1: Dust-Control Measures, AMM-AIR-3: Prepare SWPPP). With the implementation of these measures, dust from construction would be less than significant.

Construction of the FRM levee and ecotone would result in significant emissions of NO_x *and ROG. Mitigation measures are discussed below in Section 4.10.3* Mitigation Measures.

Impact AIR-2: Expose sensitive receptors to substantial pollution concentrations

The primary construction-related TACs expected from the project are diesel PM from on-road haul trucks and off-road equipment exhaust emissions. Due to the variable nature of construction activity, diesel PM and TAC emissions are temporary given the short amount of time that equipment is typically within a specific distance and could expose sensitive receptors to substantial concentrations of TACs. Also, concentrations of mobile-source diesel PM emissions diminish rapidly with distance, typically being reduced by 70 percent at a distance of 500 feet (ARB 2005). Furthermore, current models and methodologies for conducting health risk assessments are associated with longer-term exposure periods of 9 to 70 years, which do not correlate well with the temporary and highly variable nature of construction activities. Finally, the contractor will further reduce diesel PM exhaust emissions using AMMs (AMM-AIR-2: Limit Idling Time, AMM-AIR-5: Cleaner Construction Equipment, and AMM-AIR-6: Use Electrical Power where Possible).

For these reasons, impacts from TACs would be less than significant.

Impact AIR-3: Conflict with or obstruct implementation of the applicable air quality plan

A project would be inconsistent with an air quality plan if it would result in population and/or employment growth that exceed growth estimates included in the plan, which would generate emissions not accounted for. As the project would not result in population or employment growth there would be no conflict with, or obstruction of, air quality plans.

The project would have a less-than-significant impact on air quality plans.

Impact AIR-4: Create objectionable odors affecting a substantial number of people

The project would generate odors associated with diesel exhaust and other construction-related sources. The contractor will limit idle time for diesel-powered equipment which will minimize construction-related odors (AMM-AIR-2, AMM-AIR-5, and AMM-AIR-6). Odors would be temporary and localized given the short amount of time that equipment is typically within a specific distance from receptors. The Alviso Marina County Park is about 50 feet from the southwest corner of the construction area, the EEC is about 200 feet, and homes along Elizabeth Street in Alviso are about 500 feet from the nearest construction activities. Given these distances, and the short-term nature of potential odors to be generated this impact is considered less than significant.

Impacts from construction-related odors would be less than significant.

Impact AIR-5: Conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases

The BAAQMD does not have a significance threshold for GHG emissions from construction projects, although it does request that these emissions be quantified and disclosed. The bulk of GHG emissions are in the form of CO_2, which was estimated using the CalEEMod. GHG emissions are estimated to be a maximum of 90,137 lb/day (pounds per day) for the levee and Pond A12 transitional habitat construction phase. BMPs identified by the BAAQMD to reduce GHG emissions during construction include using alternatively fueled construction equipment for at least 15-percent of the fleet, using local building materials for at least 10-percent of the total, and recycling or reusing at least 50-percent of construction waste or demolition materials (BAAQMD 2010) (AMM-AIR-4: Greenhouse Gas BMPs). These and other applicable BMPs will be incorporated into project construction as appropriate.

Construction impacts from greenhouse gas emissions would be less than significant.

Summary

The construction-related impacts of Alternative 2 include significant impacts associated with emissions of ROG and NO_x from construction equipment. Other construction-related impacts from other criteria pollutants, greenhouse gas emissions, TACs, and odors would be less than significant.

Alternative 3

Alternative 3 would be the same as Alternative 2 except that the FRM levee would be constructed 1.7 feet higher and 10.2 feet wider, and the transitional habitat would be a 30:1 ecotone rather than a bench (also larger in size than the bench transitional habitat). Alternative 3 construction would be on the same schedule and would use the same types of equipment. The following paragraphs describe the potential impacts associated with short-term increases in criteria pollutants, greenhouse gas emissions, toxic air contaminants, odors, and conflicts with air quality plans from construction activities associated with Alternative 3.

Impact AIR-1: Violate any air quality standard or contribute substantially to an existing or projected air quality violation

Construction of Alternative 3 would result in a temporary increase in emissions of ROG, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, and CO_2. Construction emissions were quantified using CalEEMod and are presented in Table 4.10-9 *Estimated Maximum Daily Construction Emissions for Alternative 3 (in pounds per day)* and Table 4.10-10 *Estimated Annual Construction Emissions for Alternative 3*.

Both ROG and NO_x would exceed BAAQMD emission thresholds for maximum pounds per day from the large amount of material to be moved and placed to form the new levees and transition habitat. The total annual emissions of NO_x and ROG (57.50 tons and 5.35 tons per year, respectively) are below USEPA's *de minimis* threshold for Federal actions in moderate ozone nonattainment areas of 100 tons per year.

Table 4.10-9. Estimated Maximum Daily Construction Emissions for Alternative 3 (in pounds per day)

Year/Measurement	ROG	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_2
2017	50	550	347	0.6	35	27	64,709
2018	64	690	464	0.9	45	33	94,267
2019	60	623	439	1.0	44	32	93,843
2023	14	91	147	0.3	11	6	27,371
2024	11	73	92	0.2	9	6	23,123
Peak Day	64	690	464	1.0	45	33	94,267
Significance Threshold	54	54	None	None	82*	54*	None
Significance	S	S	LTS	LTS	LTS	LTS	LTS

* Thresholds for PM_{10} and $PM_{2.5}$ are for emissions from exhaust from construction equipment. The emissions listed in the table combine particulate matter from construction exhaust and fugitive dust.

Table 4.10-10. Estimated Annual Construction Emissions for Alternative 3

Year	ROG	NO_x	CO	SO_2	Fugitive PM_{10}	Exhaust PM_{10}	PM_{10} Total	Fugitive $PM_{2.5}$	Exhaust $PM_{2.5}$	$PM_{2.5}$ Total	Bio-CO_2	NBio-CO_2	Total CO_2	CH_4	N_2O	CO_2e
Year	tons/yr										MT/yr					
2017	3.7828	41.8761	27.2318	0.0483	2.3841	1.6591	4.0431	1.2582	1.5263	2.7845			4,447.9565			4,475.1470
2018	5.3515	57.5046	39.7119	0.0780	5.0850	2.2172	7.3022	2.6893	2.0398	4.7291			7,064.9564			7,108.6440
2019	4.8690	47.6926	40.0151	0.0735	4.2866	1.8229	6.1095	2.2338	1.6771	3.9109			6,538.0812			6,577.3242
2023	1.1211	6.9167	13.6355	0.0217	1.1254	0.2363	1.3617	0.5473	0.2174	0.7648			1,869.3687			1,879.0047
2024	0.8372	5.6154	7.9152	0.0185	1.0356	0.2087	1.2443	0.5308	0.1920	0.7228			1,601.7416			1,611.4278
Total	15.9615	159.6054	128.5096	0.2399	13.9166	6.1442	20.0608	7.2594	5.6526	12.9121			21,522.1044			21,651.5477

As described for Alternative 2, fugitive-dust emissions are addressed in the dust-control measures described in Section 4.10.2.1 *Avoidance and Minimization Measures Incorporated into the Alternatives* (AMM-AIR-1: Dust-Control Measures, AMM-AIR-3: Prepare SWPPP). With the implementation of these measures, dust from construction would be less than significant.

Construction of the FRM levee and ecotone would result in significant emissions of NO_x and ROG. Mitigation measures are discussed below in Section 4.10.3 Mitigation Measures.

Impact AIR-2: Expose sensitive receptors to substantial pollution concentrations

TAC impacts would be similar to those from Alternative 2 and would be less than significant. Implementation of the AMMs and mitigation measures listed in Section 4.10.2.1 *Avoidance and Minimization Measures Incorporated into the Alternatives* would further reduce diesel PM exhaust emissions.

Impacts from TACs would be less than significant.

Impact AIR-3: Conflict with or obstruct implementation of the applicable air quality plan

A project would be inconsistent with an air quality plan if it would result in population and/or employment growth that exceed growth estimates included in the plan, which would generate emissions not accounted for. As the project would not result in population or employment growth there would be no conflict with, or obstruction of, air quality plans.

The project would have a less-than-significant impact on air quality plans.

Impact AIR-4: Create objectionable odors affecting a substantial number of people

The project would generate odors associated with diesel exhaust and other construction-related sources. The contractor will limit idle time for diesel-powered equipment which will minimize construction-related odors (AMM-AIR-2, AMM-AIR-5, and AMM-AIR-6). Odors would be temporary and localized given the short amount of time that equipment is typically within a specific distance from receptors. The Alviso Marina County Park is about 50 feet from the southwest corner of the construction area, the EEC is about 200 feet, and homes along Elizabeth Street in Alviso are about 500 feet from the nearest construction activities. Given these distances, and the short-term nature of potential odors to be generated, this impact is considered less than significant.

Impacts from construction-related odors would be less than significant.

Impact AIR-5: Conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases

As described for Alternative 2, the bulk of GHG emissions are in the form of CO_2, which was estimated using CalEEMod. GHG emissions are estimated to be a maximum of 94,267lb/day for the levee and Pond A12 transitional habitat construction phase. BMPs identified by the BAAQMD to reduce GHG emissions during construction include using alternatively fueled construction equipment for at least 15-percent of the fleet, using local building materials for at least 10 percent of the total, and recycling or reusing at least 50 percent of construction waste or demolition materials (BAAQMD 2010). These and other applicable BMPs will be incorporated into project construction as appropriate.

Construction impacts from greenhouse gas emissions would be less than significant.

Summary

The construction-related impacts of Alternative 3 significant impacts associated with emissions of ROG and NO_x from construction equipment. Mitigation measures to reduce this impact are included in Section 4.10.3*Mitigation Measures*. Other construction-related impacts from other criteria pollutants, greenhouse gas emissions, TACs, and odors would be less than significant.

Alternative 4

Alternative 4 includes building the same WPCP levee section that is included in the Alternatives 2 and 3 with an Alviso levee section along a different alignment (the Alviso Railroad alignment). This would be a 15.2-foot NAVD 88 levee. The Ponds A12/A13 and A18 transitional habitats would be bench-type, as for Alternative 2. The construction equipment and schedules would be the same as for Alternative 2. The following paragraphs describe the potential impacts associated with short-term increases in criteria pollutants, greenhouse gas emissions, toxic air contaminants, odors, and conflicts with air quality plans from construction activities associated with Alternative 4.

Impact AIR-1: Violate any air quality standard or contribute substantially to an existing or projected air quality violation

Construction of Alternative 4 would result in a temporary increase in emissions of ROG, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, and CO_2 similar to Alternative 2 [see Table 4.10-7 *Estimated Maximum Daily Construction Emissions for Alternative 2 (in pounds per day)*]. Both ROG and NO_x would exceed emission thresholds for maximum pounds per day from the large amount of material to be moved and placed to form the new levees and transition habitat.

Fugitive-dust emissions are addressed in the dust-control measures described in *Avoidance and Minimization Measures*. With the implementation of these measures, dust from construction would be less than significant.

Construction of the FRM levee and ecotone would result in significant emissions of NO_x and ROG. Mitigation measures are discussed below in Section 4.10.3 Mitigation Measures.

Impact AIR-2: Expose sensitive receptors to substantial pollution concentrations

TAC impacts would be similar to those from Alternative 2, although the levee alignment would be closer to the EEC and residences in Alviso. Due to the variable nature of construction activity, diesel PM and TAC emissions are temporary given the short amount of time that equipment is typically within a specific distance and could expose sensitive receptors to substantial concentrations of TACs. Also, concentrations of mobile-source diesel PM emissions diminish rapidly with distance, typically being reduced by 70 percent at a distance of 500 feet (ARB 2005). Furthermore, current models and methodologies for conducting health risk assessments are associated with longer-term exposure periods of 9 to 70 years, which do not correlate well with the temporary and highly variable nature of construction activities. For these reasons, impacts from TACs would be less than significant. Implementation of the AMMs would further reduce diesel PM exhaust emissions.

Impacts from TACs would be less than significant.

Impact AIR-3: Conflict with or obstruct implementation of the applicable air quality plan

A project would be inconsistent with an air quality plan if it would result in population and/or employment growth that exceed growth estimates included in the plan, which would generate emissions not accounted for. As the project would not result in population or employment growth there would be no conflict with, or obstruction of, air quality plans.

Construction of Alternative 4 would have a less-than-significant impact on air quality plans.

Impact AIR-4: Create objectionable odors affecting a substantial number of people

The project would generate odors associated with diesel exhaust and other construction-related sources. Odors would be temporary and localized given the short amount of time that equipment is typically within a specific distance from receptors. The Alviso Marina County Park is about 50 feet from the southwest corner of the construction area, the EEC is about 50 feet and homes along Elizabeth Street in Alviso are about 500 feet from the nearest construction activities. Given these distances and the short-term nature of potential odors to be generated, this impact is considered less than significant.

Impacts from construction-related odors would be less than significant

Impact AIR-5: Conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases

GHG emissions were estimated for alternative 2 using CalEEMod, which would be similar to emissions for alternative 4. GHG emissions are estimated to be a maximum of 90,137 lb/day for the levee and Pond A12 transitional habitat construction phase a. BMPs identified by the BAAQMD to reduce GHG emissions during construction include using alternatively fueled construction equipment for at least 15-percent of the fleet, using local building materials for at least 10-percent of the total, and recycling or reusing at least 50-percent of construction waste or demolition materials (BAAQMD 2010). These and other applicable BMPs will be incorporated into project construction as appropriate.

Construction impacts from greenhouse gas emissions would be less than significant.

Summary

The construction-related impacts of Alternative 4 include significant impacts associated with emissions of ROG and NO_x from construction equipment. Mitigation measures to reduce this impact are included in Section 4.10.3 *Mitigation Measures*. Other construction-related impacts from other criteria pollutants, greenhouse gas emissions, TACs, and odors would be less than significant.

Alternative 5

Alternative 5 includes building the same WPCP levee section that is included in the other alternatives with an Alviso levee section along a different alignment (the Alviso South alignment). The levee would be a 15.2-foot NAVD 88 levee. The Ponds A12/A13 and A18 transitional habitats would be bench-type, as for Alternative 2. The construction equipment and schedules would be the same as for Alternative 2.The following paragraphs describe the potential impacts associated with short-term increases in criteria pollutants, greenhouse gas emissions, toxic air contaminants, odors, and conflicts with air quality plans from construction activities associated with Alternative 5.

Impact AIR-1: Violate any air quality standard or contribute substantially to an existing or projected air quality violation

Construction of Alternative 5 would result in a temporary increase in emissions of ROG, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, and CO_2 similar to Alternative 2 [see Table 4.10-7 *Estimated Maximum Daily Construction Emissions for Alternative 2 (in pounds per day)*], although emissions may be somewhat greater given an increase in linear feet of levee to construct. Both ROG and NO_x would exceed emission thresholds for maximum pounds per day from the large amount of material to be moved and placed to form the new levees and transition habitat.

Fugitive-dust emissions are addressed in the dust-control measures described in *Avoidance and Minimization Measures*. With the implementation of these measures, dust from construction would be less than significant.

Construction of the FRM levee and ecotone would result in significant emissions of NO_x and ROG. Mitigation measures are discussed below in Section 4.10.3 Mitigation Measures.

Impact AIR-2: Expose sensitive receptors to substantial pollution concentrations

TAC impacts would be similar to those from Alternative 2, although the levee alignment would be closer to the EEC and residences in Alviso. Due to the variable nature of construction activity, diesel PM and TAC emissions are temporary given the short amount of time that equipment is typically within a specific distance and could expose sensitive receptors to substantial concentrations of TACs. Also, concentrations of mobile-source diesel PM emissions diminish rapidly with distance, typically being reduced by 70 percent at a distance of 500 feet (ARB 2005). Furthermore, current models and methodologies for conducting health risk assessments are associated with longer-term exposure periods of 9 to 70 years, which do not correlate well with the temporary and highly variable nature of construction activities. For these reasons, impacts from TACs would be less than significant. Implementation of the AMMs would further reduce diesel PM exhaust emissions.

Impacts from TACs would be less than significant.

Impact AIR-3: Conflict with or obstruct implementation of the applicable air quality plan

A project would be inconsistent with an air quality plan if it would result in population and/or employment growth that exceed growth estimates included in the plan, which would generate emissions not accounted for. As the project would not result in population or employment growth there would be no conflict with, or obstruction of, air quality plans.

Construction of Alternative 5 would have a less-than-significant impact on air quality plans.

Impact AIR-4: Create objectionable odors affecting a substantial number of people

The project would generate odors associated with diesel exhaust and other construction-related sources. Odors would be temporary and localized given the short amount of time that equipment is typically within a specific distance from receptors. The Alviso Marina County Park is about 50 feet from the southwest corner of the construction area, the EEC is about 50 feet and properties along Spreckles Avenue in Alviso are about 70 feet from the nearest construction activities. Given these distances and the short-term nature of potential odors to be generated, this impact is considered less than significant.

Impacts from construction-related odors would be less than significant

Impact AIR-5: Conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases

GHG emissions were estimated for alternative 2 using CalEEMod, which would be similar to emissions for alternative 5. GHG emissions are estimated to be a maximum of 90,137 lb/day for the levee and Pond A12 transitional habitat construction phase and 4,024 lb/day for the Pond A18 transitional habitat construction. BMPs identified by the BAAQMD to reduce GHG emissions during construction include using alternatively fueled construction equipment for at least 15 percent of the fleet, using local building materials for at least 10 percent of the total, and recycling or reusing at least 50-percent of construction waste or demolition materials (BAAQMD 2010). These and other applicable BMPs will be incorporated into project construction as appropriate.

Construction impacts from greenhouse gas emissions would be less than significant

Summary

The construction-related impacts of Alternative 5 include significant impacts associated with emissions of ROG and NO_x from construction equipment. Other construction-related impacts from other criteria pollutants, greenhouse gas emissions, TACs, and odors would be less than significant.

4.10.2.3.2.2 Operations and Maintenance Effects

Operation of any of the action alternatives may involve infrequent or intermittent use of electric pumps, resulting in only minimal daily and annual emissions; this is consistent with existing operational and maintenance conditions. Long-term operation and maintenance emissions of ROG, NO_x, PM_{10}, $PM_{2.5}$, CO, and GHG would be similar to the existing condition.

Operations and maintenance effects would be less than significant in the emissions of criteria pollutants, greenhouse gasses, and TAC, and would not generate odors or be inconsistent with air quality plans.

4.10.2.3.2.3 Comparison of Action Alternatives

Each of the action alternatives would result in significant emissions of ROG and NO_x. All action alternatives would be required to implement the same list of construction mitigation measures.

Operation and maintenance emissions would be similar for each action alternative and would be less than significant.

4.10.3 Mitigation Measures

The following mitigation measures are needed to reduce ROG and NO_x emissions from construction equipment:

- **M-AIR-1a** – Prior to the start of construction, the contractor shall develop a plan demonstrating that the off-road equipment (more than 50 horsepower) to be used in the construction project (i.e., owned, leased, and subcontractor vehicles) would achieve a project-wide fleet average of 20 percent NO_x reduction and 45 percent PM reduction compared to the most recent ARB fleet average. Acceptable options for reducing emissions include the use of late-model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as such become available.

- **M-AIR-1b:** The contractor will require that all construction equipment, diesel trucks, and generators be equipped with BACT for emission reductions of NO_x and PM and that all equipment meets the ARB's most recent certification standard for off-road heavy-duty diesel engines

Implementing these mitigation measures would reduce construction-related air quality impacts, but not to a less-than-significant level. The measures would reduce diesel exhaust emissions by about 15 to 20 percent overall compared to uncontrolled emissions; however, based on the modeling results shown in Table 4.10-7 *Estimated Maximum Daily Construction Emissions for Alternative 2 (in pounds per day)* and Table 4.10-8 *Estimated Maximum Daily Construction Emissions for Alternative 3*, these practices and measures would not be able to reduce peak daily ROG and NO_x emissions below 54 pounds per day. The impact would remain significant.

4.10.3.1 Residual Impacts and Additional Measures Necessary to Mitigate Significant Impacts

Construction-related emissions of criteria pollutants would be significant even with the implementation of mitigation. There are no other measures available to further reduce construction emissions. Notwithstanding significance, these emissions would be temporary and permanently cease upon completion of construction.

4.10.4 Cumulative Effects

For all air quality pollutants, construction and operation and maintenance of the action alternatives would result in short-term air quality impacts that would be avoided or minimized by application of standard BMPs and the mitigation measures described in Section 4.10.3 *Mitigation Measures*. These impacts would be limited in duration and spatially distributed throughout the study area. These impacts would also take place over a number of years and thus are not expected to cause a cumulative adverse air quality condition. Regionally, emissions will probably be reduced over time as technology continues to improve emissions controls.

4.10.5 Summary

Table 4.10-11 *Air Quality NEPA Impact Conclusions* summarizes the project effects under the NEPA.

Table 4.10-11. Air Quality NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
AIR-1: Violate any air quality standard or contribute substantially to an existing or projected air quality violation	Negative	Major	Short term	Possible	Local
AIR-2: Expose sensitive receptors to substantial pollution concentrations	Negative	Minor	Short term	Possible	Limited
AIR-3: Conflict with or obstruct implementation of the applicable air quality plan	Negative	Minor	Short term	Unlikely	Limited
AIR-4: Create objectionable odors affecting a substantial number of people	Negative	Minor	Short term	Possible	Limited
AIR-5: Conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases	Negative	Minor	Short term	Possible	Local

Table 4.10-12 *Air Quality CEQA Impact Conclusions* summarizes the project effects under the CEQA.

Table 4.10-12. Air Quality CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
AIR-1: Violate any air quality standard or contribute substantially to an existing or projected air quality violation	AMM-AIR-1: Dust-Control Measures AMM-AIR-2: Limit Idling Time AMM-AIR-3: Prepared SWPPP AMM-AIR-5: Cleaner Construction Equipment AMM-AIR-6: Use Electrical Power Where Possible	S	M-AIR-1a M-AIR-1b	S
AIR-2: Expose sensitive receptors to substantial pollution concentrations	AMM-AIR-2: Limit Idling Time AMM-AIR-5: Cleaner Construction Equipment AMM-AIR-6: Use Electrical Power Where Possible	LTS	None	LTS
AIR-3: Conflict with or obstruct implementation of the applicable air quality plan		LTS	None	LTS
AIR-4: Create objectionable odors affecting a substantial number of people	AMM-AIR-2: Limit Idling Time AMM-AIR-5: Cleaner Construction Equipment AMM-AIR-6: Use Electrical Power Where Possible	LTS	None	LTS
AIR-5: Conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases	AMM-AIR-4: Greenhouse Gas BMPs	LTS	None	LTS

LTS = less than significant
S = significant

4.11 Recreation

This section discusses the impacts of the Shoreline Phase I Project on recreation facilities.

4.11.1 Affected Environment

The following sections discuss the environmental and regulatory setting for recreation in the Shoreline Phase I Study Area.

4.11.1.1 Regulatory Setting

This section presents a summary of plans, policies, and regulations relevant to the recreational facilities in the study area. The study area is governed by the applicable codes, regulations, plans, and policies of the USFWS, the San Francisco Bay Conservation and Development Commission (BCDC), Santa Clara County, and the City of San José. These agencies own land, manage facilities or resources, or have regulatory jurisdiction over land and/or resources in the study area.

4.11.1.1.1 Federal Plans and Regulations

Most of the study area is located within the Refuge, which is owned by the Federal government, managed by the USFWS, and governed by laws, executive orders, and directives that guide public use and recreation on National Wildlife Refuges. These orders and directives cover a range of topics, including administration, management, planning, special areas, and public use (e.g., fees, concessions, visitor protection, waterfowl hunting, fishing, trails, trapping, off-road vehicles, and motor boats). The following paragraphs summarize the Federal plans and regulations that guide recreational use of Federally owned and managed land.

4.11.1.1.1.1 The National Wildlife Refuge System Administration Act of 1966

The National Wildlife Refuge System (NWRS) Administration Act of 1966 [16 USC 668dd–668ee, as amended] is administered by the USFWS and provides guidelines and directives for administration and management of “wildlife refuges, areas for the protection and conservation of fish and wildlife that are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, or waterfowl production areas.” The Secretary of the Interior may open refuge areas to any use, including waterfowl hunting and/or fishing, on a determination that such uses are compatible with the purposes of the refuge and in accordance with provisions of other applicable laws.

4.11.1.1.1.1 The Administration Act and Refuge Recreation Act (Recreation Act) of 1962

The Administration Act and Refuge Recreation Act (Recreation Act) of 1962 (16 USC 460k–460k-4) governs the administration and public use of the NWRS. The Recreation Act authorizes the Secretary to administer areas within the NWRS for public recreation as an appropriate incidental or secondary use only to the extent that doing so is practicable and consistent with the primary purpose(s) for which Congress and the USFWS established the areas. The Recreation Act also authorizes the Secretary to issue regulations to carry out the purposes of the Acts and regulate uses.

4.11.1.1.1.2 The National Wildlife Refuge System Improvement Act (Improvement Act) of 1997

The National Wildlife Refuge System Improvement Act (Improvement Act) of 1997 (PL 105-57) serves to ensure that the USFWS effectively manages the NWRS as a national network of land, waters, and interests for the protection and conservation of the Nation's wildlife resources. The Improvement Act deems wildlife-dependent recreation, when compatible, to be a legitimate and appropriate public use of the NWRS through which the American public can develop an appreciation for fish and wildlife. The Improvement Act established six wildlife-dependent recreational uses: hunting, fishing, wildlife observation, photography, environmental education, and interpretation.

4.11.1.1.2 State and Regional Plans and Regulations

4.11.1.1.2.1 The McAteer-Petris Act

The McAteer-Petris Act (California Government Code 66600–66682) is the key legal provision under California State law that preserves San Francisco Bay from indiscriminate filling. Under this act, the BCDC, which is a regional agency, is charged by the State to prepare a plan (the San Francisco Bay Plan) for the long-term use of the bay and increased access to shoreline and waters.

Under the McAteer-Petris Act, the BCDC requires locations for water-oriented land uses and increased public access to shoreline and waters and encourages the provision of maximum feasible public access to the bay and its shoreline, as long as such access is compatible with wildlife protection. Similarly, the San Francisco Bay Plan contains policies that encourage the development of waterfront recreation facilities and linkages between existing shoreline parks and requires the provision of these opportunities in relationship to sensitive biological species, habitats, and future restoration of managed ponds.

The BCDC amended the managed pond section of the San Francisco Bay Plan on August 18, 2005. The amendment focuses on the significance of managed ponds to bay wildlife, on the opportunity for managed ponds to be restored to tidal action, and on the need to maximize public access and recreational opportunities while avoiding significant adverse effects on wildlife. Policy 5 of the amendment addresses the need for comprehensive planning of any development proposal in a managed pond that (1) integrates regional and local habitat restoration and management objectives and plans and (2) provides opportunities for collaboration among different stakeholders (e.g., agencies, landowners, other private interests, and the public). Relevant to recreation resources is the need to incorporate provisions for public access and recreational opportunities appropriate to the land's use, size, and existing future habitat values in the planning process.

4.11.1.1.2.2 BCDC Permit Overview

The Federal Coastal Zone Management Act of 1972, as amended, is a voluntary law enacted to encourage coastal states and territories to develop and implement programs to manage the nation's coastal resources. The BCDC was one of the first agencies to participate in the Federal program. In February 1977, the U.S. Department of Commerce approved the BCDC’s coastal management program for the San Francisco Bay segment of the California coastal zone. The BCDC has regulatory responsibility over development in San Francisco Bay and along the bay’s nine-county shoreline (i.e., the coastal zone). Within the BCDC’s areas of concern, the coastal zone consists of all areas located within the BCDC's permit jurisdiction except those lands that the Federal government owns, leases, holds in trust, or over which the Federal government has sole discretion (BCDC 2014). The BCDC is guided in its decisions by its law, the McAteer-Petris Act, the San Francisco Bay Plan, and other plans for specific areas around the bay. The BCDC would have permitting authority over those aspects of public access and recreation facilities that would require use of non-Federal lands. For example, a BCDC permit would be required for all filling, all dredging, and any substantial change in use or development activities on the Wastewater Facility property.

Federal agencies are generally required to carry out their activities and programs in a manner “consistent” with the BCDC’s coastal management program. To implement this provision, Federal agencies make “consistency determinations” on their proposed activities, and applicants for federal permits, licenses, other authorization, or federal financial assistance make “consistency certifications.” The BCDC then has the opportunity to review the consistency determinations and certifications and to either concur with them or object to them. The BCDC’s decisions on Federal consistency matters are governed by the provisions of the Coastal Zone Management Act and the Department of Commerce regulations. Typical BCDC permit conditions include provision of public access to the bay and other improvements; requirements for the construction, installation, use, and maintenance of public access areas; plan review requirements that must be met before construction can begin; and mitigation requirements to offset adverse environmental impacts of the project.

4.11.1.1.2.3 The Bay Trail

A local nonprofit organization, the San Francisco Bay Trail Project (www.baytrail.org), has developed a plan for a shared-use bicycle and pedestrian path that will allow continuous travel around San Francisco Bay. Currently, 340 miles of trail have been completed; eventually, the Bay Trail will extend for 500 miles to link the shoreline of nine counties, passing through 47 cities and crossing seven toll bridges. For the South Bay specifically, some of the Bay Trail Project’s goals include developing a continuous Bay Trail alignment, thereby eliminating the gaps in the network between Alviso and Milpitas; creating new opportunities for shoreline access where it does not yet exist; creating spur and loop trails where feasible to enable the public to see the wetlands and learn about the restoration; removing the currently proposed Bay Trail alignment off of busy streets; including opportunities for interpretation, education, resting, and viewing enjoyment; and developing new rights-of-way for separated paths to provide opportunities for the greatest range of trail usage (e.g.; bike path separate from pedestrian path; Thompson pers. comm. 2012).

4.11.1.1.3 Santa Clara County and City of San José

Santa Clara County and the City of San José have identified goals and policies in their general plans that guide development within their jurisdictions.

4.11.1.1.3.1 Santa Clara County

The Santa Clara County General Plan 1995–2010 (adopted December 20, 1994) designates land uses for most of the study area as Other Public Open Lands (National Wildlife Refuge) and Baylands. Goals, objectives, and policies pertinent to recreational use of land within the study area are contained in the Resource Conservation Element section and the Land Use Element section of the General Plan (County of Santa Clara 1994) and are presented below.

- **Goal 3.1:** An adequate system of uncrowded regional parks and public open space lands that is readily accessible to county residents and workers. An extensive countywide network of recreational hiking, bicycling, and equestrian trails and pathways linking and providing access to these public lands.
- **Goal 4.1:** Healthy, well-functioning creek, streamside, bay, and bay wetlands ecosystems capable of providing:
  a. Stable wildlife habitat, corridors linking habitat areas, and protection for Endangered species;
  b. Passive recreational and interpretive nature study; and
  c. Aesthetic enhancement of urban and rural settings.
- **Policy C-RC 3:** Multiple uses of lands intended for open space and conservation shall be encouraged so long as the uses are consistent with the objectives of resource management, conservation, and preservation, particularly habitat areas.
- **Policy R-RC 30:** Land uses in areas adjacent to the Baylands should have no adverse impact on wetlands habitats or scenic qualities of the Baylands. Uses adjacent to the National Wildlife Refuge should be compatible with the Refuge.
- **Policy R-LU 5:** The edges of San Francisco Bay shall be preserved and restored as open space. Allowable uses shall include:
  - Bay waters and sloughs;
  - Marshes, wetlands, and wetlands restoration;
  - Salt extraction;
  - Wildlife habitat;
  - Open space preserves;
  - Small piers and walkways;
  - Wildlife observation; and
  - Recreational uses, such as walking, horseback riding, bicycling, fishing, boating, education, swimming, limited hunting, aquaculture, and marinas.

- **Policy R-LU 6:** There shall be no filling of wetlands except for very limited construction of small levees, piers, or walkways necessary for the public use or study of the baylands.
- **Objective R-PR 23:** The countywide trail system should be linked to provide regional trails including the Bay Area Ridge Trail, the Benito-Clara Trail, and the San Francisco Bay Trail systems encircling the urban areas of the county and San Francisco Bay.

In addition, the *Santa Clara County Countywide Trails Master Plan Update* ("Countywide Trails Master Plan") is also part of the County General Plan and is incorporated as part of the Parks and Recreation Element of the General Plan. The Countywide Trails Master Plan identifies three regional trail routes in the project area:

- The San Francisco Bay Trail (R4)
- The Guadalupe Trail (S3)
- The Coyote Creek Trail (S5)

4.11.1.1.3.2 City of San José

The Envision San José 2040 General Plan (City of San José 2011) describes 12 major strategies that guide the physical development of San José and the City's services over the life of the General Plan. An overview of the two major strategies that are potentially relevant to recreation within the study area is provided below.

- **Major Strategy 10 – Life Amidst Abundant Natural Resources**
  - Promote access to the natural environment.
  - Build a world-class trail network.
  - Reinforce the Greenline/Urban Growth Boundary as the limit of the city's urbanized area.
- **Major Strategy 11 – Design for a Healthful Community**
  - Support the physical health of community members by promoting walking and bicycling as commute and recreational options.
  - Encourage physical activity by creating "complete" communities where most individuals' daily needs can be met walking or bicycling on safe and convenient paths and routes.
  - Encourage activity by promoting good and convenient access to a large and diverse variety of parks, trails, and recreation facilities for all city residents.

The Envision San José 2040 General Plan also presents goals, policies, and implementation actions to provide high-level policy guidance on topics related to land use and municipal services. Goals, policies, and implementation actions that are relevant to recreational and educational resources within the study area include the following:

- Limit recreational uses in wildlife refuges, nature preserves, and wilderness areas in parks to those activities that have minimal impact on sensitive habitats.
- Work with the SCVWD to preserve water quality by establishing appropriate public access and recreational uses on land adjacent to rivers, creeks, wetlands, and other significant water courses.
- Where appropriate and feasible, develop parks and recreational facilities that are flexible and can adapt to the changing needs of their surrounding community.
- Develop an integrated parks system that connects new and existing large parks together through a network of interconnected trails and/or bike lanes or routes.
- Support recreation by linking park sites and connecting to regional trail systems.
- Support environmental protection by permitting stakeholders to access, enjoy, and protect open spaces and natural resources.
- Support use of innovative design practices, materials, and construction techniques to improve the development, operation, and safety of trails.
- Minimize environmental disturbance in the design, construction, and management of trails.
- Design trail system alignments to minimize impacts and enhance the environment within sensitive riparian and other natural areas.
- Follow Riparian Corridor Goals, Policies, and Actions regarding trail design and development in proximity to riparian areas. Design new trails and retrofit existing trails to provide a variety of trails that meet the needs of users of different abilities, such as commuters, families with children, or persons with disabilities.
- Design trails to comply with applicable local, State, and Federal master plans, design guidelines, environmental mitigation, laws, permits, or accepted standards, including Community Policing through Environmental Design principles that promote accessibility, functionality, safety, and enjoyment of trails.
- Recognize that increased use of trails promotes increased safety and security for trail users.

In 2002, San José's City Council adopted the San José Bay Trail master plan. Once built, the San José portion of the trail will be approximately 13 miles long and will follow the shore and some roads in Alviso (see Section 4.11.1.1.2.3 *The Bay Trail* for more information about the San Francisco Bay Trail Project).

The Wastewater Facility, which is owned and operated by the City of San José, manages its land in accordance with the following recreational objectives:

- Allow complementary recreational uses, including interconnected trails to the bay, environmental education, and regional recreational facilities that meet regional needs.
- Promote access to recreational, educational, and economic development uses by improving transportation connections through the Wastewater Facility land.

4.11.1.2 Physical Setting (CEQA Baseline)

This section describes the existing recreational and educational resources and access within the study area. The study area is a vital educational and recreational open space resource and includes miles of trails on the levees, the Alviso Marina County Park, and the Don Edwards Environmental Educational Center (EEC). The trail system in the area provides visual access to thousands of acres of marshes, managed ponds, mud flats, sloughs, freshwater creeks, and bay shallows. The area supports more than 250 species of resident and migratory birds and is a popular bird-watching destination. The San Francisco Bay Bird Observatory is headquartered in Alviso and conducts studies of birds within and around the study area. Much of the study area is part of the Refuge.

4.11.1.2.1 Trails

The study area includes ponds surrounded by levees and berms originally constructed as part of the former salt pond operation that support trails, all of which are open to cyclists and walkers. The accessible levee trails are dirt-surfaced. In order to protect ecologically sensitive areas and species, dogs and motorized vehicles are prohibited on all Refuge trails. The trails are primarily loop trails, as opposed to connector trails, and are not typically used as a means to get to other destinations.

This area contains approximately 21 miles of trails that are part of the larger regional Bay Trail.[3] The trails in this study area are of particular value because the study area is in and around the Refuge, the nation's first urban national wildlife refuge. The Refuge, created in 1974, was largely the result of grassroots efforts by the local community to protect the San Francisco Bay ecosystem. According to the Refuge Manager, approximately 150,000 people per year use the trails in the study area. The Refuge has a parking lot for several dozen vehicles as well as a visitor and environmental education center (the EEC). The trail and associated recreation features currently in the project area are shown on Figure 4.11-1 *Existing Project Recreational Trail System*.

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[3] According to www.baytrail.org, when complete, the Bay Trail will be a continuous 500-mile recreational corridor that will encircle the entire Bay Area, connecting communities to each other and to the bay. It will link the shorelines of all nine counties in the Bay Area and 47 of its cities. As of January 2015, baytrail.org indicates that 340 miles of the Bay Trail, almost 70 percent of its ultimate length, has been developed.

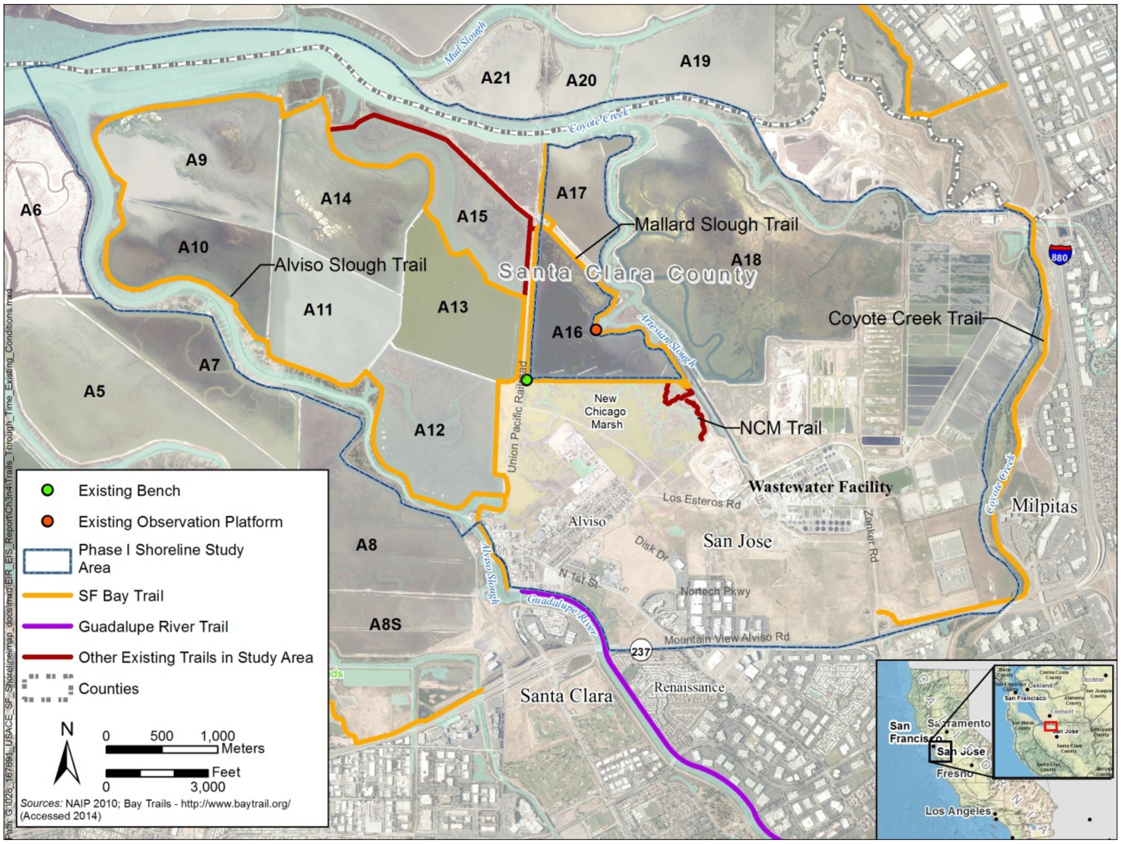

Figure 4.11-1. Existing Project Recreational Trail System

There are three main-trail loops in the Alviso area: The 9-mile Alviso Slough Loop Trail, the approximately 3-mile Mallard Slough Loop Trail, and the 0.5-mile New Chicago Marsh Trail (Figure 4.11-1 *Existing Project Recreational Trail System*). The Alviso Slough Trail Loop follows Alviso Slough to its junction with Coyote Creek and the bay. The Mallard Slough Trail, which is east of the Alviso Slough Trail, leads to the EEC. There is also a short (0.4-mile) out-and-back New Chicago Marsh View Trail, which goes south from the EEC. Of the three Refuge trails, the Mallard Slough and the New Chicago Marsh trails see more use than the Alviso Slough Trail Loop (Heroux, pers. comm., 2014). The trails in the study area during the past 5 years have very occasionally been closed due to large-scale construction activities. Rarely, additional short-term closures have occurred on a temporary basis on Refuge property by the USFWS to protect sensitive habitats and wildlife. Below is more user information for the Alviso Slough Loop and the NCM Trails; no additional use information is currently available for the Mallard Slough Loop Trail.

4.11.1.2.1.1 Alviso Slough Trail

The annual use estimate for the Alviso Slough Trail is 65,520 and was generated from actual use numbers collected during May 2014. The majority of use on this trail consists of adults and families seeking a self-directed experience (Heroux, pers. comm., 2014). For the short stretch that overlaps the Marina Loop Trail, the primary recreational uses appear to be exercise and enjoying nature (through observation and photography). For use of the longer trail, the primary user groups are birdwatchers and people viewing wildlife. The majority of these users do not complete the full 9-mile trail; however, they do go for longer out-and-back walks on this trail. Cyclists are the primary user group for the full loop trail. The primary activities include an exercise experience in nature and wildlife viewing. Visitor information is based on staff observation of visitors on the trail, not direct user responses.

4.11.1.2.1.2 New Chicago Marsh Trail

The annual use estimate for the NCM Trail is 8,200 visits, based on observations only. Preliminary results from the 2014 trail user survey indicate that the primary user groups for this trail are organized educational groups (approximately 66 percent) (Heroux, pers. comm., 2014). The trail is a significant resource for the environmental education program. Groups include first- through sixth-grade classes, homeschool and scout groups, and college classes. In addition to formalized educational groups, the general public uses the trail for wildlife viewing and photography. For the general public, the experience is a self-guided Refuge experience. However, to date, no surveys have been conducted on this user group. The educational group numbers are collected as part of the programming conducted at the EEC.

4.11.1.2.2 Don Edwards Environmental Education Center

The EEC, which is owned and operated by the USFWS, is located adjacent to Pond A16 and Artesian Slough and is surrounded by upland, marshes, and managed ponds. The building was designed as an educational center and contains two classrooms, an auditorium, and an enclosed observation tower. The parking area at the EEC, and its location next to the boardwalk and the Alviso Slough Loop Trail, make it ideal place to begin a hike or bike ride through the Alviso Pond complex. The EEC is reserved throughout the school year by school field trip groups and is generally open to the public from 10 AM until 5 PM on the weekends. The EEC also hosts weekend interpretive programs. Refuge naturalists and volunteers offer a wide variety of free guided programs and walks as well as other activities. Many of the interpretive programs are funded by the Santa Clara Valley Urban Runoff Pollution Prevention Program through a grant (the Watershed Watcher Program) to the San Francisco Bay Wildlife Society and by the Living Wetlands Program through a City of San José grant. These programs cover a wide range of topics such as bird watching, owl programs, habitat hikes, watershed programs, arts and crafts, night events, special events, and community service projects (USFWS 2013).

4.11.1.2.3 Alviso Marina County Park

Alviso Marina County Park is a 19-acre county park located immediately south of Pond A12 and adjacent to Alviso Slough (Figure 4.11-2 *Alviso* Marina and Marina County Park). The park is owned and operated by the Santa Clara County Department of Parks and Recreation. The eastern edge of the park is bordered by the Union Pacific Railroad track, which divides the park from the New Chicago Marsh. Aside from being used as a marina for launching boats, the park is used for bicycling, hiking, bird watching, and picnicking. Swimming and hunting are not allowed in the park. The park includes a boat ramp into Alviso Slough. Alviso Marina

County Park also serves as an important entry point for the Refuge both for water-based recreation and for the Alviso Slough Loop. Trails from the Marina also head south along the Alviso Slough Trail. This trail terminates at the railroad crossing. Once the Gold Street Bridge connection is completed, there will be a safe pedestrian crossing that would join the Alviso Slough Trail to the Guadalupe River Trail.

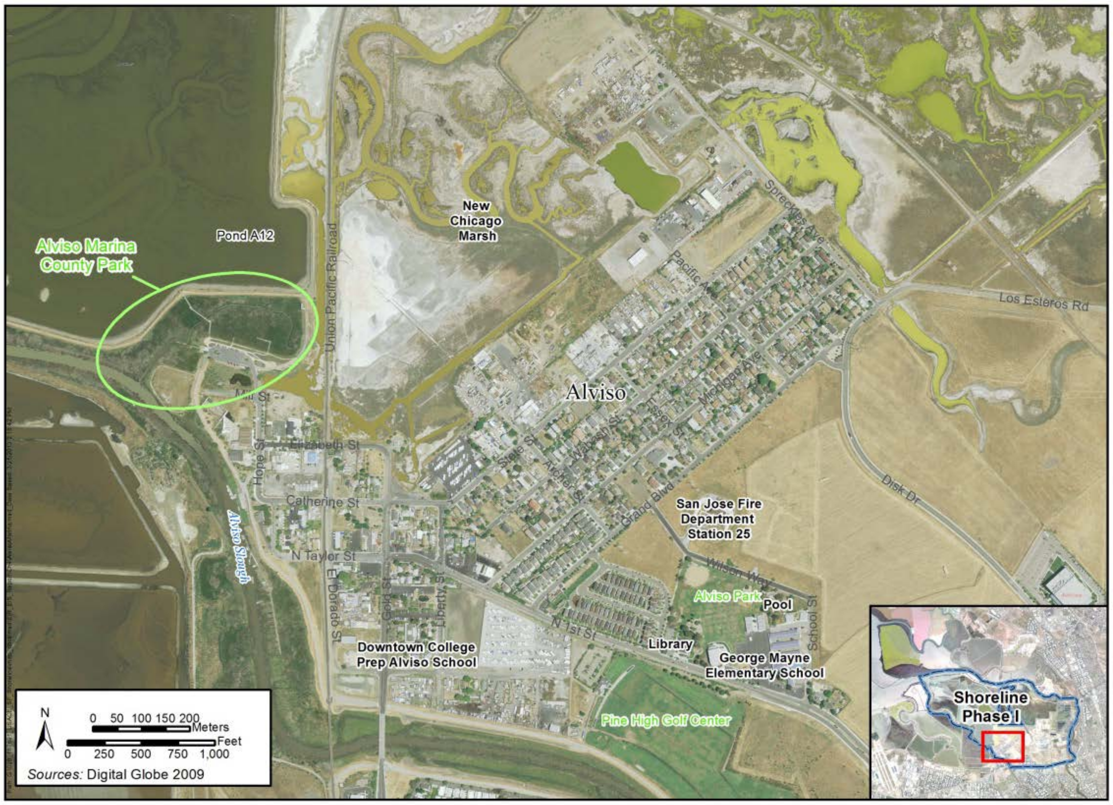

Figure 4.11-2. Alviso Marina and Marina County Park

4.11.1.2.4 Adjacent Trails

The Bay Trail/Coyote Creek Trail runs adjacent to Coyote Creek but does not currently directly connect with the Shoreline Phase I Study Area. Other trails leading to the Shoreline Phase I Study Area include the Guadalupe River Trail. The Guadalupe River Trail officially ends at the Gold Street Bridge. (This is also where the Guadalupe River changes its name and becomes Alviso Slough. This is why the trail downstream of here on the same river levee system is called the Alviso Slough Trail.)

The City of San José has plans for a safe pedestrian crossing under the railroad tracks that would seamlessly connect the Guadalupe River Trail with the Alviso Slough Trail, but this railroad crossing is currently not funded. Western segments of the Bay Trail currently end at Pond A8, outside the project area. A connection through Pond A8 is planned but is not currently funded. In addition to these trails, a network of street bike lanes provides bicycle connections between Coyote Creek and the Guadalupe River outside the project area south of SR 237.

4.11.1.2.5 Dispersed Recreation

Dispersed recreational activities that occur in the study area include wildlife watching, fishing, hunting, boating, educational opportunities, and hiking/cycling trail use. Refuge regulations specifically prohibit some types of recreational activities, including swimming, camping, barbecuing, and kite-flying. The following paragraphs describe the most popular dispersed recreational activities in the study area.

4.11.1.2.5.1 Fishing

Fishing is permitted by boat in the bay and its tributaries but not in managed ponds or small slough channels, subject to California State Fishing Regulations. There are no fishing amenities (piers, stocked streams or reservoirs, etc.) in the study area, so people who fish in Alviso Slough or the adjacent bay waters must access the areas by boat.

4.11.1.2.5.2 Hunting

The broader Refuge contains 10,285 acres of tidal areas and managed ponds that are open to waterfowl hunting every October through January. Waterfowl hunting season opening and closing dates are determined by the State of California and may vary from season to season. Hunting is not allowed in Ponds A-9 through A15.

4.11.1.2.5.3 Boating

Boating is permitted on the bay and its tributaries but not in managed ponds. Motorized boats and jet skis are prohibited in the Refuge to avoid noise-related impacts on wildlife. Canoes without motors, kayaks, and other small rowboats are allowed throughout the study area.

4.11.1.2.5.4 Environmental Education and Interpretation

The Refuge offers numerous opportunities and resources for educational groups free of charge. Resources include teacher orientations, field trips, local library presentations, and summer camps. Thousands of youth visit every year to learn about wildlife, habitat, or ecological processes.

Refuge naturalists and volunteers offer a wide variety of free guided programs and walks at both Refuge headquarters in Fremont and at the EEC in Alviso. Many interpretive programs in Alviso are funded by the Santa Clara Valley Urban Runoff Pollution Prevention Program through a grant (the Watershed Watcher Program) to the San Francisco Bay Wildlife Society These programs cover a wide range of topics such as bird watching, owl programs, habitat hikes, watershed programs, arts and crafts, night events, special events, and community service projects.

4.11.1.2.5.5 Hiking and Biking Trails

The Refuge contains more than 30 miles of hiking trails (see Section 4.11.1.2.1 *Trails*), many of which accommodate bicycles. All motor vehicles are prohibited on Refuge trails. Within the study area, there are 10.5 miles of hiking and bicycling trails.

4.11.1.3 National Environmental Policy Act and Engineer Regulation 1105-2-100: *Planning Guidance Notebook* Baseline Condition

For recreation, the NEPA and the Planning Guidance Notebook baseline condition is determined by projecting how the resource condition might change between the current condition discussed in Section 4.11.1 *Affected Environment* and the start of construction. There are no other projects anticipated for construction in the study area from 2014 through 2018, so recreational opportunities in the Shoreline Phase I Study Area are anticipated to remain constant. Therefore, the baseline condition is not expected to be different. The analysis contained in Section 4.11.2 *Environmental Consequences* assumes that the NEPA and the Planning Guidance Notebook baseline condition is the same as the physical setting described in Section 4.11.1.2 *Physical Setting (CEQA Baseline)*.

4.11.2 Environmental Consequences

4.11.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

Avoidance and minimization measures are those parameters that have been built into the design of the project and are committed to as part of project implementation. These measures are generally included in the alternatives description of this report (Section 3.8 *Action Alternatives Component Details*), but, where appropriate, the specific measures related to the impact evaluations are also summarized in the resource chapters.

The following AMMs would be implemented as part of the project design and would avoid or minimize adverse effects:

- **AMM-REC-1: Incorporate Existing Trails** – Incorporation of existing trail segments into a levee, either by including a crossing of the levee or by providing Americans with Disabilities Act-compliant access to pedestrians along portions of the levee alignment.
- **AMM-REC-2: Landscape Displays** – Interpretive displays will be incorporated into the landscape (i.e., former viewshed blocked by the levee) to explain the restoration project efforts and the impacts and development of the project in phases.
- **AMM-REC-3: Bay Trail Connection** – An enhancement to connect the Bay Trail spine between Milpitas and Alviso (just north of SR 237) has been incorporated into the design at 100% non-Federal cost to meet a goal of the Bay Trail Board. This segment of trail could be used by commuters and provide regional trail connectivity. Paving this segment for non-motorized multiple uses would encourage bicycle commuters to use the Bay Trail instead of the new unpaved levee maintenance trail.

4.11.2.2 Methodology for Impact Analysis and Significance Thresholds

An alternative is considered to have a significant effect on recreational resources if it would:

- **Impact REC-1:** Limit or impede existing recreational uses in the project area such as trails, access to the bay, and environmental education
- **Impact REC-2:** Increase the use of existing neighborhood and regional parks or other recreation facilities such that substantial physical deterioration of the facility would occur or be accelerated.
- **Impact REC-3:** Require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment.

4.11.2.3 Alternatives Evaluation

This section evaluates the impacts on recreation facilities and trails from the alternatives, as further described below.

4.11.2.3.1 No Action Alternative

With the No Action Alternative, the existing recreational features in and recreational uses of the study area would continue to function as they do currently. Some regional trail system improvements, such as a planned bikeway along SR 237, might provide new connections to the study area trail network if other proponents provide funding and design. The No Action Alternative would avoid short- and long-term impacts to recreation that might be associated with constructing, maintaining, and operating elements of the action alternatives. The existing recreational facilities would be maintained as they are currently. The Alviso Marina would continue to operate. Ongoing management of the Refuge might cause some short-term trail closures, but the long-term condition would be similar to the existing condition, and pond dikes would continue to be maintained and would provide recreation amenities in the form of trails.

In the very long term, SLC could adversely affect trails, the Alviso Marina, and use of the Refuge as once-dry land becomes inundated and is no longer accessible by foot.

4.11.2.3.2 Action Alternatives

This section describes the recreation impacts of each action alternative. Some project elements are the same for each action alternative and these elements are discussed one time. A comparison of the action alternatives is provided after the analysis section.

Impact REC-1: Limit or impede existing recreational uses in the project area such as trails, access to the bay, and environmental education

4.11.2.3.2.1 Construction Effects

FRM Levee Construction Impacts

During construction, the USACE would coordinate with the USFWS on signs and detours to safeguard recreationists during construction and maintain access to unaffected areas.

The following sections describe the effects of constructing the FRM levee.

Alternatives 2 and 3

As described in Section 3.8 *Action Alternatives Component Details*, Alternatives 2 and 3 would construct a FRM levee between the Wastewater Facility and Pond A18 (WPCP South levee section) and between Pond A16 and the NCM (Alviso North levee section).

Figure 3.5.1 *Potential Alviso Segment Levee Alignments* in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* shows the Alviso levee alignments. The Alviso North levee section of the Alternatives 2 and 3 FRM levee would establish a new 1.7-mile segment along the top of the FRM levee in the form of a levee maintenance road. The new route would connect to existing trails near the EEC and to trails that use former salt pond dikes and berms throughout the pond area. The new route would also provide a connection to the Alviso Marina area. Alternatives 2 and 3 would connect to a new bridge over the Artesian Slough near the southeast corner of Pond A16 and would have a bridge crossing the Union Pacific Railroad tracks near the northeast corner of Pond A12 and southwest corner of Pond A16.

During construction, the existing trail segment between Artesian Slough and the Alviso Marina may be subject to closure, trail detours, truck/construction equipment traffic and operation, and related dust, exhaust emissions, and noise (also see Section 4.10 *Air Quality/Greenhouse Gases* and Section 4.13 *Noise*). Trails around the EEC and the EEC itself may also be directly or indirectly affected during levee construction due to increased traffic, noise, and dust or construction access to the work area. Direct impacts would be limited to immediate work areas, which would change as construction progresses, and would be short term. The viewshed from the EEC would see a long-term minor effect as demonstrated by the simulation in Section 4.12.2.3.2 *Action Alternatives* (Figure 4.12-20 *Alternative View from Location 5 — View Northwest within the Alviso* Unit *of the Refuge near the Environmental Education Center of Alviso* North Levee Alignment (Alternative 3)). Note that the proposed connection from the existing boardwalk to the new levee trail to crest would be ADA-compliant (likely a switchback with rest area) and construction would be completed in a way to minimize effects to the existing boardwalk and adjacent habitat (e.g., would stay within the 30 feet combined permanent [15 feet] and temporary [15 feet] proposed easement footprint).

The distance of trail that may need to be temporarily closed and the duration of trail closures would vary depending on construction progress and how the affected trail segment connects to other trails not affected by construction. Temporary trail closures already occur on the Refuge property since the USFWS may close trails temporarily to protect sensitive habitats and wildlife. However, according to the USFWS, this is not a regular occurrence. Therefore, trail closures over the course of 1 to 1.5 years would be an impact to recreationists. However, given the availability of other trail opportunities in the area the impact is considered less than significant.

As described in Section 4.3 *Land Use and Planning*, use of the Alviso Marina may also be temporarily affected due to construction activity. Construction activity could affect access (e.g., cause delays or detours) and may cause dust and noise that affect people's enjoyment of the facility. All of the construction impacts would be short term (4 to 6 months) and limited to immediate work areas. Because of these factors, impacts to the Alviso Marina are less than significant.

Temporary loop trails around ponds not scheduled for breaching until a later phase may be made available to the public by USFWS Refuge staff over the 14-year window of pond restoration construction (see Section 3.8.3 *Construction Schedule*). Depending on the extent to which berms are being used by birds for nesting and the current availability of alternative nesting site options nearby, any new trail alignments will be decided post-breach with the goal of providing wildlife-oriented public access but also minimizing public impacts on wildlife.

Construction of the FRM levee for Alternatives 2 and 3 would not significantly limit or impede existing recreational uses in the project area such including trails, access to the bay, and environmental education. The impact would be less than significant.

Alternatives 4 and 5

As shown in Figure 3.5.1 *Potential Alviso Segment Levee Alignments* in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*, Alternatives 4 and 5 would construct the Alviso levee section along an existing nonengineered levee that runs north to south along the east side of Pond A12 and then turns east to follow the south side of Pond A16 to Artesian Slough. The section would be constructed on an existing nonengineered levee maintenance road that travels on berms and levees originally constructed as part of the salt pond operation between the Alviso Marina and Pond A13. Alternatives 4 and 5 would connect to the WPCP South levee segment via a new bridge over the Artesian Slough near the southeast corner of Pond A16.

Building the levee would directly affect the viewshed from the EEC, as demonstrated by the simulation in Section 4.12.2.3.2 *Action Alternatives* (Figure 4.12-18 *Existing View from Location 5 — View Northwest within the Alviso Unit of the Refuge near the Environmental Education Center*). Alternative 4 would have a bridge crossing the Union Pacific Railroad tracks where the new levee segment turns into the NCM and east from Pond A12. Alternative 5 would have a bridge crossing the Union Pacific Railroad tracks near the Alviso Marina.

Trails and trail users could be directly or indirectly affected during levee construction due to temporary trail closures, increased traffic, noise, and dust. The EEC could be directly affected, with construction activity temporarily affecting access to the facility and users' ability to enjoy their experience on site. Direct impacts would be limited to immediate work areas, which would change as construction progresses, and would be short term. Because of this, these impacts on trail use and the EEC would be less than significant. Similar to what is described for Alternatives 2 and 3, trail construction along this part of the Alviso Railroad Spur (Alternative 4) levee section could temporarily affect access to and use of the Alviso Marina for an estimated 4 to 6 months and could cause temporary trail closures over the course of 1 to 1.5 years. Such impacts would be short term and limited to immediate work areas.

Currently, the Alviso South (Alternative 5) levee section alignment does not support an existing, formal trail between the Alviso Marina and the upper part of Artesian Slough. Because of this, construction is not expected to affect recreational trail use. This section also begins at Alviso Marina, so the temporary construction-related effects on marina use described above in discussion of Alternatives 2 and 3 could also occur under this alternative (i.e., closures up to 4 to 6 months).

Since there is no existing levee trail available for recreation along Pond A18 (WPCP South Levee segment), and therefore, no current recreational access, no construction-related effects are discussed here. Long-term impacts are described below.

Construction of the FRM levee for Alternatives 4 and 5would not significantly limit or impede existing recreational uses in the project area such including trails, access to the bay, and environmental education are less than significant. The impact would be less than significant.

FRM Levee Long-term Impacts

Alternatives 2 and 3

Alviso Segment

In general, the FRM levee would be a permanent new feature within the study area and would cross or coincide with existing trail alignments. No net loss of trails is anticipated as a result of the FRM levee. The proposed maintenance road on top of the levee could be opened as a trail for use by pedestrian recreational traffic. This trail would provide an elevated view of the adjacent marshlands. However, construction of the new FRM levee would affect use and access to trails that follow the existing pond dikes, altering the view and surrounding environment.

Similar to existing trails in the Refuge, trail surfaces would be gravel or dirt with interpretive information, directional signs, possible fencing to protect sensitive resources or plant operations, and, in future phases, benches or overlooks or other trail amenities, if deemed appropriate and consistent with ongoing Refuge management (amenities such as benches and interpretive signs would be cost-shared with the non-Federal sponsor). Any areas of vegetation cultivated by EEC volunteer groups removed due to the construction will be replaced.

In locations where the new levee would cross an existing trail, the existing trail would be rerouted up and over the levee to reconnect with the original alignment (AMM-REC-1: Incorporate Existing Trails). In locations where the levee would be coincident with the trail, the trail would be relocated to the top of the levee along the given segment. To the maximum extent feasible, this trail would be designed to accommodate the access needs of all designated users, using Architectural Barriers Act Accessibility Guidelines (ABAAG) Final Guidelines for Outdoor Developed Areas (for details, see www.access-board.gov/guidelines-and-standards/recreation-facilities/outdoor-developed-areas/final-guidelines-for-outdoor-developed-areas). Both alternatives include constructing a bridge over the Union Pacific Railroad tracks, which would provide connectivity between the Refuge-area trails and the area around the Alviso Marina.

Once the levee is constructed, the maintenance trail on the Alviso North levee section would be potentially available for pedestrian traffic as determined by the USFWS

In addition, because the westernmost extent of the proposed levee's maintenance trail would end (with the levee itself) at existing high ground adjacent to the Alviso Marina, this would facilitate another connection to the Bay Trail if the City of San José's proposed plans to connect the Alviso Marina to the larger trail network are realized. Final design would take into consideration any planning efforts in development at that time by the City and other local and regional authorities. Such a connection would be beneficial to recreational uses.

The long-term effect of the Alviso segment of the FRM levee for Alternatives 2and 3 would have a beneficial impact to recreational uses in the project area such including trails, access to the bay, and environmental education. The impact would be less than significant under the CEQA/beneficial under the NEPA.

WPCP South Segment

Alternatives 2 and 3 also include a new 11,000-foot-long (about 2 miles) section of maintenance trail along the crest of the new WPCP South levee section, which can be made available for pedestrian traffic at the discretion of City of San José and Wastewater Facility staff. The WPCP South levee section would require a BCDC permit, which would emphasize public access to the shoreline. Adding a new trail segment that connects into the existing and planned trail system is a beneficial effect because it would provide additional regional connectivity.

Consistent with the Wastewater Facility Plant Master Plan, the eastern extent of the levee maintenance trail would connect to a designated route generally following the ingress route mapped for staging areas (see Figure 4.11-3 *Project Area Recreational Trails System at Completion of Construction*) and connecting to the existing bridge at McCarthy Boulevard. The existing pedestrian walkway on the bridge would take recreationists to the Coyote Creek Trail that runs along the east bank of the creek. The proposed trail connection would be refined in final design with consideration of both public safety and the addition of features (e.g., fencing) to limit public access to sensitive wildlife areas. If the trail connection alignment does follow project construction haul route(s), post-construction road restoration efforts could incorporate the recreational trail objective (e.g., during regrading and repairs), thus limiting any additional negative impacts from potential future trail construction.

The proposed trail would be about 1,200 feet away from the edge of the City's bomb-disposal site on the Wastewater Facility property (see Section 4.3.1.2.2 *San José* for a description of the disposal site). The City uses a strict bomb-disposal protocol that focuses on ensuring human safety. The protocol includes advance notification and requirements for pre-disposal visual indication that a detonation or disruption is going to occur. Most of the tools that are used for disruption or exploration are small and require a safe perimeter of 75 to 100 feet. All disruptions are contained within the perimeter of the disposal area. Seventy-five percent of all disruptions at the range involve small, controlled explosions that are similar to the sound of a handgun or shotgun shot; this level of sound would not substantially affect visitor experience for people using the levee trail. The types of disruptions that occur at the site result in minimal vibratory impacts that would not be felt by users of a trail that is 1,200 feet or more distant.

The combined segments of the FRM levee trail would enhance recreational use of the study area. The long-term strategy development would continue with Refuge, City and SBSP Restoration Project staff, and the final plan will include consideration for both the broader San Francisco Bay Trail Plan and public input received (AMM-REC-3:Bay Trail Connection).

The long-term effect of the WPCP segment of the FRM levee for Alternatives 2and 3 would have a beneficial impact to recreational uses in the project area such including trails, access to the bay, and environmental education. The impact would be less than significant under the CEQA/beneficial under the NEPA.

Alternatives 4 and 5

Alviso Segment

The Alviso levee sections of Alternatives 4 and 5 have the same general alignment along an approximate 0.75-mile section between (1) the point where the railroad spur abuts the Wastewater Facility property at Grand Boulevard and (2) Artesian Slough near the EEC where the levee would connect to the WPCP South levee section alignment. For both alternatives, this part of the levee section would follow the boundary between the NCM and Alviso and existing berms and levees that support Refuge trails associated with the EEC. Both alternatives include constructing a bridge over the Union Pacific Railroad tracks.

Following construction, for both Alternatives 4 and 5, the trail that runs along the east side of Pond A12 and turns east along the south side of Pond A16 would be re-established . This is a less than significant effect.

WPCP South Segment

Alternatives 4 and 5 would include construction of the same WPCP South levee section and would have the same effects as Alternatives 2 and 3.

The impact would be less than significant under the CEQA/neutral under the NEPA.

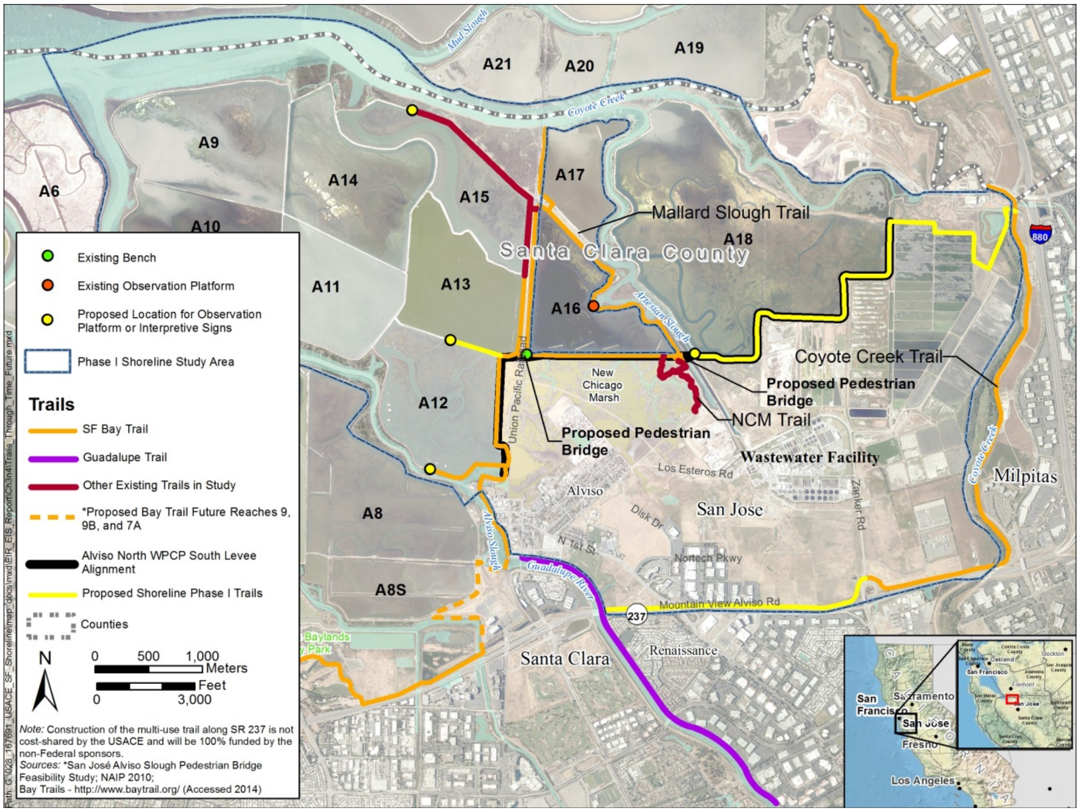

Figure 4.11-3. Project Area Recreational Trails System at Completion of Construction

Ecosystem Restoration – Construction

Ecosystem restoration activities, including construction of a bench (Alternatives 2, 4, and 5) or a 30:1 ecotone (Alternative 3) would be phased over time. This construction phasing would result in a phased change to recreational features associated with this part of the Refuge, most notably the trail system and the viewshed from the EEC.

Pond construction would affect access to perimeter trails while ponds are being prepared for breaching. The amount of earthwork would be minor compared to the FRM levee, so the extent of truck and construction activity would be more limited as would the related dust, exhaust emissions, and noise.

Restoration of the existing ponds to tidal marsh habitat involves the breaching of pond dikes that may currently serve as trail segments, resulting in terminating trails, eliminating loop systems, changing trail circulations, and decreasing the overall mileage of trail within the pond system. The breaching of pond dikes as part of the ecosystem restoration would ultimately eliminate large segments of the trail system and change the nature of the Alviso Slough Trail (see Figure 4.11-3 *Project Area Recreational Trails System at Completion of Construction*). These changes would take place over time as each set of pond breaches is implemented.

- In the first phase (2020), the planned breach of Pond A12 would eliminate a segment of the loop trail along the outer berm of the pond; Figure 4.11-1 *Existing Project Recreational Trail System* provides the current trail configuration in the project study area for reference. However, depending on the extent to which berms are being used by birds for nesting and the current availability of alternative nesting site options nearby, adjustments may be made by USFWS Refuge staff to identify alternative temporary trail alignment(s) (see Table 4.11-1 *Trail Changes over Time in the WPCP South Levee Section and Alviso North Levee Section* for trail loss expected). Breaching in Pond A18 during this first phase would have no impact on trails as there are currently no public trails around Pond A18.
- Breach of the second phase of ponds (2025) would eliminate access to the trail along outer Alviso Slough (see Figure 4.11-3 *Project Area Recreational Trails System at Completion of Construction*). Similar to the previous phase, final design of any temporary trail realignment would be contingent on bird nesting activity and at the discretion of USFWS Refuge staff (see Table 4.11-1 *Trail Changes over Time in the WPCP South Levee Section and Alviso* North Levee Section for trail loss expected).
- The final phase of pond breaching (2030) would permanently change the Alviso Slough Loop Trail from a two-bow loop system to a spine train with fin or spur trails out into tidal marsh and connections to the Mallard Slough Loop. The trail around Pond A16 constructed through the SBSP Restoration Project Phase I project and associated with the Mallard Slough Loop Trail would be kept (see Table 4.11-1 *Trail Changes over Time in the WPCP South Levee Section and Alviso* North Levee Section for trail loss expected).

Under the McAteer-Petris Act, the BCDC encourages the provision of maximum feasible public access to the bay and its shoreline, as long as such access is compatible with wildlife protection. Ecosystem restoration would affect the current configuration of the Alviso Slough Trail and could change shoreline access in the areas of Ponds A9 through A15. Given the constraints of putting trails in sensitive tidal wetlands, the Shoreline Phase I Project provides as much feasible access as possible. Instead of a contiguous loop, the remaining portion of the existing loop trail would consist of a north-south alignment and several in-and-out segments extending along existing inner dikes to the west.

Although the reduction in trail-miles for the loop trail is notable, the impact to visitation would not be substantial because most visitation along the trail is concentrated in the segments that would remain in place. Only a small proportion of visitors circumnavigate the loop, primarily due to its long length (9 miles). The Shoreline Phase I Project would maintain the existing trails along the edge of Alviso Loop, parallel with the railroad right-of-way, and would add out-and-back spur trails to provide marsh viewing opportunities.

Maintaining the Alviso Slough Trail in its current configuration would require maintaining the existing salt pond berms in place and bridging all proposed breaches. While technically feasible, this would have substantial impacts to sensitive tidal marsh species. Furthermore, maintaining the existing berms for trails would preclude their use as borrow sites and would not allow the project to create high-tide islands or pickleweed marsh on the former berms, an action that would enhance wildlife habitat. For the most part, the trails that would be retained would be concentrated on one side of the Alviso Loop to minimize the adverse impacts of human/wildlife interactions. Changes to the Alviso Loop Trail configuration would ensure compatibility with wildlife and habitat created as a result of restoration while maintaining public access to the shoreline.

Ecosystem restoration would result in the net loss of approximately 2.2 miles of trails around the ponds. In addition to creating new trails, the Shoreline Phase I Study has focused on maximizing public access by greatly improving the regional trail connections and enhancing the trail experience. The project would connect the Refuge trail system with the Bay Trail/Coyote Creek Trail through Pond A18. The project would also provide a more efficient and direct connection between the Alviso Marina County Park and the EEC by constructing a pedestrian bridge over the railroad tracks (the railroad bridge would eliminate the current 1.5-mile out-and-back detour to the railroad grade crossing).

The Union Pacific Railroad bridge would enhance visitor experience by offering excellent views of the ponds and restoring marshes and the surrounding landscape as well as eliminating pedestrian-railroad conflicts. The railroad bridge structure would be built on Refuge property and would meet the Refuge design regulations and policies to match the aesthetic style of other facilities on the Refuge. The pedestrian bridge over Artesian Slough would also enhance visitor experience. Finally, additional overlook platforms and interpretive signs would improve visitors’ enjoyment and knowledge of the site.

The restored environment and the trail system enhancements would accommodate continued recreational use of trails in the study area. Impacts to recreational opportunities in the project area would be less than significant.

The construction of ecosystem restoration elements for all alternatives would have a less-than-significant impact to recreational uses in the project area such including trails, access to the bay, and environmental education.

Ecosystem Restoration – Long Term

For all action alternatives, outboard pond dike breaches would interrupt pond perimeter trails, thereby severing existing connectivity. The anticipated before-trail conditions are shown on Figure 4.11-1 *Existing Project Recreational Trail System*, and the after-trail condition in the study area are shown on Figure 4.11-3 *Project Area Recreational Trails System at Completion of Construction*.

Overall, ecosystem restoration would result in a reduction of about 7.4 miles of trails, however, with the addition of trail along Pond A18 (additional 3.3 miles) and a proposed trail at SR 237 (1.6 miles; see discussion below), the net loss would be about 2.2 miles (see Table 4.11-1 *Trail Changes over Time in the WPCP South Levee Section and Alviso North Levee Section*).

The non-Federal sponsors are proposing to fund and construct a portion of the Bay Trail just north of SR 237. This would provide 1.6 miles of paved multi-use trail and provide connection at a current gap in the multi-use network between Dixon Landing Road in Milpitas and Zanker Road in Alviso (shown as the dotted red line on Figure 4.11-1 *Existing Project Recreational Trail System*) (AMM-REC-3). This trail system, which is part of the City of San José's planned SR 237 bikeway, would provide a route for bicycle commuters to travel through the area and would provide a valuable connection to the Bay Trail network. This connection between Milpitas and Alviso on the Bay Trail network is of high value to community users and meets a specific goal of the Bay Trail Board (Thompson pers. comm. 2012).

Table 4.11-1 *Trail Changes over Time in the WPCP South Levee Section and Alviso North Levee Section* shows the impacts associated with all levee section alignments, since restoration impacts would be consistent across alignments.

Table 4.11-1. Trail Changes over Time in the WPCP South Levee Section and Alviso North Levee Section

Year	Action	Trail Added (mi)	Trail Lost (mi)	Difference
2021	Post A12 and A18 breach and FRM levee construction	+3.6	-0.9	+2.7
2026	Post A9, A10, and A11breach	0	-3.8	-3.8
2030	Post A13, A14, and A15 breach	0	-2.7	–2.7
	Total change in existing trail length	+3.6	-7.4	–3.8
2020	Proposed construction of paved multi-use trail along SR 237[a]	1.6	0.0	+1.6
	Total change with SR 237 construction	+5.2	-7.4	–2.2

[a] The SR 237 segment of trail would be funded and constructed by the non-Federal sponsor.

The lead agencies have designed the new proposed levee-top routes (maintenance roads that could be used as trails) to remain gravel. Leaving this trail unpaved would promote its use for educational tours and bird-watching over its use as a commuter route.

Ecosystem restoration activities would require a BCDC permit for the segment along Pond A18 that is owned by the City (i.e., non-Federal land). One of the BCDC's objectives is to provide *maximum feasible public access* to the bay and shoreline. Even though ecosystem restoration activities would result in a loss of about 3.8 miles of pond trail on Federal lands (see Figure 4.11-3 *Project Area Recreational Trails System at Completion of Construction* and the discussion on page 4-567 for information regarding changes to the Alviso Slough Trail on Federal land), improvements that are proposed as part of the project (benches, interpretive displays, observation platforms, pedestrian crossings of Artesian Slough and the Union Pacific

Railroad tracks, and the proposed 1.6 miles of paved multi-use trail) would enhance recreational use of the overall area, Refuge, and adjacent land and provide public access to the shoreline (AMM-REC-2: Landscape Displays). Restored areas would provide new, different opportunities for people to enjoy the same types of activities that they currently enjoy (hiking and bicycling, wildlife watching, fishing, and boating). The proposed changes are consistent with the USFWS's management of the Refuge and the City's and Wastewater Facility's recreational objectives for the area. The project would not disconnect the Refuge trail system from other regional trails but would enhance such connectivity. Given the expected recreational enhancement that ecosystem restoration would facilitate, the adverse impacts related to loss of 3.8 miles of trail (2.2 miles net) would be less than significant.

The long-term effect of ecosystem improvements for all alternatives would have a less-than-significant impact to recreational uses in the project area such including trails, access to the bay, and environmental education.

Recreational Features Construction

All of the action alternatives include constructing pedestrian crossings of Artesian Slough and the Union Pacific Railroad tracks and user enhancements, such as benches, interpretive displays, and observation platforms. The potential effects of the Artesian Slough crossing on biological resources are discussed in Section 4.6 *Aquatic Biological Resources* and Section 4.7 *Terrestrial Biological Resources*. The Union Pacific Railroad crossing is not expected to cause any long-term environmental effects. Benches, interpretive displays, and observation platforms would be constructed throughout the ecosystem restoration process.

One of the proposed trail improvements that would be funded by the non-Federal sponsors (i.e., is not cost-shared by the USACE) is creating a paved section of the planned Bay Trail along SR 237. Once this trail is paved and linked to other existing Bay Trail segments, users would be able to quickly and more safely pass through the area. This would have the added benefit of reducing the potential numbers of people who might use the Refuge trails to connect between the existing Coyote Creek section of the Bay Trail east of the study area and the Sunnyvale section of the Bay Trail west of the study area for purposes other than Refuge visitation. Trail users would still be able to easily access the Refuge trails but would have the option of using the more direct, paved SR 237 trail. This is a beneficial impact.

When these features are constructed, activity might cause temporary, construction-related effects on people using study area trails. If a trail passes through one of the areas that are under construction, users might be directed to a detour, or short trail segments might be closed altogether. Trail users might also be disturbed by noise and dust, especially when the pedestrian crossings are being constructed. All of these types of effects would be short-term and limited to immediate work areas. In the long term, these changes would provide new trail connectivity (the pedestrian crossings) and would provide amenities that would enhance users' experiences. The construction-related effects would be less than significant because they would be limited in duration and location (i.e., 1 to 1.5 years of trail closures, moving east to west; 4 to 6 months of

Marina closures). The long-term effects related to improved connectivity and recreational enhancement would be beneficial.

The construction of the recreational features for all alternatives would have a less-than-significant impact to recreational uses in the project area such including trails, access to the bay, and environmental education.

4.11.2.3.2.2 Operation and Maintenance Effects

Long-term operation and maintenance of the FRM levee and restored ecosystem components would not significantly affect the new or existing recreational features in or recreational use of the study area. Long-term operation and maintenance of the FRM levee would allow the Refuge to continue to provide recreational opportunities even in the case of SLC; new trails would be elevated to a higher level, and the EEC would be on the upstream side of the FRM levee with all alternatives. Routine levee maintenance activity, such as vegetation removal, might require temporary trail closures but in general would not prevent people from using recreational facilities in the study area or prevent people from participating in dispersed recreational activities. Operation and maintenance of the FRM levee would not affect recreational resources in or recreational use of the study area.

Long-term operation and maintenance of areas restored to tidal marsh would not affect people's ability to use developed recreational features in the study area or to practice dispersed recreation. Avoidance and minimization measures adopted as part of the project allow Refuge staff to close specific trails protect sensitive species and their habitats (AMM-TBR-13); this is not a change from how the Refuge currently manages for such species. Routine maintenance of ecotone areas and remaining levee segments might cause some temporary disruption of recreational use in the area, but such activity would not further limit or prevent long-term access to the Refuge. Ongoing adaptive-management activity, such as monitoring and minor modifications to restored areas, would not affect long-term recreational use of or access to the Refuge. Finally, long-term operation and maintenance would not prevent future connections to other regional trails, such as the Bay Trail. Overall, then, long-term maintenance and operation of restored areas would not significantly affect recreational resources in or recreational use of the study area.

Project impacts that limit or impede existing recreational uses in the project area such including trails, access to the bay, and environmental education would be less than significant.

Impact REC-2: Increase the use of existing neighborhood and regional parks or other recreation facilities such that substantial physical deterioration of the facility would occur or be accelerated

As discussed above, construction would result in the temporary closure of trails in the immediate vicinity of construction. This is a short-term impact and trails would be available once construction moves from the area. There would still be other trails in the area available for public use.

In the long term, the quantity of miles of trails would decrease, but the quality of those trails would be improved as shown on Figure 4.11-3 *Project Area Recreational Trails System at Completion of Construction* and discussed in the section titled *Ecosystem Restoration – Long Term* on page 4-521. The project would not increase the use of recreational facilities in a substantive way what would cause physical deterioration.

Project impacts relating to increased use or physical deterioration of recreational facilities would be less than significant.

Impact REC-3: Require the construction or expansion of recreational facilities that might have an adverse physical effect

Construction would result in the temporary closure of trails in the immediate vicinity of construction. This is a short-term impact and trails would be available once construction moves from the area. There would still be other trails in the area available for public use.

In the long term, the quantity of miles of trails would decrease, but the quality of those trails would be improved as shown on Figure 4.11-3 *Project Area Recreational Trails System at Completion of Construction* and discussed in the section titled *Ecosystem Restoration – Long Term* on page 4-521. These changes would not require the expansion of recreational facilities elsewhere.

Project impacts relating to the construction or expansion of recreational facilities would be less than significant.

4.11.2.3.2.3 Comparison of Action Alternatives

Table 4.11-2 *Summary of Action Alternative Impacts on Recreation Facilities* compares the effects of the action alternatives. Impacts on pond trails resulting from ecosystem restoration activities would be the same for all action alternatives.

Alternatives featuring the Alviso North levee section (Alternatives 2 and 3) would relocate trails along the western segment of the levee—the eastern edge of Pond A12, the southeast corner of Pond A13, and the southern edge of Pond A16—from existing berms to the top of the new levee.

Alternatives featuring the Alviso South levee section (Alternative 5) and the Alviso Railroad levee section (Alternative 4) would follow the same footprint as Alternatives 2 and 3, using an existing trail that tops the non-engineered levee that is currently in place. A large proportion of the short (0.4-mile) Marsh View Trail would be relocated to the top of the levee.

Given that all levee alternatives are designed to be constructed north and bayward of the EEC, all alignments afford flood protection to the existing facility and parking area. Alternatives 2 and 3 (Alviso North levee option) would be the farthest north of the facility at approximately 175 feet, while Alternatives 4 (Alviso Railroad) and 5 (Alviso South) would have a greater impact on the viewshed of the EEC at only approximately 5 to 10 feet bayward of the facility. However, with all alternatives, the levee itself would give recreationists alternative access and more expansive views of the NCM and Pond A18.

In addition, since the purpose of the ecotone is to provide layers of transitional habitat in order to enhance the area for tidal marsh species, it is likely that wildlife diversity would increase, thereby enhancing viewing and educational opportunities as a result of the restoration. Further, the experience on trails would improve due to the restoration (increased diversity of habitats and wildlife experienced, improved aesthetics, etc.). Finally, while there would be a slight decrease in land-based linear trails, there would be an increase in aquatic access and other types of recreation options (improved bird watching, photography, etc.). More information on levee visual impacts on the study area is provided in Section 4.12 *Aesthetics*.

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Table 4.11-2. Summary of Action Alternative Impacts on Recreation Facilities

Alternative	Summary of Impacts
2 – Alviso North with 12.5-foot Levee and Bench	• Would relocate or elevate trail segments to top of FRM levee (eastern edge of Pond A12, southeast corner of Pond A13, and southern edge of Pond A16). • Would cause loss of 3.8 miles of existing trail. With surface street Bay Trail establishment at SR 237, new and upgraded trail would increase to 5.2 miles, resulting in a net loss of about 2.2 miles. • Moderate temporary impacts on recreationists during construction (noise, dust, access). • Moderate temporary impacts on recreationists during closures due to construction (assumes moving the work east to west for 1 to 1.5 years along Alviso segment; first year along A18 levee wouldn't result in any anticipated closures to existing pond loop trails). • Moderate impacts on recreationists at the Alviso Marina due to closures for 4 to 6 months. • Significant permanent impacts to the EEC viewshed to ponds A9–A15 area.
3 – Alviso North with 15.2-foot Levee and 30:1 Ecotone	• Same as Alternative 2.
4 – Alviso Railroad with 15.2-foot Levee and Bench	• Would use existing non-engineered trail along eastern edge of Pond A12, southeast corner of Pond A13, and southern edge of Pond A16. • Would relocate large portion of the Marsh View Trail to top of levee. • Trail losses would be similar to those from Alternative 2. • Moderate temporary impacts on recreationists during construction (noise, dust, access). • Moderate impacts on recreationists during closures due to construction (moving the work east to west for 1 to 1.5 years). • Moderate impacts on recreationists at the Alviso Marina due to closures for 4 to 6 months. • Significant permanent impacts to the EEC viewshed for the NCM and Ponds A9–A15; access to levee trails would provide alternate viewing areas.
5 – Alviso South with 15.2-foot Levee and Bench	• Recreation trail would be same as Alternative 4. • Trail losses would be similar to those from Alternative 2. • Moderate temporary impacts on recreationists during construction (noise, dust, access). • Moderate impacts on recreationists during closures due to construction (moving the work east to west for 1 to 1.5 years. • Moderate impacts on recreationists at the Marina due to closures for 4 to 6 months. • Significant permanent impacts to the EEC viewshed for the NCM and Ponds A9–A15; access to levee trails would provide alternate elevated viewing areas.

Key: FRM = flood risk management

With-Project Impacts to Recreation Value

In order for restoration actions to occur in Ponds A9–A15, the existing approximately 10.5-mile loop trails around these ponds would have to be removed as the ponds are opened up to the tidal action of the bay by breaching the outboard levees. As described below, in the absence of other measures taken, removing this loop trail is anticipated to have an adverse impact on the recreation value in the study area.

For feasibility studies, the USACE often uses what is known as the Unit Day Value (UDV) method to value changes in recreational value associated with projects (USACE 2015). This method relies on expert or informed opinion and judgment to approximate the average willingness to pay of users of Federal or Federally-assisted recreation resources. The categories used to evaluate recreational resources are Recreation Experience (number of activities), Availability of Opportunity (proximity of similar opportunities), Carrying Capacity (how additional use degrades the experience for the users), Accessibility, and Environmental (aesthetic qualities). The latest USACE Economic Guidance Memorandum (13-03 *Unit Day Values for Recreation for Fiscal Year 2015*) estimates the value of a general (non-specialized) recreation experience at between $3.80 and $11.39.

Based on the fact that the primary features and amenities of the site would still be intact, it is assumed that the loss of the loop trail would not have a significant effect on attendance or total annual use. However, because the loop trail extends into the bay and allows users a somewhat more aesthetic experience than along other parts of the trail in the area, it is anticipated that, in the absence of other measures taken, there would be at least a small loss in the average value of recreation experiences due to a decrease in the Environmental category that is part of the UDV method. The UDV method rates recreation experiences on a scale of 0 to 100, of which up to 20 points are assigned to the Environmental category.

Importantly, the restoration options would allow continued recreational use of the area. Figure 4.11-3 *Project Area Recreational Trails System at Completion of Construction* shows a conceptual design of the final Bay Trail configurations associated with the project alternatives. According to the preliminary design documents completed to date for the recreation features, the reconfiguration of recreation features would take place in a phased approach. These changes to trail configuration would be complete in 2028 at an estimated cost of approximately $2.2 million. The recreation features include the construction of trail as well as the addition of three observation platforms. The relocated/constructed trail would facilitate an improved and more convenient connection between the bay trail segments to the west and the east of the study area.

From a UDV perspective, the improved connectivity of the relocated trail could result in a higher score in the Accessibility category since cyclists, hikers, and other users (in particular those coming from the east) could more easily and conveniently reach the site. The UDV Method assigns up to 18 of the 100 total points to the Accessibility category. It is possible that the improved connectivity and accessibility would ultimately have the effect of increasing attendance at the site, but that effect is uncertain at this point.

In summary, removing the loop trail would result in an adverse impact on total recreation value (lower overall aesthetics) and maintaining trail use in the refuge and providing better trail connectivity would have a beneficial impact (improved accessibility). Given these findings, no separable economic justification has been completed for this feasibility study.

4.11.3 Mitigation Measures

Implementation of AMMs that are a part of the project would avoid and minimize significant adverse effects; all project impacts related to recreation would be less than significant. No mitigation for construction-related or long-term impacts is necessary.

4.11.3.1 Residual Impacts and Additional Measures Necessary to Mitigate Significant Impacts

Long-term residual impacts would be largely positive and would include new recreation amenities that would afford access to new views of pond features and would complement and expand the recreation and bike circulation system for the area.

4.11.4 Cumulative Effects

The Shoreline Phase I Project is not expected to cause any significant environmental effects on recreational facilities or to affect long-term recreational use of the study area. When considered in conjunction with the SBSP Restoration Project, other local FRM projects listed in Section 4.1.8 *Cumulative Impacts Setting*, and ongoing uses of the study region (built-out residential uses and continued operation and expansion of the Wastewater Facility), the less-than-significant effects of the Shoreline Phase I Project on recreational resources are not expected to cause or contribute to cumulative short-term interruptions of recreational use of regional facilities such as the Bay Trail; short-term or long-term losses of recreational opportunities; or short-term or long-term needs for construction of new recreational facilities.

Restoration of the existing ponds to tidal marsh habitat involves activity that would cause changes to the existing trail system and loss of trail segments but the project and SBSP Restoration Project include construction of new trail segments that would provide better regional connectivity. The non-Federal sponsor plans to construct a segment of the Bay Trail along SR 237 south of the study area using 100 percent non-Federal funding. With these improvements, the contribution of the project to cumulative impacts on recreation is not considerable.

4.11.5 Summary

In summary, the action alternatives would result in a net loss of approximately 2.2 miles of trail but would still support a useful Refuge trail system and would provide a connection to other regional trails such as the Bay Trail system. The project would result in long-term enhancements for Refuge visitors by providing new pedestrian crossings of Artesian Slough and the Union Pacific Railroad tracks and providing benches, interpretive displays, and observation platforms. The project would limit use of the Alviso Marina during construction for an estimated 4 to 6 months.

The project would also result in long-term impacts to the viewshed from the EEC; for Alternatives 2 and 3, the impact is minor, as the levee is further away, and the addition of new trails leading up to and along the crest of the levee will provide new opportunities for views as demonstrated by the simulation in Section 4.12.2.3.2.2 *Comparison of Action Alternatives* [Figure 4.12-20 *View from Location 5 — View Northwest within the Alviso Unit of the Refuge near the Environmental Education Center of Alviso North Levee Alignment (Alternative 3)]*. For Alternatives 4 and 5, the viewshed impacts are increased, as these proposed levee alignments come within 25 feet of the viewing platform at the EEC. The project uses two strategies to address EEC viewshed concerns: (1) developing interpretive displays explaining the restoration project and ecosystem enhancements and changes between the levee and the EEC and (2) developing new trails at the crest of the proposed levee (Alternatives 2 and 3 only), with accessible trail enhancements that would provide alternative elevated views and trail access along the marsh area.

The project is not expected to result in the need for development of additional recreation resources in the area or to result in an increase in the use of neighborhood parks, regional parks, or other recreation facilities.

Based on the previous analysis, the action alternatives would result in impacts that are less than significant and would not result in adverse long-term impacts on recreation facilities or resources, with one exception: the viewshed at the EEC. The development of the levee would result in a minor impact for both short- and long-term impacts for Alternatives 2 and 3, and short- and long-term adverse impacts on the viewshed for Alternatives 4 and 5.

The project would have the following beneficial impacts:

- Enhance public open space lands that are readily accessible to county residents and workers.
- Enhance an extensive countywide network of recreational hiking, bicycling, and equestrian trails and pathways linking and providing access to these public lands.
- Create a healthy, well-functioning creek, streamside, bay, and bay wetlands ecosystems capable of providing a passive recreational and interpretive nature study.
- Encourage multiple uses of lands intended for open space and conservation consistent with the objectives of resource management, conservation, and preservation, particularly habitat areas.
- Preserve and restore the edges of San Francisco Bay as open space.
- Encourage the countywide trail system to be linked to provide regional trails including the Bay Area Ridge Trail, the Benito-Clara Trail, and the San Francisco Bay Trail systems encircling the urban areas of the county and San Francisco Bay.
- Support complementary recreational uses, including interconnected trails to the bay, environmental education, and regional recreational facilities that meet regional needs.
- Support recreational, educational, and economic development uses by impeding transportation connections through the project area.

- Support educational and recreational opportunities at the EEC, including interpretive programs, guided programs and walks.

Table 4.11-3 *Recreation NEPA Impact Conclusions* summarizes the project effects under the NEPA.

Table 4.11-3. Recreation NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
REC-1: Limit or impede existing recreational uses in the project area such as trails, access to the bay, and environmental education	Negative	Minor	Short term	Likely	Limited
REC-2: Increase the use of existing neighborhood and regional parks or other recreation facilities such that substantial physical deterioration of the facility would occur or be accelerated	Negative	Minor	Shore term	Unlikely	Limited
REC-3: Require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment.	Negative	Minor	Short term	Unlikely	Local

Table 4.11-4 *Recreation CEQA Impact Conclusions* summarizes the project effects under the CEQA.

Table 4.11-4. Recreation CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
REC-1: Limit or impede existing recreational uses in the project area such as trails, access to the bay, and environmental education	AMM-REC-1: Incorporate Existing Trails AMM-REC-2: Landscape Displays AMM-REC-3: Bay Trail Connection	LTS	None	LTS
REC-2: Increase the use of existing neighborhood and regional parks or other recreation facilities such that substantial physical deterioration of the facility would occur or be accelerated		LTS	None	LTS
REC-3: Require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment.		LTS	None	LTS

LTS = less than significant
S = significant

4.12 Aesthetics

This section discusses the regulatory and physical settings, as well as the project impacts for aesthetics in the Shoreline Phase I Study Area as of 2014 (see Figure 1.9-3 *Shoreline Project Phase I Area of Impact and Biological Buffer Area* in Chapter 1 *Study Information*).

4.12.1 Affected Environment

4.12.1.1 Regulatory Setting

This section discusses regulatory information that applies to aesthetic resources. Additional regulatory information appears in Chapter 8 *Compliance with Applicable Laws, Policies, and Plans*.

4.12.1.1.1 Federal and State

It is USACE National policy that aesthetic resources be protected along with other natural resources. Planning guidance specifies that the Federal objective of water-related resource planning is to contribute to the NED consistent with protecting the Nation's environment. Established USACE goals include: (1) preservation of unique and important aesthetic values and (2) restoration and maintenance of the natural and human-made environment in terms of variety, beauty, and other measures of quality (USACE 2000).

4.12.1.1.2 Local

In addition to establishing provisions for scenic roads, city and county General Plans may include policies for protection of scenic resources, such as hillsides, natural area, landmarks, and historic districts. Such policies may restrict new development in areas that maintain scenic vistas. Applicable policies of the Cities of Fremont and San José and Santa Clara County are described below. In addition, the San Francisco Bay Plan (BCDC 2002) provides findings and policies related to the visual effects of development on the shoreline as further described below.

4.12.1.1.2.1 City of Fremont

The City of Fremont General Plan (1991) considers its open space frame (which includes wetlands and the bay) Fremont's dominant visual characteristic. The open space frame provides panoramic views of open space from the city and views of the city from the open space frame. The objective and policy relevant to the Shoreline Phase I Project in protecting the city's visual resources are as follows:

- **Objective NR 13.1:** Preservation of the visual character of the city's open space frame and other unique natural visual elements of Fremont. The frame includes the Hill Face, baylands, Alameda Creek Flood Control Channel, and adjacent publicly owned open space areas.
- **Policy NR 13.1.1:** Seek permanent protection of unique visual elements within the city. Minimize any negative development impacts on the visual characteristics of the resource when permanent protection is not feasible.

4.12.1.1.2.2 City of San José

The City of San José's General Plan (2011) identifies the city's baylands as one of many scenic resources. Visual quality–related goals are generally relevant to new development. The City also recognizes that preservation of scenic routes is critical to preservation and enhancement of such resources. Designated trails and pathways are located near the southern boundary of the Alviso pond complex. The following policy is relevant to the Shoreline Phase I Project:

> The City should control land development along designated Trails and Pathways Corridors in order to provide sufficient trail right-of-way and to ensure that new development adjacent to the corridors does not compromise safe trail access nor detract from the scenic and aesthetic qualities of the corridor.

4.12.1.1.2.3 Santa Clara County

The Santa Clara County General Plan (1994) identifies strategies and policies to preserve and enhance scenic resources within its boundaries. Three general strategies include: (1) manage growth and plan for open space, (2) minimize development impacts on significant scenic resources, and (3) maintain and enhance the values of scenic urban settings. Specific policies relevant to the Shoreline Phase I Project that support these strategies are identified below.

- **C-RC 57:** The scenic and aesthetic qualities of both the natural and built environments should be preserved and enhanced for their importance to the overall quality of life for Santa Clara County.
- **C-RC 58:** The general approach to scenic resource preservation on a countywide basis should include the following strategies:
  a. Conserving scenic natural resources through long-range, inter-jurisdictional growth management and open space planning;
  b. Minimizing development impacts on highly significant scenic resources; and
  c. Maintaining and enhancing scenic urban settings, such as parks and open space, civic places, and major public commons areas.
- **C-RC 59:** Scenic values of the natural resources of Santa Clara County should be maintained and enhanced through countywide growth management and open space planning.

4.12.1.1.2.4 San Francisco Bay Plan

The Appearance, Design, and Scenic Views section of the San Francisco Bay Plan (Bay Plan; BCDC 2002) provides the findings and policies related to visual effects of development on the shoreline. Specific policies relevant to the project include the following:

- In some areas, a small amount of fill may be allowed if the fill is necessary—and is the minimum absolutely required—to develop the project in accordance with the Commission's design recommendations.
- Structures and facilities that do not take advantage of or visually complement the bay should be located and designed so as not to visually affect the bay and shoreline. In particular, parking areas should be located away from the shoreline. However, some small parking areas for fishing access and bay viewing may be allowed in exposed locations.
- Shoreline developments should be built in clusters, leaving open area around them to permit more frequent views of the bay. Developments along the shores of tributary waterways should be bay-related and should be designed to preserve and enhance views along the waterway, so as to provide maximum visual contact with the bay.
- "Unnatural" debris should be removed from sloughs, marshes, and mudflats that are retained as part of the ecological system. Sloughs, marshes, and mudflats should be restored to their former natural state if they have been despoiled by human activities.
- Towers, bridges, or other structures near or over the bay should be designed as landmarks that suggest the location of the waterfront when it is not visible, especially in flat areas. But such landmarks should be low enough to ensure the continued visual dominance of the hills around the bay.
- In order to achieve a high level of design quality, the BCDC's Design Review Board, composed of design and planning professionals, should review, evaluate, and advise the Commission on the proposed design of developments that affect the appearance of the bay in accordance with the Bay Plan findings and policies on Public Access; on Appearance, Design, and Scenic Views; and with the Public Access Design Guidelines. City, county, regional, State, and Federal agencies should be guided in their evaluation of bayfront projects by the above guidelines.
- Views of the bay from vista points and from roads should be maintained by appropriate arrangements and heights of all developments and landscaping between the view areas and the water. In this regard, particular attention should be given to all waterfront locations, areas below vista points, and areas along roads that provide good views of the bay for travelers, particularly areas below roads coming over ridges and providing a "first view" of the bay.
- Vista points should be provided in the general locations indicated in the Plan maps. Access to vista points should be provided by walkways, trails, or other appropriate means and should connect to the nearest public thoroughfare where parking or public transportation is available. In some cases, exhibits, museums, or markers would be desirable at vista points to explain the value or importance of the areas being viewed.

4.12.1.2 Physical Setting (CEQA Baseline)

Shoreline Phase I Study Area visual characteristics include the Santa Cruz Mountains to the west and south, the Diablo Range to the east, San Francisco Bay, and the managed ponds along the edge of the bay. Urban and rural visual features are intermixed in the area. Rural areas feature managed ponds, mudflats, marshes, sloughs, and parks. Urban areas include the community of Alviso and feature industrial, commercial, and residential development and related infrastructure, such as roads, FRM waterways, and power lines. Urban areas surround the study area on the west, south, and east.

Ponds within the study area are dominated by shades of blue and green from pond water, algae, and vegetation; brown from mud and berms; and white, and other colors to a lesser extent, from minerals associated with past salt production. Pronounced geometric shapes of the ponds and meandering creeks and sloughs can be best seen from elevated areas overlooking the ponds. Pond characteristics vary throughout the year, with the colors constantly changing because of time of day, season, and cloud cover. Scenic views of the ponds are found along the public streets, trails, and parks in the area (EDAW et al. 2007).

The Shoreline Phase I Study Area is characterized by a relatively flat topographical expanse, which provides views of the coast, sky, and surrounding mountain ranges. Urban views of residential and industrial uses can be seen from the inland ponds, while bay views can be seen from the bayside ponds. Creeks and sloughs within the pond complex are mainly hidden because of low-lying vegetation and can be seen only at short-range distances (EDAW et al. 2007).

No designated scenic vistas have been identified in the study area; however, the Alviso Marina and the Refuge are recognized as areas that attract visitors for the viewing of attractive marsh areas and wildlife. The ponds provide remarkable views of many species, especially shorebirds. A popular access area for visiting the ponds for recreation and wildlife viewing is the Alviso Unit of the Refuge. Access is adjacent to the NCM and features a parking area, an environmental education center, boardwalk, and miles of trails.

The Wastewater Facility occupies a large portion of the study area. It features industrial areas as well as expansive areas of treatment-related ponds, spreading areas, and previously disturbed vacant land.

Photographs of key locations within the study area were taken in June 2012 (Views 1 through 4) and June 2014 (View 5) to further illustrate the existing visual setting and to provide a comparison to photographic simulations of the completed FRM levee. See Action Alternatives for locations, descriptions, and corresponding photographs of the existing condition [Figure 4.12-1 *Proposed Alternatives and Existing Representative Levee Height Comparison*; Figure 4.12-3 *Photograph Location Points*; Figure 4.12-5 *Simulated View from Location 1 — View North from Trail within Alviso Marina of North and Railroad Levee Alignments (Alternatives 2, 3, and 4)*; Figure 4.12-8 *Simulated View from Location 2 — View North from Elizabeth Street and Gold Street of Alviso* South Levee Alignment (Alternative 5); Figure 4.12-12 *Simulated View from Location 3 — View Northwest from Pacific Avenue North of State Street of Alviso*

South Levee Alignment (Alternative 5); and Figure 4.12-17 *Simulated View from Location 4 — View Northeast near Spreckles Avenue of Alviso Railroad* Levee Alignment (Alternative 4)].

4.12.1.3 National Environmental Policy Act and Engineer Regulation 1105-2-100: *Planning Guidance Notebook* Baseline Condition

For aesthetics, the NEPA and the Planning Guidance Notebook baseline condition is determined by projecting how the condition might change between the current condition discussed in Section 4.12.1 *Affected Environment* and the start of construction. Some local development and SBSP Restoration Project actions near the study area will occur between 2014 and 2017, but the amount and magnitude of these changes are not expected to substantially change views of and views from the study area. For this reason, the NEPA and the Planning Guidance Notebook baseline condition considered in Section 4.12.2 *Environmental Consequences* is the same as the physical setting described in Section 4.12.1.2 *Physical Setting (CEQA Baseline)*.

4.12.2 Environmental Consequences

4.12.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

Avoidance and minimization measures are those parameters that have been built into the design of the project and are committed to as part of project implementation. These measures are generally included in the alternatives description of this report (Section 3.8 *Action Alternatives Component Details*), but, where appropriate, the specific measures related to the impact evaluations are also summarized in the resource chapters.

The following AMMs would be implemented as part of the project design and would avoid or minimize adverse effects by ensuring that the future appearance of the levees blends in with the surrounding environment as much as possible:

- **AMM-AES-1: Stabilize Disturbed Areas:** Temporarily disturbed areas would be stabilized; bayward sides of the levee would be seeded if native vegetation did not establish on its own (see Appendix F *Shoreline Study Monitoring and Adaptive Management Plan for Ecosystem Restoration)*.

4.12.2.2 Methodology for Impact Analysis and Significance Thresholds

An alternative is considered to have a significant effect if it would:

- **Impact AES-1:** Have a substantial short-term negative aesthetic effect on the existing visual character or quality of the pond areas during construction;
- **Impact AES-2:** Have a substantial, demonstrable negative aesthetic effect on scenic vistas such as those associated with the Alviso Marina and the Refuge;
- **Impact AES-3:** Create a new source of glare that would adversely affect views in the area; or
- **Impact AES-4:** Have a substantial long-term negative aesthetic effect on the existing visual character or quality of the pond areas.

There are no roads in or near the study area that are designated as scenic highways in Federal or State plans for maintaining and enhancing scenic viewsheds. Accordingly, there would be no effects on State scenic highways, and no further analysis is necessary.

4.12.2.3 Alternatives Evaluation

4.12.2.3.1 No Action Alternative

The No Action Alternative would include activities to maintain pond dikes, activities that are consistent with current management and would not alter views of the study area. In the near term, the views of the ponds are not expected to change substantially, since the scale of the visual changes within the study area and its surroundings would be limited. Because ponds would be maintained similar to the existing condition, their visual character would not change. The ponds would still exhibit an open space character consistent with the surrounding baylands.

With No Action, ongoing restoration associated with the nearby SBSP Restoration Project and development associated with and adjacent to the Wastewater Facility will change the view from the Shoreline Phase I Study Area. These changes would occur with or without the project. Activity associated with the SBSP Restoration Project will change the appearance of some adjacent ponds, but these changes are consistent with the baseline landscape (undeveloped wildlife refuge) and would not substantially affect the local viewshed.

Development that is part of the Wastewater Facility and that is south of the facility along SR 237 will change the appearance of the transition area between the Shoreline Phase I Study Area and adjacent urban areas. Much of the expected development along SR 237 (office, research and development, light industrial, and commercial) will not be visible from the study area, and this type of development will be consistent with the physical setting that is currently present and expected over time. Changes in the appearance of the Wastewater Facility such as transitioning areas to burrowing owl habitat, wetlands, habitat easements, and recreation areas may improve scenic vistas from the study area, since these types of uses could enhance the visual transition between the study area and the operational area of the Wastewater Facility.

4.12.2.3.2 Action Alternatives

Impact AES-1: Have a substantial short-term negative aesthetic effect on the existing visual character or quality of the pond areas during construction

FRM levee construction would remove vegetation and disturb soil along the levee alignment. Potentially affected viewers of the levee would vary by specific alignment; however, they are expected to include recreation trail users, visitors to the Alviso Marina and the EEC, customers or employees of adjacent commercial development, and drivers along bayside roads. Bayward views from nearby residences are largely blocked by commercial development so that views from residential development would be least likely to be affected. Exposed soil in disturbed areas is expected to be lighter in color than that in surrounding undisturbed areas. Fill material placed along the levee alignment to construct the levee, bench, and transitional areas is expected to be lighter in color than the surrounding, undisturbed areas. As the levee is constructed, the light material would contrast in color and tone moderately with the surrounding areas in foreground views. In addition, the steep 3:1 slopes of the levee would strongly contrast in form with the flat topography of the area in foreground views. Middle views would be affected to a lesser extent, and background views are generally not expected to be affected. If viewers are very close to a levee, it would dominate the foreground, middle, and background views.

Four potential staging areas have been identified to support FRM construction (see the description in Section 3.5 *Flood Risk Management Options*). Staging Areas #1 and #2 are in disturbed areas of the Wastewater Facility (e.g., biosolid spreading), while Staging Area #3 is in a disturbed area of the Zanker Material Recovery Facility property. Viewers of these staging areas would be employees of the Wastewater Facility, the nearby Los Esteros Substation, and Zanker Material Recovery Facility. These areas are subject to industrial activities under the baseline condition (trucks and equipment operating, etc.). Thus, the nature of the activity is not dramatically different; however, there would be a greater massing of equipment (more vehicles) and more frequent activity associated with vehicles moving fill. Nonetheless, given the existing industrial nature of the setting, staging within Staging Areas #1 through #3 is not expected to degrade the long-term visual character or quality of the site, and the short-term activity is not inconsistent with baseline uses that affect the visual environment.

Staging Area #4 is within the eastern edge of Pond A12, is adjacent to an existing perimeter trail and New Chicago Marsh, and would support construction of the western portion of the levee. The setting would be similar to the view on Figure 4.12-4 *Existing View from Location 1 — View North from Trail within Alviso Marina.* Given the local topography, this area is not likely to be visible from the Alviso Marina, and views of the staging area would be limited to foreground views from the adjacent trail and railroad, while middle and background views would be similar to the baseline condition. As a result, staging in Staging Area #4 is not expected to degrade the visual character or quality of the area.

Staging areas would also be stabilized consistent with the project-specific SWPPP following construction (AMM-AES-1: Stabilize Disturbed Areas). Stabilization would reduce the contrast (color and texture) between the disturbed areas and areas that would not be subject to disturbance. Disturbed areas that are not part of the levee would return to preconstruction conditions over time as the sites revegetate and continue to stabilize.

Pond work would proceed in stages as described in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*, so that the disturbance footprint within the pond system would be limited at any one time. Ponds would be drawn down to prepare complete earthwork prior to breaching. During these activities, foreground views of ponds and wetlands would be converted to shallow pond, earth and mud, and equipment. Middle and background views would continue to be dominated by pond and wetland views. Many of these areas are more remote, so that the effects would be most pronounced in areas of higher access such as near Alviso Marina County Park or the Refuge EEC. However, the effects would also be limited in scale as well as duration and are not expected to substantially degrade the overall visual character or quality of the area.

Construction activity associated with the project would not substantially degrade the visual character or quality of the surrounding area. The impact would be less than significant.

Impact AES-2: Have a substantial, demonstrable negative aesthetic effect on scenic vistas such as those associated with the Alviso Marina and the Refuge

FRM levee construction would have temporary aesthetic effects along the levee alignment. Potentially affected viewers include Refuge user and visitors to the Alviso Marina and the EEC. The disturbance would be temporary as construction moves between levee segments and would therefore not have a significant effect on vistas from any given location.

The project would have a less-than-significant impact on scenic vistas.

Impact AES-3: Create a new source of glare that would adversely affect views in the area

Glare from construction may occur due to nighttime security lighting and if construction activity occurs after dark (such as truck traffic into and out of the staging areas after 6:00 PM; see Section 4.9 *Transportation* for information about allowable timeframes for truck traffic), this nighttime activity could require additional lighting in the construction staging areas. It is anticipated that equipment staging areas and construction field offices would be lighted to minimize vandalism and other illegal activities. The lighting would generally limited to that required for safety and would be oriented toward the ground. If additional lighting is needed for nighttime work, it would need to be sufficient to ensure worker safety. This type of lighting would be used temporarily and limited to active work periods. As a result of these types of nighttime lighting, adjacent viewers (residents) may see some “nighttime glow” in the vicinity of the staging areas. The glow is not expected to result in intrusive glare affecting the local community. With greater distance from the site, the minimal effect would be diminished further since the localized lighting would blend in with other urban lighting.

No new permanent sources of glare are anticipated to be introduced as a result of the project because no permanent lighting is proposed as part of any element of the project.

Construction could cause a temporary "nighttime glow," but overall the project would have a less-than-significant impact due to glare.

Impact AES-04: Have a substantial long-term negative aesthetic effect on the existing visual character or quality of the pond areas

FRM Levee

Construction of the FRM levee would change views within the study area and would vary by specific location and distance. The landward side of the levee likely would not be planted; however, over time, the levee material would weather and would become naturally seeded with grasses and small-scale vegetation. The bayward side of the levee would feature some planting.

Figure 4.12-1 *Proposed Alternatives and Existing Representative Levee Height Comparison* provides an example height comparison of a representative cross-section of existing non-engineered levee. The existing levees range from about 6 feet NAVD 88 high to 10 feet NAVD 88 high. The representative levee heights (indicated by the blue and red dashed lines) are12.5 feet NAVD 88 (Alternative 2) and 15.2 feet NAVD 88 (Alternatives 2, 3, 4, and 5).

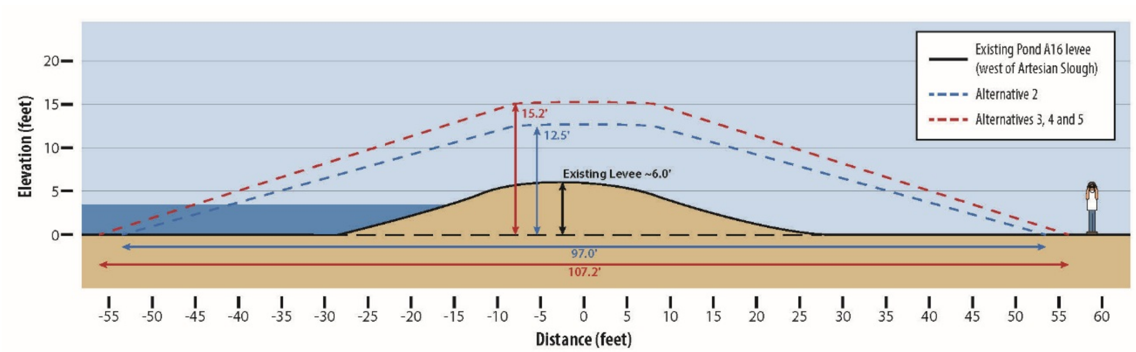

Figure 4.12-1. Proposed Alternatives and Existing Representative Levee Height Comparison

Figure 4.12-2 *Proposed and Existing Levee Height Comparison for Alternatives 3, 4, and 5 at Pond A16* provides a representative comparison for that section of the Alternative levee along the south side of Pond A16. The existing levee is about 10 feet NAVD 88 high in this location. Figure 4.12-2 *Proposed and Existing Levee Height Comparison for Alternatives 3, 4, and 5 at Pond A16* shows that a 15.2-foot NAVD 88 levee would add about 5 feet of height to the existing Pond A16 levee.

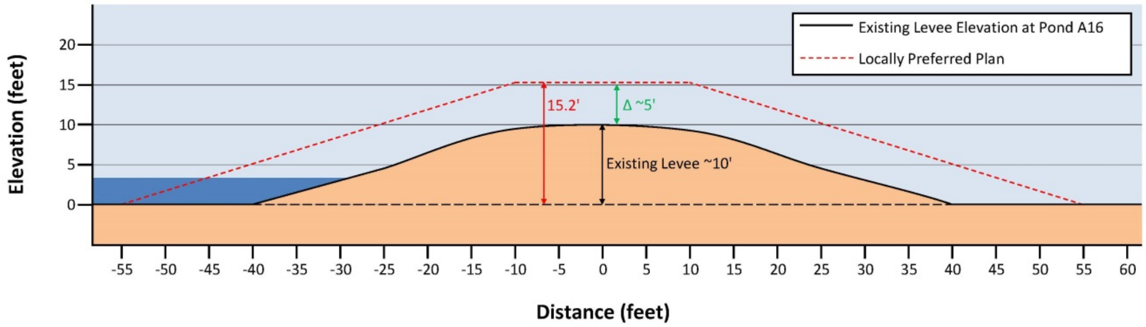

Figure 4.12-2. Proposed and Existing Levee Height Comparison for Alternatives 3, 4, and 5 at Pond A16

For nearby viewers such as recreationists, employees of commercial uses adjacent to a levee, ore residents living in areas close to an alignment, the levee would dominate foreground views and would block middle and background views. In this circumstance, the levee would be a strong contrast in color, shade, and form with the surrounding environment. In the long term, with weathering and natural restoration of the landscaping, the contrast in color and shade would be reduced.

With more distance, the levee would be prominent in the middle view and thus would represent a dominant feature in the landscape and may block background views (Figure 4.12-5 *Simulated View from Location 1 — View North from Trail within Alviso Marina of North and Railroad Levee Alignments (Alternatives 2, 3, and 4)*. In this circumstance, the levee would be a strong to moderate contrast in color, shade, and form with the surrounding environment. In the long term, the contrast in color and shade would be reduced, but the contrast in form is likely to remain prominent.

At moderate to greater distance, the levee would be mostly indiscernible (Figure 4.12-10 *Simulated View from Location 3 — View Northwest from Pacific Avenue North of State Street of Alviso Railroad Levee Alignment (Alternative 4)*. In this circumstance, the levee would be a minor or negligible contrast in color, shade, and form with the surrounding environment.

As illustrated by the above discussion, the closer the levee to the view/viewer, the more prominent the visual obstruction and affect. The contrast in shade would not be substantial, and would be reduced over time by weathering and natural seeding. The levee may function as a publicly accessible trail along some segments, and would provide more expansive views of the baylands than is currently afforded by the topography. The levee is not likely to cause substantial negative aesthetic effects on scenic vistas from Alviso Marina but would change the visual character from the EEC depending on the location of a viewer and the alternative. This sort of effect would be significant to nearby viewers but would not be significant to distant viewers.

Photographs of key locations (Figure 4.12-3 *Photograph Location Points*) within the study area were taken in June 2012 (Locations 1 through 4) and June 2014 (Location 5) and demonstrate current on-the-ground conditions. These were added to further illustrate the existing visual setting and to provide comparison with photographic simulations of the completed FRM levee. Photographs of the existing condition are provided for comparison and are also described below. Photograph simulations were prepared to illustrate views of the FRM levee alignments at five representative locations within the study area. A description of the views for the five locations with respect to each levee alignment follows. Table 4.12-1 *Summary of Aesthetic Impacts of the Action Alternatives on Visual Resources* compares the visual effects of the FRM levee for each alternative.

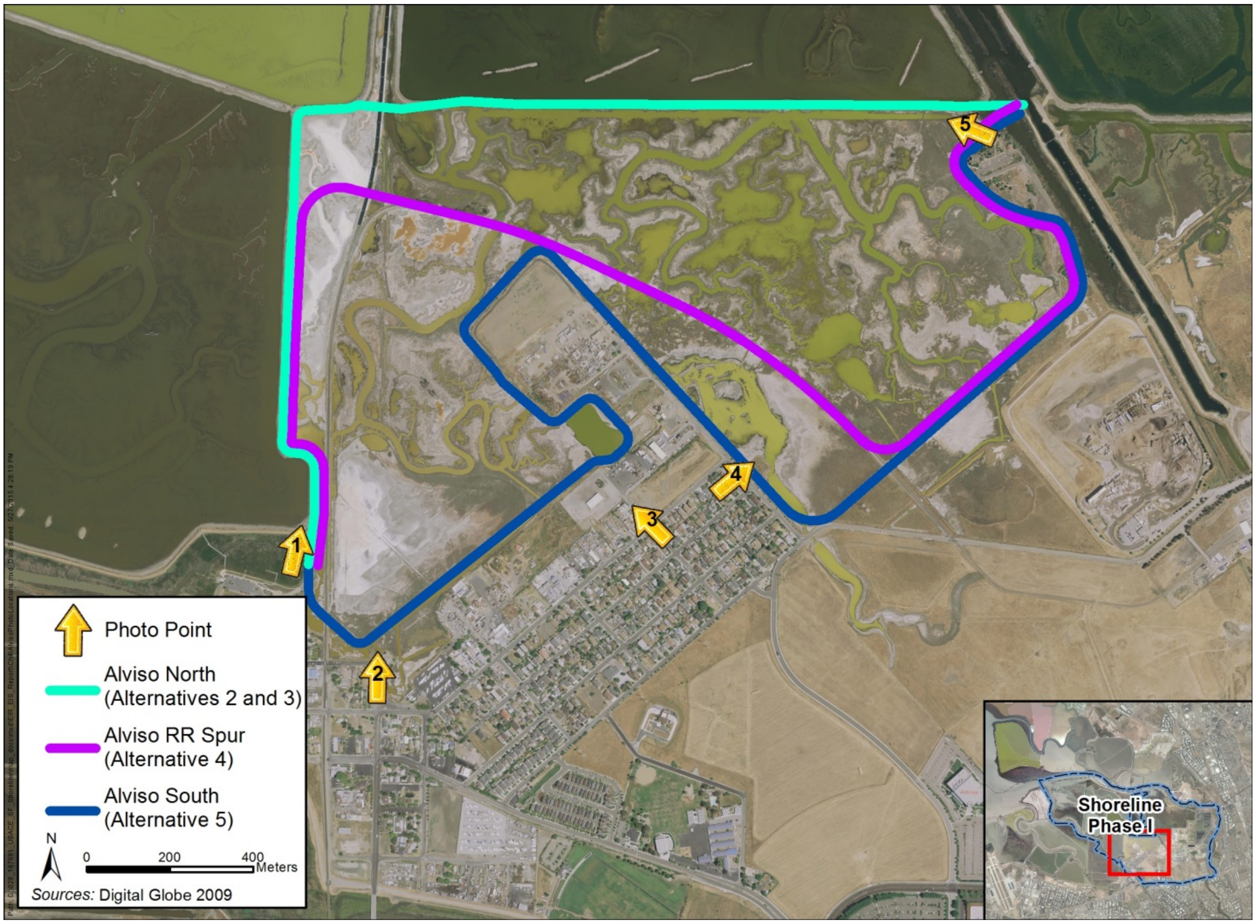

Figure 4.12-3. Photograph Location Points

Location 1

The view at Location 1 is from a trail within Alviso Marina, a county park (Figure 4.12-4 *Existing View from Location 1 — View North from Trail within Alviso* Marina). This view features foreground views of Pond A12; middle views of earthen flats and berms, railroad, and New Chicago Marsh (left side of the photograph); and background views of developed areas, expansive landscape, mountains, and sky.

Figure 4.12-4. Existing View from Location 1 — View North from Trail within Alviso Marina

The Alviso North (Alternatives 2 and 3) and Alviso Railroad (Alternative 4) levee alignments are illustrated on Figure 4.12-5 *Simulated View from Location 1 — View North from Trail within Alviso* Marina *of North and Railroad Levee Alignments (Alternatives* 2, 3, and 4). The Alviso South (Alternative 5) levee alignment would not be visible at this angle and is represented by the existing view (Figure 4.12-4 *Existing View from Location 1 — View North from Trail within Alviso* Marina).

Figure 4.12-5. Simulated View from Location 1 — View North from Trail within Alviso Marina of North and Railroad Levee Alignments (Alternatives 2, 3, and 4)

In this view, the Alviso North (Alternatives 2 and 3) and Alviso Railroad (Alternative 4) alignments would be prominent and would mostly block middle views of the adjacent New Chicago Marsh, while the Alviso South (Alternative 5) alignment would be on the landward side of New Chicago Marsh, so views from this location would be preserved. None of the alignments would obscure views within the Alviso Marina. In addition, views from the top of the levee would provide more-expansive views of the baylands than what are currently afforded by the topography. Therefore, the project would not have a demonstrable negative aesthetic effect on the marina’s scenic vista, nor would it substantially degrade the existing visual character or quality of the area surrounding the Alviso Marina for Location 1.

The impact would be less than significant.

Location 2

The view at Location 2 is from Elizabeth Street and Gold Street in the community of Alviso (Figure 4.12-6 *Existing View from Location 2 — View North from Elizabeth Street and Gold Street*). This view features foreground views of upland marsh vegetation, earth, and water channels; middle views of ponds and marshes, interior berms, and low-lying vegetated bluffs; and background views of buildings and structures, low-lying hills, and mountains and sky.

Figure 4.12-6. Existing View from Location 2 — View North from Elizabeth Street and Gold Street

The view of the Alviso North (Alternatives 2, 3) alignment is illustrated on Figure 4.12-7 *Simulated View from Location 2 — View North from Elizabeth Street and Gold Street of Alviso North* Levee Alignment (Alternatives 2 and 3), and the view of the Alviso Railroad (Alternative 4) alignment would be very similar. The Alviso South (Alternative 5) alignment is illustrated on Figure 4.12-8 *Simulated View from Location 2* — View North from *Elizabeth Street and Gold Street of Alviso South* Levee Alignment (Alternative 5).

Figure 4.12-7. Simulated View from Location 2 — View North from Elizabeth Street and Gold Street of Alviso North Levee Alignment (Alternatives 2 and 3)

Figure 4.12-8. Simulated View from Location 2 — View North from Elizabeth Street and Gold Street of Alviso South Levee Alignment (Alternative 5)

In this view, the Alviso North (Alternatives 2 and 3) and Alviso Railroad (Alternative 4) alignments would be a prominent backdrop in the middle view and would mostly block background views of distant landscape, foothills, and mountains. The Alviso South (Alternative 5) alignment would be much closer in this view, so that only the foreground would be preserved and the middle and background views would be levee.

For this location, Alternative 5 would substantially degrade the existing visual quality of the surrounding area. This impact would be significant under the CEQA. Other alternatives would not substantially degrade visual quality, and the impact would be less than significant.

Location 3

The view at Location 3 is from a commercial business at Pacific Avenue north of State Street (Figure 4.12-9 *Existing View from Location 3 — View Northwest from Pacific Avenue North of State Street*). This view features foreground views of commercial/industrial developed elements (paved areas, buildings, chain-link fences, trucks, and cars), middle views of medium-height vegetation, and background views of earthen berms and sky.

Figure 4.12-9. Existing View from Location 3 — View Northwest from Pacific Avenue North of State Street

The view of the Alviso Railroad (Alternative 4) alignment is illustrated on Figure 4.12-10 *Simulated View from Location 3 — View Northwest from Pacific Avenue North of State Street of Alviso Railroad* Levee Alignment (Alternative 4). Views of the Alviso North (Alternatives 2 and 3) and Alviso South (Alternative 5) alignments are illustrated on Figure 4.12-11 *Simulated View from Location 3* — View Northwest from *Pacific Avenue North of State Street of Alviso North Levee* Alignment (Alternatives 2 and 3) and Figure 4.12-12 *Simulated View from Location 3 — View Northwest from Pacific Avenue North of State* Street of Alviso South Levee Alignment (Alternative 5).

Figure 4.12-10. Simulated View from Location 3 — View Northwest from Pacific Avenue North of State Street of Alviso Railroad Levee Alignment (Alternative 4)

Figure 4.12-11. Simulated View from Location 3 — View Northwest from Pacific Avenue North of State Street of Alviso North Levee Alignment (Alternatives 2 and 3)

Figure 4.12-12. Simulated View from Location 3 — View Northwest from Pacific Avenue North of State Street of Alviso South Levee Alignment (Alternative 5)

In this view, the Alviso South (Alternative 5) alignment would be highly visible in the middle view but would not be overly prominent and would not degrade the visual character or quality of the area around Location 3. The levee would not be discernible with the Alviso Railroad (Alternative 4) and Alviso North (Alternatives 2 and 3) alignments.

The levee would have a less-than-significant impact to visual quality at Location 3 for all alternatives.

Location 4

The view at Location 4 is adjacent to Spreckles Avenue looking toward New Chicago Marsh (Figure 4.12-13 *Existing View from Location 4 — View Northeast near Spreckles Avenue*). This view features foreground views of roadway fence, trees, and grass; middle views of earth, berms, and brown vegetation; and background views of mountains and sky.

Figure 4.12-13. Existing View from Location 4 — View Northeast near Spreckles Avenue

Figure 4.12-14 *Alternative Simulated View from near Location 4 — View Northeast near Spreckles Avenue of Alviso North Levee Alignment (Alternative 3)* shows a simulated view of the Alviso North (Alternative 3) alignment. The pink line on Figure 4.12-14 *Alternative Simulated View from near Location 4 — View Northeast near Spreckles Avenue of Alviso North* Levee Alignment (Alternative 3) indicates the estimated top of the 15.2-foot NAVD 88 levee.

Figure 4.12-15 *Alternative Simulated View from near Location 4 — View Northeast from Grand Boulevard of Alviso North Levee Alignment (Alternative 3)* shows a simulated view from Grand Boulevard around the corner from (southwest of) the southeastern end of Spreckles Avenue. Figure 4.12-15 *Alternative Simulated View from near Location 4 — View Northeast from Grand Boulevard of Alviso North* Levee Alignment (Alternative 3) looks toward the Union Pacific Railroad tracks northeast of Location 4. Again, the pink line on Figure 4.12-15 *Alternative Simulated View from near Location 4 — View Northeast from Grand Boulevard of Alviso North* Levee Alignment (Alternative 3) indicates the estimated top of the 15.2-foot NAVD 88 levee.

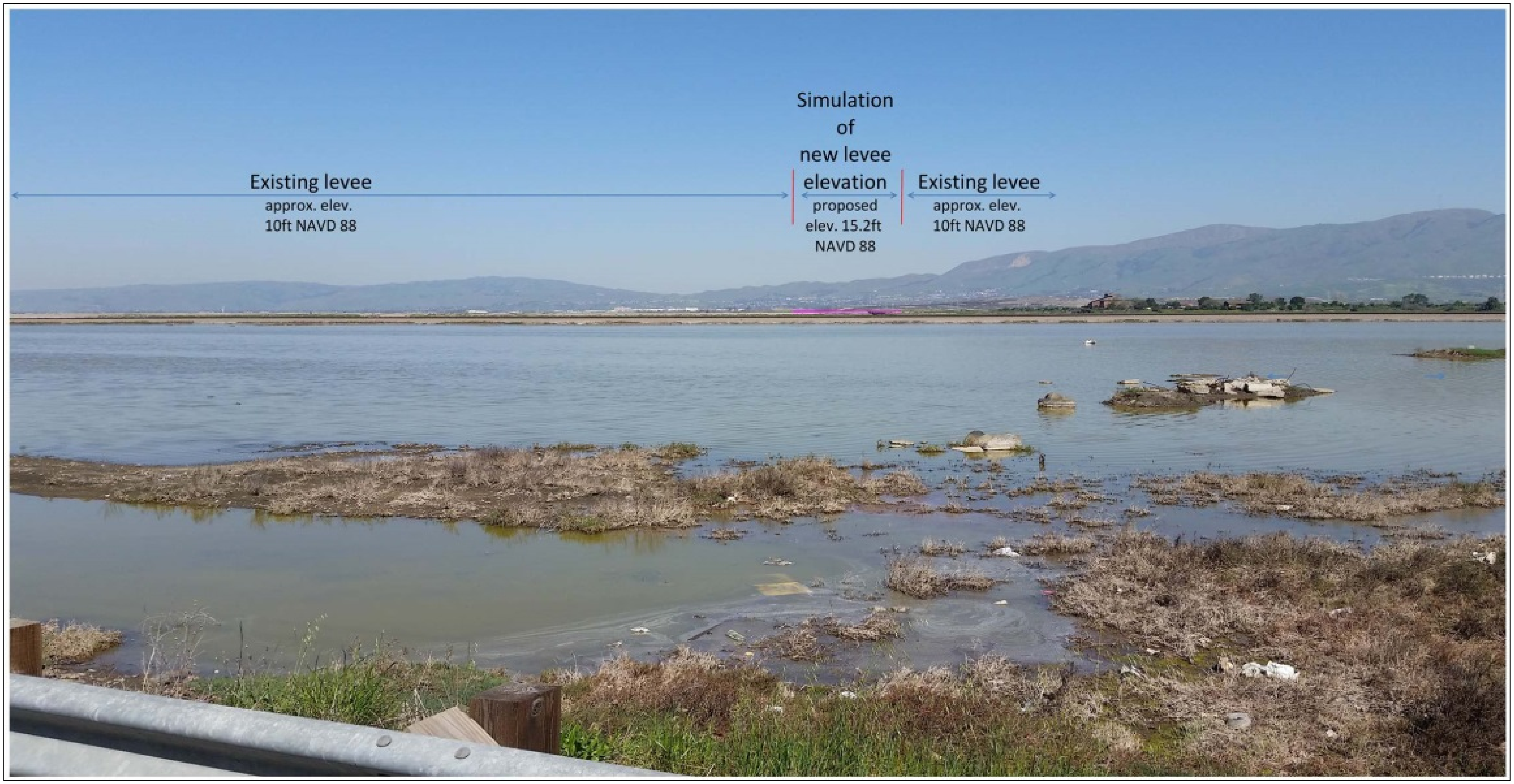

Figure 4.12-14. Alternative Simulated View from near Location 4 — View Northeast near Spreckles Avenue of Alviso North Levee Alignment (Alternative 3)

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Figure 4.12-15. Alternative Simulated View from near Location 4 — View Northeast from Grand Boulevard of Alviso North Levee Alignment (Alternative 3)

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The view of the Alviso South (Alternative 5) alignment is illustrated on Figure 4.12-16 *Simulated View from Location 4 — View Northeast near Spreckles Avenue of Alviso South* Levee Alignment (Alternative 5). The view of the Alviso Railroad alignment (Alternative 4) is illustrated in on Figure 4.12-17 *Simulated View from Location 4* — View Northeast near *Spreckles Avenue of Alviso Railroad Levee Alignment (Alternative 4)*. The Alviso North (Alternatives 2 and 3) alignment is not discernible in this view and would be the same as the existing view.

Figure 4.12-16. Simulated View from Location 4 — View Northeast near Spreckles Avenue of Alviso South Levee Alignment (Alternative 5)

Figure 4.12-17. Simulated View from Location 4 — View Northeast near Spreckles Avenue of Alviso Railroad Levee Alignment (Alternative 4)

In this view, the Alviso South (Alternative 5) alignment would be close, and the levee would obscure the middle and background views. The Alviso Railroad (Alternative 4) alignment would be set back farther but would still dominate the middle view and would substantially obscure the background view. *Alternatives 4 and 5 would substantially degrade the visual character of the area around Location 4 by blocking views of the Refuge. This impact would be significant under the CEQA.*

Location 5

The view at Location 5 is within the Refuge near the EEC (Figure 4.12-18 *Existing View from Location 5 — View Northwest within the Alviso Unit of the Refuge near the Environmental Education Center*). This view features foreground views of marsh vegetation and wetlands, middle views of trail features and marsh areas, and background views of foothills and sky.

Figure 4.12-18. Existing View from Location 5 — View Northwest within the Alviso Unit of the Refuge near the Environmental Education Center

Figure 4.12-19 *View from Location 5 — View Northwest within the Alviso Unit of the Refuge near the Environmental Education Center of Alviso North Levee Alignment (Alternative 2)* shows the view of the Alviso North alignment (Alternatives 2) from Location 5, while Figure 4.12-20 *Alternative View from Location 5 — View Northwest within the Alviso* Unit of the Refuge near the Environmental Education Center of Alviso North Levee Alignment (Alternative 3) shows the view of Alternative 3 (the pink line indicates the top of a 15.2-foot NAVD 88 levee).These alternatives differ in size, with the Alternative 3 (Proposed Project) levee being larger than the Alternative 2 levee.

Figure 4.12-19. View from Location 5 — View Northwest within the Alviso Unit of the Refuge near the Environmental Education Center of Alviso North Levee Alignment (Alternative 2)

Figure 4.12-20. Alternative View from Location 5 — View Northwest within the Alviso Unit of the Refuge near the Environmental Education Center of Alviso North Levee Alignment (Alternative 3)

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In this view, both of the Alviso North Alternatives' levees (Alternatives 2 and 3) would obscure background views of foothills and would change the middle view. In both cases, the levee would cross paths associated with access to the Refuge, requiring rerouting of a trail (i.e., existing boardwalk) over the levee as shown in the inset of Figure 4.12-19 *View from Location 5 — View Northwest within the Alviso* Unit *of the Refuge near the Environmental* Education Center *of Alviso North* Levee Alignment (Alternative 2). Refuge visitors would gain elevated views of the Refuge area from the top of the levee under either alternative. The Alternative 2 or Alternative 3 levee would be visible from within the Refuge and would change views from specific perspectives, having a moderate effect on the overall scenic quality of the site. *These alternatives would result in a moderate negative aesthetic effect, but this would not be substantial. The Location 5 aesthetic impact for Alternatives 2 and 3 would be less than significant.*

Figure 4.12-21 *View from Location 5 — View Northwest within the Alviso Unit of the Refuge near the Environmental Education Center of Alviso Railroad Spur or Alviso South Levee Alignment (Alternatives 4 and 5)* shows the view of the Alviso Railroad (Alternative 4) and Alviso South (Alternative 5) alignments from Location 5.

Figure 4.12-21. View from Location 5 — View Northwest within the Alviso Unit of the Refuge near the Environmental Education Center of Alviso Railroad Spur or Alviso South Levee Alignment (Alternatives 4 and 5)

In this view, the levee associated with either Alternative 4 or Alternative 5 would dominate the foreground and would completely obscure middle views and the background. These alternatives would substantially degrade the existing visual character and quality of the site and would cause a substantial negative aesthetic effect.

This impact would be significant under the CEQA.

Ecosystem Restoration

The creation of tidal habitat would alter the view of the ponds from its somewhat barren condition to that of a vegetated area with meandering water channels. Due to the flat topography and location, the changes may not be visible from recreation trails elsewhere in the Refuge and the Alviso Marina. The changes would be visible in short-range views from EEC trails, but it is likely that they would not be visible in medium- and long-range views due to the flat topography of the area, its surroundings, and the remote location.

Visual changes for project activities would be limited in extent, occurring only within the ponds where construction would occur. The overall visual character of the study area would not change substantially. Ponds would be converted to tidal habitat. The changes that would occur within the ponds would result in a more natural and less industrial visual character, which would be aesthetically beneficial. The tidal areas would eventually contain lush marsh vegetation which would provide visual contrast next to the geometric structures of the ponds.

The conversion of ponds to tidal habitat would change the industrial character of former polygonal-structured salt ponds to become more natural after levees are breached and many of the ponds are eventually filled in with sediment and become covered with marsh vegetation. Existing glare associated with sunlight on pond surfaces would change or be eliminated, depending on the specific activities and long-term adaptive management. While it might be different, the amount and quality of glare would not adversely affect views in the area.

Overall, the changes to the pond system are expected to substantially benefit the visual character and quality of pond area and surroundings. The changes would not affect scenic vistas from the Alviso Marina.

4.12.2.3.2.2 Comparison of Action Alternatives

Table 4.12-1 *Summary of Aesthetic Impacts of the Action Alternatives on Visual Resources* compares the aesthetics impacts of the action alternatives.

Table 4.12-1. Summary of Aesthetic Impacts of the Action Alternatives on Visual Resources

Alternative	Impact Summary
2 – Alviso North with 12.5-foot Levee and Bench	• Farthest away from the Alviso community and developed areas • May be dominant in middle views near Alviso Marina, but levee is lower in height than with Alternative 3 • Moderate visual impact at the Refuge where levee crosses trail • Bench on the bay side would provide some vegetation and break in form along certain segments
3 – Alviso North with 15.2-foot Levee and 30:1 Ecotone	• Farthest away from the Alviso community and developed areas • May be dominant in middle views near Alviso Marina • Moderate visual impact at the Refuge where levee crosses trail • Ecotone would provide shallow slopes along certain segments bayside of the levee, would include vegetation on these slopes, and would soften the contrast in form in these locations
4 – Alviso Railroad Spur with 15.2-foot Levee and Bench	• Intermediate distance from the Alviso community and developed areas • May be dominant in middle views near Alviso Marina (same as Alternative 2) • Significant visual impact to view adjacent to Spreckles Avenue looking toward New Chicago Marsh (View 4) • Significant visual impact at the Refuge due to levee obscuring views from EEC (View 5) viewing platform • Bench on the bay side of certain segments of the levee would provide some vegetation and break in form
5 – Alviso South with 15.2-foot Levee and Bench	• Closest to the Alviso community and developed areas; dominant views of levee along adjacent areas • Least visual impacts on views near Alviso Marina • Significant visual impact at Elizabeth and Gold Streets (View 2) due to impacts to middle and background views • Significant visual impact to view adjacent to Spreckles Avenue (View 4) looking toward New Chicago Marsh (same as Alternative 4) • Significant visual impact at the Refuge due to levee obscuring views from EEC viewing platform (View 5; same as Alternative 4) • Bench on the bay side of certain segments of the levee would provide some vegetation and break in form

Based on the above analysis, Alternatives 2 and 3 would have the least visual impacts. Alternative 2 would have a levee that is lower in height than the Alternative 3 levee but would lack the added value of the sloping ecotone. Alternatives 4 and 5 would have greater impacts than Alternatives 2 and 3 because they would be closer to the community of Alviso, impacting those views, and in addition, would substantially degrade views at the EEC.

4.12.3 Mitigation Measures

Alternatives 2 and 3 would not result in major effects under the NEPA or significant effects under the CEQA. No mitigation is necessary for these alternatives.

Alternatives 4 and 5 would cause major negative effects under the NEPA and significant effects under the CEQA. The levees are integral to the success of the project, and, without them, the project could not accomplish its purpose. No mitigation is available to reduce the effects of Alternatives 4 and 5 on visual character from Alviso to moderate or minor under the NEPA or to a less-than-significant level under the CEQA.

4.12.3.1 Residual Impacts and Additional Measures Necessary to Mitigate Significant Impacts

Alternatives 4 and 5 would result in major negative effects under the NEPA and significant effects under the CEQA. No mitigation is available to reduce these effects. Because of this, the aesthetics impacts associated with these alternatives remain.

4.12.4 Cumulative Effects

An introduction to cumulative effects is included in Section 4.1.8 *Cumulative Impacts Setting*, including a list of projects considered in this analysis. Past development has substantially changes the aesthetic value of the region resulting in a cumulatively significant impact.

Depending on the alternative selected, the Shoreline Phase I Project would cause minor less than significant (Alternatives 2 and 3) to major significant (Alternatives 4 and 5) project-related impacts related to aesthetics. Past, present, and reasonably foreseeable actions that could contribute to cumulative effects include other local restoration activity, such as that associated with the SBSP Restoration Project and the Wastewater Facility Plant Master Plan implementation, ongoing use and management of the Refuge, infill development in the community of Alviso, and regional development that affects background views such as development on hillsides to the east of the study area.

The construction of the levee for alternatives 4 and 5 would reduce the aesthetic value of the marsh from Alviso and this impact is cumulatively considerable in addition to being a project level impact. As discussed above in Mitigation Measures, there is no mitigation available to reduce the impact of a levee in close proximity to Alviso. Alternatives 4 and 5 would have an unavoidable cumulative impact. Alternatives 2 and 3 would have the levee aligned further from Alviso, and the impact would not be a substantial contribution to a cumulative effect for these alternatives.

The aesthetic effects of restoration activity associated with the SBSP Restoration Project would be similar to those described for the Shoreline Phase I Project. Most of the SBSP Restoration Project's negative impacts would be associated with construction activities, would be minor and short term, and would occur in a limited area. If SBSP Restoration Project construction is coincident with Shoreline Phase I Project construction, then the local impacts could be increased for people using the Refuge for recreation, but these construction impacts would be minor for both projects and separated by a distance of at least a few miles for trail users. The project would not result in a substantial contribution to construction-related aesthetic impacts.

Changes at the Wastewater Facility include both restoration and infrastructure development. The facility is already industrial in nature, so the aesthetic effects associated with infrastructure construction would be consistent with the current uses and would not be cumulatively considerable. Restoration activity that takes place at the facility could have minor, short-term, limited impacts. As described for the SBSP Restoration Project, if these impacts occur concurrent with Shoreline Phase I Project impacts (and SBSP Restoration Project impacts), then people using the Refuge might experience significant effects to the aesthetic environment. It is unlikely that all three projects would be working in the same area simultaneously. Because of this, it is unlikely that users would experience this type of significant cumulative effect.

Infill development in Alviso might have very limited aesthetic effects associated with active construction sites. However, since these effects would be physically removed from most of the Shoreline Phase I Project work area, they are not likely to combine and create a cumulatively considerable negative effect. In the long term, the visual effects of completed infill development are not expected to combine with the visual effects of the Shoreline Phase I Project to result in a cumulatively considerable negative effect.

Regional development is expected to occur consistent with adopted general plans and zoning codes. As development occurs over time, the background views are likely to change. Some municipalities have hillside-protection ordinances in effect that would protect the long-term vistas of these hillside areas. Project-related foreground changes associated with the long-term effects of restoration are not expected to combine with long-term background changes to cause cumulatively considerable effects on views of scenic vistas from the study area.

Finally, the Shoreline Phase I Project is expected to result in long-term beneficial effects to the overall aesthetic environment as areas are restored to tidal marsh. This effect, when combined with similar effects associated with the SBSP Restoration Project and restoration associated with the Wastewater Facility Plant Master Plan, would contribute to a long-term benefit to the aesthetic environment. The Proposed Project, in conjunction with other restoration projects, is expected to have a positive, cumulative aesthetic impact on the area.

4.12.5 Summary

Table 4.12-2 *Aesthetics NEPA Impact Conclusions* summarizes the project effects under the NEPA.

Table 4.12-2. Aesthetics NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
AES-01: A substantial short-term negative aesthetic effect on the existing visual character or quality of the pond areas during construction	Negative	Minor	Short term	Probable	Limited
AES-02: A substantial, demonstrable negative aesthetic effect on scenic vistas such as those associated with the Alviso Marina and the Refuge	Negative	Minor	Short term	Probable	Limited
AES-03: Create a new source of glare that would adversely affect views in the area	Negative	Minor	Short term	Possible	Local
AES-04: Have a substantial long-term negative aesthetic effect on the existing visual character or quality of the pond areas	Negative	Minor (Alt 2,3) Major (Alt 4,5)	Long term	Probable	Local

Table 4.12-3 *Aesthetics CEQA Impact Conclusions* summarizes the project effects under the CEQA.

Table 4.12-3. Aesthetics CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance After Mitigation
AES-1: A substantial short-term negative aesthetic effect on the existing visual character or quality of the pond areas during construction	AMM-AES-1: Stabilize Disturbed Areas	LTS (Alt 2,3) S (Alt 4,5)	None	LTS (Alt 2,3) S (Alt 4,5)
AES-2: A substantial, demonstrable negative aesthetic effect on scenic vistas such as those associated with the Alviso Marina and the Refuge		LTS	None	LTS
AES-3: Create a new source of glare that would adversely affect views in the area		LTS	None	LTS
AES-4: Have a substantial long-term negative aesthetic effect on the existing visual character or quality of the pond areas		LTS (Alt 2,3) S (Alt 4,5)	None (Alt 2,3) None available (Alt 4,5)	LTS (Alt 2,3) S (Alt 4,5)

LTS = less than significant
S = significant

Alternatives 2 and 3 would not cause any significant effects related to aesthetics. Alternatives 4 and 5 would result in significant aesthetic effects from the blocking of view and degradation of visual quality looking out from Alviso at new levees.

4.13 Noise

4.13.1 Affected Environment

This section describes the physical setting for noise in and around the Shoreline Phase I Study Area. This section focuses on the study area but also considers noise-generating uses near but outside of the study area such as transportation corridors and airports. Information in this section is based on studies completed in support of the SBSP Restoration Project Programmatic EIS/EIR, which was completed in 2007 (EDAW et al. 2007) and studies completed in support of the City of San José's General Plan (City of San José 2011).

4.13.1.1 Regulatory Setting

Noise is regulated in the Shoreline Phase I Study Area through implementation of local general plan policies and noise regulations and the State of California. Local general plans identify general principles intended to guide and influence development plans, and noise regulations set forth specific standards and procedures for addressing particular noise sources and activities.

The purpose of noise regulations is to protect the health and welfare of the public by minimizing excessive, unreasonable, and unnecessary noise. Each jurisdiction defines unacceptable noise levels and, in most cases, noise level standards and work hour limitations to achieve this goal.

4.13.1.1.1 City of San José

The City of San José's 2040 General Plan (City of San José 2011) identifies goals and policies to reduce noise impacts on people. Specifically, its goal is to minimize noise levels through noise-reduction and -suppression techniques as well as appropriate land-use policies. The City's acceptable exterior noise-level objective is 60 L_{dn} (day-night noise level) or less for residential and most institutional land uses (Policy EC-1.1). This standard applies to areas in the city except in the environs of the San José International Airport and the Downtown (City of San José 2011).

Title 20 of the City of San José Municipal Code provides exterior noise standards for specific land-use districts. Noise-level standards vary from a maximum noise level of 55 dBA (decibels on the A-weighted scale) (e.g., residential) to 70 dBA (e.g., industrial or open space next to industrial uses) unless a conditional-use permit is granted. The City of San José Municipal Code does not specify noise exemptions for construction activities (City of San José 2005a).

The general plan has a policy that specifically addresses construction-related noise. Policy EC-1.7 states that the City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would involve substantial noise-generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

The general plan also contains policies that address vibration. The City's goal is to minimize vibration impacts on people, residences, and business operations. Policy EC-2.3 requires new development to minimize vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, a vibration limit of 0.08 in/sec PPV (inches per second, peak particle velocity) will be used by this analysis to limit the potential for cosmetic damage to a building. A vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction.

4.13.1.1.2 Santa Clara County

The Santa Clara County General Plan (1994) sets noise compatibility standards for land use within the county as well as strategies and policies to keep residents free from noise that would affect their health and well-being. Satisfactory noise levels range from 45 to 55 L_{dn} for residential uses, hotel uses, parks, open space reserves, and wildlife refuges; 65 L_{dn} for public or semipublic facilities (churches, hospitals, nursing homes, schools, libraries, and civic buildings); 65 L_{dn} for other non-hotel commercial uses and agricultural uses; and 70 L_{dn} for industrial uses.

Relevant noise strategies, policies, and implementation include the following:

- **Strategy #1:** Prevent or Minimize Noise Conflicts.
  - **C-HS 24.** Environments for all residents of Santa Clara County free from noises that jeopardize their health and well-being should be provided through measures which promote noise and land-use compatibility.
  - **C-HS 25.** Noise impacts from public and private projects should be mitigated.
  - **C-HS(i) 25.** Prohibit construction in areas which exceed applicable interior and exterior standards, unless suitable mitigation measures can be implemented.

To promote public health, welfare, and safety, Chapter VIII, Section B-11, of the Santa Clara County Code prohibits unnecessary, excessive, and annoying noise (County of Santa Clara 2003). It sets maximum exterior noise limits for specific land uses during specified periods. Permissible noise levels range from 45 dBA for residential uses during the night (10:00 PM to 7:00 AM) to 75 dBA for heavy industrial uses anytime during the day. Residential public space noise levels are limited to 55 dBA during the daytime hours (7:00 AM to 10:00 PM). Higher noise levels are permitted for construction and demolition activities. The maximum noise levels for repetitively scheduled and relatively long-term operation of stationary equipment ranges from 60 to 70 dBA between 7:00 AM to 7:00 PM, depending on the land use. Permitted noise levels for nonscheduled, intermittent short-term operation increase by 15 dBA above the levels for stationary sources. Variances from the noise provisions may be authorized by the City, assuming that included permit conditions are protective of identified noise-sensitive uses.

The Santa Clara County Code also provides exterior noise limits for various categories of land uses that receive noise. For one- to two- story residential uses, noise levels cannot exceed 45 dBA for more than 30 minutes in any hour from 10:00 PM to 7:00 AM and 55 dBA for more than 30 minutes in any hour from 7:00 AM to 10:00 PM (County of Santa Clara 2003).

The County Code prohibits operating or permitting the operation of any device that creates a vibrating or quivering effect that endangers or injures the safety or health of human beings or animals; annoys or disturbs a person of normal sensitivities; or endangers or injures personal or real properties [County Code Sec. B11-154 (b)(7)].

4.13.1.1.3 State of California Airport Noise Standard

California Code of Regulations Title 21, Subchapter 6, contains regulations regarding airport noise standards. Section 5012 of this Code states that the standard for the acceptable level of aircraft noise for persons living in the vicinity of airports is a community noise equivalent level (CNEL) of 65 decibels. Airports must map the 65-CNEL noise exposure contour as part of the airport planning and operations processes.

4.13.1.2 Physical Setting (CEQA Baseline)

San Francisco Bay Area communities are primarily urban in character but also include open space and other undeveloped areas (including ecological reserves, wildlife refuges, and parks) that fringe the southern portion of the San Francisco Bay region and are scattered in and around the communities in the area. The following paragraphs provide background information regarding noise and vibration properties, noise-sensitive uses, and existing noise levels and sources.

4.13.1.2.1 Background: Noise Properties and Descriptors

Noise is any sound that is undesirable because it interferes with speech and hearing or is otherwise annoying (unwanted sound). If present in high intensities, loud sounds can cause hearing damage. Sound is measures in decibels (dB), a logarithmic ratio between pressures caused by a given sound and a reference sound pressure. The human ear is not equally sensitive to all frequencies or tones of sound. For this reason, it is standard to represent sound levels using a scale that approximates the way people perceive sounds—the A-weighted decibel scale, which is expressed as dBA.

Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 dB represents a ten-fold increase in acoustic energy, a 20-dB increase is 100 times more acoustic energy, a 30-dB increase is 1,000 times more acoustic energy, and so on. There is a relationship between the subjective noisiness or loudness of a sound and its decibel level. Each 10-dB increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities (Bies and Hansen 2009). A healthy human ear can typically perceive a 3-dBA change in sound levels, while smaller changes are typically imperceptible.

Noise can be generated by either mobile sources or stationary sources. Mobile sources include automobiles, trains, and airplanes, while stationary sources include construction sites, machinery, and industrial operations. Ambient or background noise sources can contribute substantially to the overall noise environment of an area. Background noise sources can include birds chirping, occasional vehicles passing by, or leaves rustling in the breeze. These background noises can determine the ambient noise environment in areas that are not dominated by a single major noise source.

Sound levels at a typical suburban single-family residence range from 45 dBA to 55 dBA. Sounds associated with freeway or highway traffic generally are louder, ranging from 65 dBA to 80 dBA, depending on the type, number, and speeds of vehicles on the road, the distance from the noise source (traffic) to noise-sensitive receivers (homes), and the topographic condition. The equivalent continuous sound level, or L_{eq}, is used to represent the acoustical energy of a fluctuating or changing sound such as traffic or construction noise.

The amount of noise reduction, or attenuation, attributed to a given area depends on the type of noise source and the terrain between the noise source and the receiver. For stationary sources, the rate of reduction is 6 dBA per doubling of distance. For example, if a stationary source generates a noise level of 60 dBA at 50 feet, the noise level at 100 feet for that source would be 54 dBA. For mobile sources, the rate of reduction ranges between 3 dBA and 4.5 dBA per doubling of distance.

Noise levels at a given location can usually be reduced by placing barriers between the noise source and the receiver. In general, a structure acts as an effective noise barrier only when the structure breaks the line, called the line-of-sight, between the noise source and the receiver. Buildings, walls, dense foliage, and intervening topography can all act as noise barriers in various situations.

4.13.1.2.2 Background: Vibration Properties and Descriptors

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several methods are typically used to quantify the amplitude of vibration, including peak particle velocity (PPV) and root mean square (RMS) velocity. PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. RMS velocity is defined as the average of the squared amplitude of the signal. PPV is typically used to evaluate vibration effects on buildings, while RMS velocity is typically used to evaluate human responses to vibration (FTA and BART 2006).

Table 4.13-1 *Reaction of People and Damage to Buildings from Continuous Vibration Levels* shows the reaction of people and the damage to buildings from continuous levels of vibration. Annoyance is a subjective measure, and vibrations can be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the person. To sensitive people, vibrations approaching the threshold of perception can be annoying.

Table 4.13-1. Reaction of People and Damage to Buildings from Continuous Vibration Levels

Vibration Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.006 to 0.019	Threshold of perception.	Vibration is unlikely to cause damage of any type.
0.08	Vibrations are readily perceptible.	Recommended upper level of vibration to which ruins and ancient monuments should be subjected.
0.10	Continuous vibrations begin to annoy people.	Virtually no risk of "architectural" damage to normal buildings.
0.20	Vibrations are annoying to people in buildings.	Threshold at which there is a risk of "architectural" damage to normal dwellings such as those with plastered walls or ceilings.
0.40 to 0.60	Vibrations are considered unpleasant by people subjected to continuous vibrations.	Vibration at this level would cause "architectural" damage and possibly minor structural damage.

Source: Caltrans 2002
PPV = peak particle velocity; in/sec = inches per second

Low-level vibrations frequently cause irritating secondary vibrations such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can lead to vibration complaints, even though there is little risk of structural damage. In loud noise environments, which are more prevalent where ground-borne vibration approaches perceptible levels, this rattling can also be produced when loud airborne environmental noise causes induced vibration in exterior doors and windows.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving, vibratory compaction equipment, and blasting typically generates the highest construction-related ground-borne vibration levels. Because of the impulsive nature of such activities, the use of PPV has been routinely used to measure and assess ground-borne vibration from construction activities (Caltrans 2002).

The two primary concerns with project-induced vibration, the potential to damage a structure and the potential to annoy people, are evaluated against different vibration limits. Studies have shown that the threshold of perception for the average person is a PPV in the range of 0.008 to 0.012 inches per second (in/sec). Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. People exposed to elevated ambient vibration levels, such as people in an urban environment, might tolerate a higher vibration level.

Vibration damage to buildings can be classified as cosmetic only, such as minor cracking of building elements, or structural damage, which could threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary depending on whether the vibrations are short-duration single events, such as from blasting, or continuous or repeated vibration events, such as from railroads or rail transit. The safe vibration limit from blasting is typically in the range of 2 in/sec, while the safe limit from continuous vibrations is typically 0.2 in/sec to prevent architectural damage to buildings (Caltrans 2002). Construction-induced vibration that can be detrimental to a building is very rare and has been observed only in instances when the structure is in poor condition and the construction activity occurs immediately next to the structure.

4.13.1.2.3 Noise Levels and Sources

In general, noise-sensitive land uses include uses when exposure to noise results in adverse health effects on humans and/or wildlife, as well as when quiet is a critical element of the intended function of the land use. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Other noise-sensitive land uses where low interior noise levels are essential include schools, hospitals, convalescent facilities, parks, hotels, offices, churches, and libraries (EDAW et al. 2007).

Sensitive receptors within the Shoreline Phase I Study Area are influenced by surface transportation noise emanating from vehicular traffic on nearby roadways, primarily I-880 and SR 237. Additional influences include aircraft en route to and from nearby airports, railroad operations along railway lines, highway- and development-related construction, office uses, and industrial/commercial uses. Other minor influences on the existing noise environment include intermittent noise from outdoor activities at surrounding residences in the community of Alviso, activities such as people talking, landscaping equipment operating, car doors slamming, and dogs barking. Ambient noise levels depend on the proximity to noise sources and their specified land uses in urban areas. For this reason, these noise levels are widely varied (EDAW et al. 2007).

The Alviso pond complex is located bayward from the cities of Fremont, San José, Sunnyvale, Mountain View, and Palo Alto and unincorporated Santa Clara County. The study area is within but does not include all of the ponds that make up the complex. According to Plan Bay Area (One Bay Area 2013), 2010 transportation-related noise levels in Santa Clara County were at or above the limit for noise-sensitive land uses (such as picnic areas and recreation areas) on 91 percent and 81 percent of freeway and expressway roadway miles, respectively (Dyett & Bhatia 2013).Figure 4.13-1 *2010 Noise Contours near the Shoreline Phase I Study Area* shows the 2010 noise contours for freeways and expressways in the city of San José and near the study area.

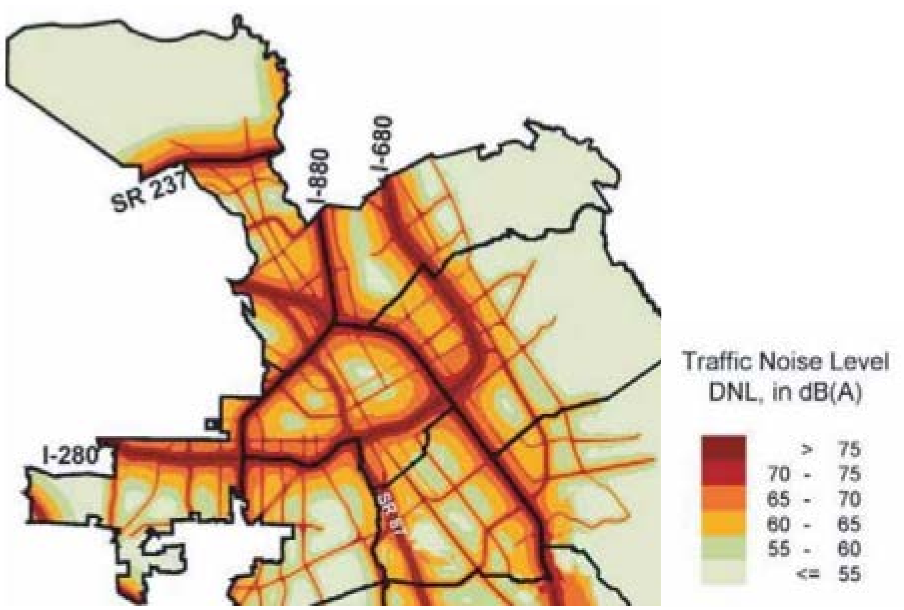

Figure 4.13-1. 2010 Noise Contours near the Shoreline Phase I Study Area
Source: Illingworth & Rocklin 2010 in City of San José 2011

According to the City of San José, the main sources of noise in the City's Alviso Planning Area, which includes most of the Shoreline Phase I Study Area, include SR 237 and I-880, railroad train operations along the Union Pacific Railroad line, and commercial aircraft from Norman Y. Mineta San José International Airport. A 2010 noise measurement made near SR 237 indicates an ambient noise level of 74 dBA. Other major noise-generating roads in the Alviso Planning Area include North First Street, Gold Street, Los Esteros Road, and Zanker Road. Noise-sensitive land uses are generally located in areas well away from stationary noise sources (e.g., Zanker Road Landfill) (City of San José 2011).

Currently, there are no major noise sources within the study area, with the exception of the railroad that crosses the study area in a north-south alignment along the eastern edge of Ponds A12, A13, and A15 (EDAW et al. 2007). Intermittent noises can be heard in the vicinity of recreational facilities (see Section 4.11 *Recreation* for a description of these locations).

Construction activity could be coincident with activity at the City of San José's bomb-disposal site (see Section 4.3.1.2.2 *San José* for a description of the disposal site). Activity at this site occurs about two to three times a month and typically results in noise that is about as loud as a handgun or shotgun shot. Vibration that is associated with the bomb-disposal site would not be detected at the WPCP South levee location. The frequency and level of noise and vibration associated with the bomb-disposal site would not substantially contribute to the overall noise and vibration environment.

The southern part of the study area is within the 60-CNEL (aircraft community noise equivalent level) noise exposure contour associated with the international airport. The study area is completely outside the 65-CNEL contour. By 2027, improvements in technology will shrink the size of the 60-CNEL contour, and the study area will also be outside the 60-CNEL contour.

Although residential dwellings are present in the community of Alviso, which abuts but is not within the Shoreline Phase I Study Area, there are no residential dwellings within the study area. Sensitive receptors in the study area include the Alviso Marina County Park, which is located in the southwestern corner, and the EEC, which is located along Artesian Slough on the north end of the NCM. In addition to developed areas of Alviso, other uses south and east of the study area include public service facilities (Wastewater Facility, solid waste disposal areas), commercial, and industrial uses. Areas to the west of the study area are also managed pond areas and areas restored to tidal marsh. Other nearby sensitive receptors are residences on Elizabeth Street at the southwestern corner of the study area (near the Alviso Marina).

4.13.1.3 National Environmental Policy Act and Engineer Regulation 1105-2-100: *Planning Guidance Notebook* Baseline Condition

For noise, the NEPA and the Planning Guidance Notebook baseline condition is determined by projecting how the condition might change between the current condition discussed in Section 4.13.1 *Affected Environment* and the start of construction. The primary noise sources near the study area are related to transportation, specifically traffic on SR 237, rail operations, and commercial aircraft. Rail operations are unlikely to change at the baseline condition, so noise levels associated with this use in 2017[4] would be the same as described in this section. According to the City of San José, the 2017 demand for passenger flights and air cargo flights at Norman Y. Mineta San José International Airport is expected to be the same as the 2010 level (City of San José 2010).

The transportation-related noise condition in the Shoreline Phase I Study Area is anticipated to remain constant. Given the VTA’s expectation to absorb forecasted ridership increase through efficiency improvements (see Section 4.9 *Transportation*), the condition is not anticipated to be different for the current condition. Other sources of ambient noise are also not expected to be different.

Therefore, the analysis contained in Section 4.11.2 *Environmental Consequences* assumes that the NEPA and the Planning Guidance Notebook baseline condition is the same as the physical setting described in Section 4.11.1.2 *Physical Setting (CEQA Baseline)*.

4.13.2 Environmental Consequences

4.13.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

The project includes a number of measures intended to avoid or minimize potential project-related noise impacts. Implementing these measures will not only minimize the effects

[4] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

associated with construction-related noise but will also avoid and minimize noise and vibration that could affect people and wildlife using areas near active work sites (e.g., birders and trail users). Avoidance and minimization measures include:

- **AMM-NOI-1: Work Hours –** Truck delivery and regular construction work hours will be restricted from 9:00 AM to 3:00 PM Construction also has seasonal restrictions as discussed in Section 4.6 *Aquatic Biological Resources* and Section 4.7 *Terrestrial Biological Resources*.
- **AMM-NOI-2: Wildlife Buffers** – Construction must maintain minimum buffers from sensitive wildlife species as discussed in Section 4.7 *Terrestrial Biological Resources*.
- **AMM-NOI-3: Noise Best Management Practices** – The contractor will implement practices that minimize disturbances to residential neighborhoods surrounding work sites, including:
  - Internal combustion engines will be equipped with adequate mufflers;
  - Excessive idling of vehicles will be prohibited;
  - All construction equipment will be equipped with manufacture's standard noise control devices;
  - The arrival and departure of trucks hauling material will be limited to the hours of construction; and,
  - The use of jake brakes is prohibited in residential areas.

4.13.2.2 Methodology for Impact Analysis and Significance Thresholds

4.13.2.2.1 Methodology for Analysis

The methodology for evaluating potential noise impacts from the proposed action is based on the procedures of International Standards Organization (ISO) 9613-2:1996, *Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation*. This international standard procedure is widely used for estimating and evaluating environmental noise over distances and is the basis for calculation protocols in numerous computer models, including CadnaA and SoundPlan. To be able to calculate estimate noise levels, such computer models require complex information on scheduling and daily duration of each noise-producing activity. Since detailed information was not available, this team instead uses simple spreadsheet calculations based on the ISO 9613-2:1996 standard. The procedure essentially involves determining the maximum noise levels during the various stages of noise-producing activities and then estimating those noise levels to the nearest noise-sensitive land uses, such as residences, schools, or parks.

Construction noise levels and noise impacts are directly related to the number and types of heavy equipment being used. The most comprehensive database of construction and heavy equipment source noise is maintained by the Federal Highway Administration (FHWA). The database was created in conjunction with the USEPA and is widely used for highway and non-highway projects. Table 4.13-2 *Equipment Source Noise and Acoustical Usage Factor* lists equipment noise source data and the acoustical usage factor, which is the percentage of time that the equipment is typically in use over a given period (FHWA 2006).

Table 4.13-2. Equipment Source Noise and Acoustical Usage Factor

Equipment	Peak Noise Level at 50 feet (dBA L_{max})	Acoustical Usage Factor (%)
Screen plant	87	50
Conveyors, belts, etc.	80	50
Pile hammer	101	20
Dozers	82	40
Front-end loaders	79	40
Backhoes	78	40
Graders	85	40
Scrapers	84	40
Excavators	81	40
Dump trucks	76	40
Compactors	83	20
Water trucks	76	40

Source: FHWA 2006
Key: dBA = decibels on the A-weighted scale; L_{max} = peak noise level

Noise levels are determined based on the L_{eq}, which is calculated from the peak noise level (L_{max}) and the acoustical usage factor using the following equation (FTA 2006):

$$L_{eq} = L_{max} + 10 \log(\text{usage factor})$$

Calculated noise levels are then estimated to the nearest noise-sensitive land use and compared to the local noise regulations to determine whether there would be a noise impact. If noise impacts are identified, appropriate mitigation measures would be developed to reduce the projected noise to a level below the local regulations.

For the purpose of evaluating noise levels against the local regulations, the study area would be categorized as the source property and would be an industrial land use. The receiving properties would consist of land uses around the study area and would include residential, commercial, recreation, public and industrial land uses. Table 4.13-3 *Noise Receivers near the Shoreline Phase I Study Area* lists the nearby receiving properties, the properties' designated land use, and the approximate distance from the nearest potential noise-generating activities from each alternative on the source property.

Table 4.13-3. Noise Receivers near the Shoreline Phase I Study Area

Property	Land Use	Distance in Feet to Nearest Activity		
		Alt. 2 & 3	Alt. 4	Alt. 5
Homes along State Street in Alviso	Residential	1,500	600	600
Homes along Elizabeth Street in Alviso	Residential	500	500	100
Homes along Spreckles Avenue in Alviso	Residential	2,700	800	70
Alviso Marina County Park	Recreation	50	50	50
Don Edwards Environmental Education Center	Recreation	200	50	50

4.13.2.2.2 Significance Criteria

A project alternative would have a significant noise or vibration impact if it would:

- **Impact NOI-1:** Expose people to or generate noise levels in excess of standards established in the City of San José's municipal code for land inside the city limits or the Santa Clara County Code standards for land in unincorporated areas of Santa Clara County
- **Impact NOI-2:** A substantial temporary or periodic increase in ambient noise levels in the project vicinity due to construction activities
- **Impact NOI-3:** Expose people to or generate excessive ground-borne vibration or ground-borne noise levels
- **Impact NOI-4:** A substantial permanent increase in ambient noise levels or vibration in the project vicinity above existing levels without the project
- **Impact NOI-5:** Exposure of people residing or working in the study area to excessive aircraft-generated noise levels.

As discussed in Section 4.13.1.1 *Regulatory Setting*, applicable noise-level standards vary depending on the local jurisdiction in which the noise levels or construction activity would occur. Because this project would not include changes to an existing airport and because the airport noise exposure levels currently experienced in the study area are not in excess of the 65-CNEL standard, the following analysis does not consider aircraft-generated noise impacts (Impact NOI-05).

4.13.2.3 Alternatives Evaluation

Five alternatives have been developed for the project, including the No Action Alternative. They are each described below.

4.13.2.3.1 No Action Alternative

Under the No Action Alternative, the project would not be constructed, and the current condition in the area would continue. There would be no change to current noise or vibration levels at noise-sensitive land uses around the study area as a result of project construction. Changes in the noise environment could occur over time with traffic increases and ongoing development in the area along SR 237. There are no other projects that would create a new permanent or temporary noise source that would be heard by sensitive receptors in the project area.

4.13.2.3.2 Action Alternatives

4.13.2.3.2.1 Construction Effects

Alternative 2

Impact NOI-1: Expose people to or generate noise levels in excess of standards established in the City of San José's municipal code for land inside the city limits or the Santa Clara County Code standards for land in unincorporated areas of Santa Clara County

Impact NOI-2: A substantial temporary or periodic increase in ambient noise levels in the project vicinity due to construction activities

Construction of Alternative 2 would include soil importation, levee construction, pond preparation, ecosystem restoration, and construction of recreation elements. This alternative places the Alviso section of the FRM levee along the north alignment and incorporates the WPCP South levee section alignment to construct a 12.5-foot NAVD 88 levee. Levee construction would occur between 2018 and 2021. Ecosystem restoration would include a 50-foot-wide bench to provide transitional habitat. The FRM levee and Pond A12 and Pond A18 transitional habitat construction would occur from 2019 to 2021. Ecosystem restoration activity would take place in stages over time, with breaches occurring in about 2020, 2025, and 2030. The contractor would minimize noise disturbances to neighbors and wildlife by implementing AMMs (AMM-NOI-1: Work Hours, AMM-NOI-2: Wildlife Buffers, AMM-NOI-3: Noise Best Management Practices**)**

Estimation of construction noise levels was based on the assumption that most or all of the equipment listed in Table 4.13-2 *Equipment Source Noise and Acoustical Usage Factor* would be utilized in the action alternatives. Based on the nature of the project, this study assumes that construction equipment would be continually moving throughout the construction area, with perhaps only two or three pieces of equipment operating simultaneously in any one area. Assuming three of the louder pieces of mobile equipment, such as a grader (85 L_{max}, 40-percent usage factor), a scraper (84 L_{max}, 40-percent usage factor), and a sheep's-foot compactor (83 L_{max}, 20-percent usage factor) operating simultaneously, the average noise level at 50 feet would be 84 dBA L_{eq}, using the formula in Section 4.13.2.2.1 *Methodology for Analysis* and common principles of acoustic addition.

The nearest receiver to the work sites for Alternative 2 would be the Alviso Marina County Park located near Hope Street and Mill Street, which is about 50 feet from the southwest corner of the construction area. Projecting the calculated noise level to a distance of 50 feet results in an estimated construction noise level of 84 dBA L_{eq} at this receiver. The other identified receiver would be the EEC located in the study area at the north end of Grand Boulevard, which is about 200 feet from the construction area. Projecting the calculated noise level to a distance of 200 feet results in an estimated construction noise level of 72 dBA L_{eq} at this receiver. Both of these receivers are recreational land uses. The nearest residential land use to the Alternative 2 construction would be the homes along Elizabeth Street in Alviso, which is about 500 feet from the nearest construction activities. Projecting the calculated noise level to a distance of 500 feet results in an estimated construction noise level of 64 dBA L_{eq} at these receivers. These estimated construction noise levels would exceed the limits in the San José Municipal Code.

The project would exceed local noise standards and cause significant temporary increases in noise levels in the project vicinity. These impacts would be significant.

If construction activity were to occur continuously for 12 months, the activity would be subject to a construction noise logistics plan consistent with the City of San José's general plan policy EC-1.7. Project work would take place over several years, and construction would never occur for 12 months at a time due to time restrictions based on the protection of fish and wildlife resources (see Section 4.6 *Aquatic Biological Resources* and Section 4.7 *Terrestrial Biological Resources*).

As part of Alternative 2 construction, about 775,587 cubic yards of fill soil would need to be imported from off-site borrow locations for the construction of the levee. Potential off-site borrow locations have not been identified but are assumed to be about 15 miles from the study area, resulting in a 30-mile round-trip haul route for dump trucks. All truck trips would need to occur between 9 AM and 3 PM each day (AMM-NOI-1), so the daily activity could be no more than 224 trips per day. Based on these constraints, Alternative 2 would require a period of about 133 work days or about 27 weeks to complete hauling to accomplish the fill soil importing, resulting in potential noise impacts on nearby noise-sensitive land uses along the haul routes for this duration. However, although borrow locations have not yet been identified, proposed haul routes would use existing truck routes and interstate highway facilities, which already have a substantial amount of truck traffic. The increase in truck trips would not be substantial enough to increase the ambient noise level of these routes.

The impact from haul route truck traffic for soil importing for this alternative would be less than significant.

Impact NOI-3: Short-Term Increase in Ground-Borne Vibration Levels.

Low to moderate levels of ground-borne vibration could be produced during much of the construction activities for Alternative 2. The movement of heavy equipment and pounding of pile-driving equipment during construction of the pedestrian bridges would produce the highest levels of ground-borne vibration. Ground-borne vibration dissipates rapidly with distance from the source, and, because the nearest sensitive residential receiver would be about 500 feet from the construction area, ground-borne vibration produced during construction would dissipate to below background levels before reaching residents. Therefore, this alternative would not expose people to excessive ground-borne vibrations from construction activities.

Construction-generated vibration would be less than significant.

Alternative 3

Impact NOI-1: Expose people to or generate noise levels in excess of standards established in the City of San José's municipal code for land inside the city limits or the Santa Clara County Code standards for land in unincorporated areas of Santa Clara County

Impact NOI-2: A substantial temporary or periodic increase in ambient noise levels in the project vicinity due to construction activities

Construction of Alternative 3 would be the same as for Alternative 2 except that the FRM levee would be 15.2 feet NAVD 88 in height and the transitional habitat would be a 30:1 ecotone. The same AMMs would be utilized.

Estimation of construction noise levels was based on the assumption that most or all of the equipment listed in Table 4.13-2 *Equipment Source Noise and Acoustical Usage Factor* would be utilized in the action alternatives. Based on the nature of the project, this study assumes that construction equipment would be continually moving throughout the construction area, with perhaps only two or three pieces of equipment operating simultaneously in any one area. Assuming three of the louder pieces of mobile equipment, such as a grader (85 L_{max}, 40-percent usage factor), a scraper (84 L_{max}, 40-percent usage factor), and a sheep's-foot compactor (83 L_{max}, 20-percent usage factor) operating simultaneously, the average noise level at 50 feet would be 84 dBA L_{eq}, using the formula in Section 4.13.2.2.1 *Methodology for Analysis* and common principles of acoustic addition.

As described for Alternative 2, the nearest receiver to the work sites for Alternative 3 would be the Alviso Marina County Park, which is about 50 feet from the southwest corner of the construction area. Projecting the calculated noise level to a distance of 50 feet results in an estimated construction noise level of 84 dBA L_{eq} at this receiver. The other identified receiver would be the Don Edwards EEC, as described for Alternative 2, which is about 200 feet from the construction area. Projecting the calculated noise level to a distance of 200 feet results in an estimated construction noise level of 72 dBA L_{eq} at this receiver.

The nearest residential land use to the Alternative 2 construction would be the homes along Elizabeth Street in Alviso, which is about 500 feet from the nearest construction activities. Projecting the calculated noise level to a distance of 500 feet results in an estimated construction noise level of 64 dBA L_{eq} at these receivers. These estimated construction noise levels would exceed the limits in the San José Municipal Code.

The project would exceed local noise standards and cause significant temporary increases in noise levels in the project vicinity. These impacts would be significant.

As described for Alternative 2, long-term construction activity (continuous for 12 or more months) would be subject to a construction noise logistics plan. Project work would take place over several years, and construction would never occur for 12 months at a time due to time restrictions based on the protection of fish and wildlife resources.

As part of Alternative 3 construction, about 860,000 cubic yards of fill soil would need to be imported from off-site borrow locations for the construction of the levee. Potential off-site borrow locations have not been identified but are assumed to be about 15 miles from the study area, resulting in a 30-mile round-trip haul route for dump trucks. Based on the maximum of 224 trips per day, fill soil importing would require about 148 work days or about 30 weeks, resulting in potential noise impacts on nearby noise-sensitive land uses along the haul routes. However, although borrow locations have not yet been identified, proposed haul routes would use existing truck routes and interstate highway facilities, which already have a substantial amount of truck traffic. The increase in truck trips would not be substantial enough to increase the ambient noise level of these routes.

The impact from haul route truck traffic for soil importing for this alternative would be less than significant.

Impact NOI-3: Short-Term Increase in Ground-Borne Vibration Levels

Low to moderate levels of ground-borne vibration could be produced during much of the construction activities for Alternative 3. As described for Alternative 2, the heavy equipment use and pile driving would produce the highest levels of ground-borne vibration. Ground-borne vibration dissipates rapidly with distance from the source, and, because the nearest sensitive residential receiver would be about 500 feet from the construction area, ground-borne vibration produced during construction would dissipate to below background levels before reaching the sensitive receivers. Therefore, this alternative would not expose people to excessive ground-borne vibrations from construction activities.

Construction-generated vibration would be less than significant.

Alternative 4

Impact NOI-1: Expose people to or generate noise levels in excess of standards established in the City of San José's municipal code for land inside the city limits or the Santa Clara County Code standards for land in unincorporated areas of Santa Clara County

Impact NOI-2: A substantial temporary or periodic increase in ambient noise levels in the project vicinity due to construction activities

Construction of Alternative 4 would differ from that of Alternatives 2 and 3 in the location of the Alviso levee segment. This alternative would place the Alviso section of the 15.2-foot NAVD 88 levee along an existing railroad spur alignment, and include a bench transitional habitat. The other project elements—pond preparation, ecosystem restoration, and recreation elements—would be similar to those for Alternative 2, including implementation of AMMs.

Estimation of construction noise levels would involve most or all of the equipment listed in Table 4.13-2 *Equipment Source Noise and Acoustical Usage Factor*. Based on the nature of the project, this study assumes that construction equipment would be continually moving throughout the construction area, with perhaps only two or three pieces of equipment operating simultaneously in any one area. Assuming three of the louder pieces of mobile equipment, such as a grader (85 L_{max}, 40-percent usage factor), a scraper (84 L_{max}, 40-percent usage factor), and a sheep's-foot compactor (83 L_{max}, 20-percent usage factor) operating simultaneously, the average noise level at 50 feet would be 84 dBA L_{eq}, using the formula in Section 4.13.2.2.1 *Methodology for Analysis* and common principles of acoustic addition.

The nearest receiver to the work sites for Alternative 4 would be the Alviso Marina County Park, which is about 50 feet from the southwest corner of the construction area. Projecting the calculated noise level to a distance of 50 feet results in an estimated construction noise level of 84 dBA L_{eq} at this receiver. With Alternative 4, the FRM levee would be much closer to the EEC; the levee construction area would be about 50 feet from the EEC, resulting in an estimated construction noise level of 84 dBA L_{eq} at this receiver.

The nearest residential land use to the Alternative 4 construction would be the homes along Elizabeth Street in Alviso, which is about 500 feet from the nearest construction activities. Projecting the calculated noise level to a distance of 500 feet results in an estimated construction noise level of 64 dBA L_{eq} at these receivers. These estimated construction noise levels would exceed the limits in the San José Municipal Code.

The project would exceed local noise standards and cause significant temporary increases in noise levels in the project vicinity. These impacts would be significant.

As described for Alternative 2 above, long-term construction activity (continuous for 12 or more months) would be subject to a construction noise logistics plan. Project work would take place over several years, and construction would never occur for 12 months at a time due to time restrictions based on the protection of fish and wildlife resources.

As part of Alternative 4 construction, about 909,469 cubic yards of fill soil would need to be imported from off-site borrow locations for the construction of the levee. Potential off-site borrow locations have not been identified but are assumed to be about 15 miles from the study area, resulting in a 30-mile round-trip haul route for dump trucks. Based on the maximum of 224 trips per day, fill soil importing would require about 156 work days or about 31 weeks, resulting in potential noise impacts on nearby noise-sensitive land uses along the haul routes. However, although borrow locations have not yet been identified, proposed haul routes would use existing truck routes and interstate highway facilities, which already have a substantial amount of truck traffic. The increase in truck trips would not be substantial enough to increase the ambient noise level of these routes.

The impact from haul route truck traffic for soil importing for this alternative would be less than significant.

Impact NOI-3: Short-Term Increase in Ground-Borne Vibration Levels

Low to moderate levels of ground-borne vibration could be produced during much of the construction activities for Alternative 4. As described for Alternatives 2 and 3, heavy equipment use and pile driving would produce the highest levels of ground-borne vibration. Ground-borne vibration dissipates rapidly with distance from the source, and, because the nearest sensitive residential receiver would be more than 500 feet from the construction area, ground-borne vibration produced during construction would dissipate to below background levels before reaching the sensitive receivers. Therefore, this alternative would not expose people to excessive ground-borne vibrations from construction activities.

Construction-generated vibration would be less than significant.

Alternative 5

Impact NOI-1: Expose people to or generate noise levels in excess of standards established in the City of San José's municipal code for land inside the city limits or the Santa Clara County Code standards for land in unincorporated areas of Santa Clara County

Impact NOI-2: A substantial temporary or periodic increase in ambient noise levels in the project vicinity due to construction activities

Construction of Alternative 5 would differ from that of the other alternatives in the location of the Alviso levee segment. This alternative would place the Alviso section of the 15.2-foot NAVD 88 levee along the south alignment, which would abut the community of Alviso, and include a bench transitional habitat. The other project elements—pond preparation, ecosystem restoration, and recreation elements—would be similar to those for Alternative 2, including implementation of AMMs.

Estimation of construction noise levels was based on the assumption that most or all of the equipment listed in Table 4.13-2 *Equipment Source Noise and Acoustical Usage Factor*, would be utilized in the action alternatives. Based on the nature of the project, this study assumes that construction equipment would be continually moving throughout the construction area, with perhaps only two or three pieces of equipment operating simultaneously in any one area. Assuming three of the louder pieces of mobile equipment, such as a grader (85 L_{max}, 40-percent usage factor), a scraper (84 L_{max}, 40-percent usage factor), and a sheep's-foot compactor (83 L_{max}, 20-percent usage factor) operating simultaneously, the average noise level at 50 feet would be 84 dBA L_{eq}, using the formula in Section 4.13.2.2.1 *Methodology for Analysis* and common principles of acoustic addition.

As described for the other action alternatives, the nearest receiver to the work sites for Alternative 5 would be the Alviso Marina County Park, which is about 50 feet from the southwest corner of the construction area. Projecting the calculated noise level to a distance of 50 feet results in an estimated construction noise level of 84 dBA L_{eq} at this receiver. The FRM levee construction area would also be about 50 feet from the EEC, as described for Alternative 4. The estimated construction noise level would be 84 dBA L_{eq} at this receiver.

The nearest residential land use to the Alternative 5 construction would be the homes along Spreckles Avenue in Alviso, which is about 70 feet from the nearest construction activities. Projecting the calculated noise level to a distance of 70 feet results in an estimated construction noise level of 81 dBA L_{eq} at these receivers. These estimated construction noise levels would exceed the limits in the San José Municipal Code.

The project would exceed local noise standards and cause significant temporary increases in noise levels in the project vicinity. These impacts would be significant.

Project work would take place over several years, and construction would never occur for 12 months at a time due to time restrictions based on the protection of fish and wildlife resources.

As part of Alternative 5 construction, about 912,847 cubic yards of fill soil would need to be imported from off-site borrow locations for the construction of the levee. Potential off-site borrow locations have not been identified but are assumed to be about 15 miles from the study area, resulting in a 30-mile round-trip haul route for dump trucks. Based on the maximum of 224 trips per day, fill soil importing would require about 157 work days or about 32 weeks, resulting in potential noise impacts on nearby noise-sensitive land uses along the haul routes. However, although borrow locations have not yet been identified, proposed haul routes would use existing truck routes and interstate highway facilities, which already have a substantial amount of truck traffic. The increase in truck trips would not be substantial enough to increase the ambient noise level of these routes.

The impact from haul route truck traffic for soil importing for this alternative would be less than significant.

Impact NOI-3: Short-Term Increase in Ground-Borne Vibration Levels

Low to moderate levels of ground-borne vibration could be produced during much of the construction activities for Alternative 5. As described for the other alternatives, heavy equipment use and pile driving would produce the highest levels of ground-borne vibration.

Ground-borne vibration dissipates rapidly with distance from the source, and, because the nearest sensitive residential receiver is more than 70 feet from the construction area, ground-borne vibration produced during construction would dissipate to near background levels before reaching the sensitive receivers. Therefore, this alternative would not expose people to excessive ground-borne vibrations from construction activities.

Construction-generated vibration would be less than significant.

4.13.2.3.2.2 Operation and Maintenance Effects

Impact NOI-4: Long-Term Increase in Noise Levels

Once construction of the necessary levee and habitat restoration features are complete, activity under any of the action alternatives would shift to operation and monitoring activities which would be the same for all alternatives. Regular maintenance would include occasional maintenance activities and would require the use of light-duty trucks and occasionally other equipment such as mowers.

Potential noise-producing operational activities would include the operation of pumps to move water into or out of managed ponds or for emergencies consistent with the current operation of the ponds complex. Pump stations would be located to minimize impacts on nearby noise-sensitive land uses. Assuming that a pump station is located 500 feet from a noise-sensitive land use and has an estimated operational noise level of 75 dBA L_{eq} at 50 feet, the projected noise at the noise-sensitive land use would be 55 dBA L_{eq}. This estimated operational noise level is within the limits specified in local regulations (Section 4.13.1.1 *Regulatory Setting*). Long-term operation would not generate or expose people to noise levels in excess of the City's standards and would not result in a substantial permanent increase in ambient noise levels in the project vicinity.

Operation-and-maintenance-generated noise would be less than significant.

Long-Term Increases in Vibration Levels. Possible vibration-producing activities from any of the action alternatives could include operation of pumps; however, the level of vibration produced by pump activity is expected to be minimal. Ground-borne vibration dissipates rapidly with distance from the source, and vibration-generating activities would not be located near vibration-sensitive receivers. Long-term operation and maintenance of any of the action alternatives would not expose people to or generate excessive ground-borne vibration.

Operation-and-maintenance-generated vibration would be less than significant.

4.13.2.3.2.3 Comparison of Action Alternatives

Table 4.13-4 *Summary of Noise Impacts from the Action Alternatives* summarizes the differences among the action alternatives.

Table 4.13-4. Summary of Noise Impacts from the Action Alternatives

Alternative	Maximum Noise Level during Construction (dBA L_{eq})			
	50 Feet from Construction Area	Alviso Marina	EEC	Nearest Residential Receiver
2 – Alviso North with 112.5-foot Levee and Bench	84	84	72	64
3 – Alviso North with 15.2-foot Levee and 30:1 Ecotone	84	84	72	64
4 – Alviso Railroad with 15.2-foot Levee and Bench	84	84	84	64
5 – Alviso South with 15.2-foot Levee and Bench	84	84	84	81

dBA = decibels on the A-weighted scale; EEC = Environmental Education Center; L_{eq} = equivalent continuous sound level

All four action alternatives would generate similar noise levels at a distance of 50 feet from the construction activity and at the Alviso Marina. Alternatives 2 and 3, which would place the levee on the north alignment, would result in lower construction noise levels at the EEC than would Alternatives 4 and 5, which would place the levee along the Alviso Railroad and Alviso South alignments, respectively. Alternatives 2, 3, and 4 would result in lower construction noise levels at the nearest residential receivers than Alternative 5, which would place the levee, and therefore construction activities, closer to residences.

No noise impacts are anticipated from the operation of any of the action alternatives.

4.13.3 Mitigation Measures

Because there is a potential for occasional noise levels above local jurisdictional noise standards and increases in temporary noise levels during construction activities, the following mitigation measure will be incorporated into construction activities to reduce noise levels. Implementing this measure will ensure that construction activity complies with local noise standards (which vary depending on the land-use designation) and will reduce noise impacts associated with construction. Keeping or reducing construction-related noise to the applicable allowable standard will reduce noise impacts to less than significant under the CEQA.

- **M-NOI-1:** The contractor will obtain a conditional-use permit from the City of San José to allow exceedances of the noise standard during construction activities. The contractor will comply with all provisions of the conditional-use permit, which are expected to include time-of-day restrictions, equipment setback requirements, notification requirements, equipment maintenance, and equipment muffler requirements. The contractor will monitor construction-related noise levels for a period of at least one hour daily during active construction for activity that is within 100 feet of the Alviso Marina, the EEC, or any residences. If noise levels exceed the levels permitted through the conditional-use permit or City of San José standards, the contractor will reduce the numbers of noise-generating equipment in use at any one time or install temporary noise barriers. After necessary noise control measures are implemented, the contractor will continue to monitor noise levels for a period of at least one hour daily during active construction to ensure that noise levels remain within the allowable standard(s).

As discussed in Section 4.13.1.1.1 *City of San José*, the San José Municipal Code does not provide an exemption for construction activities, so any exceedance would need a conditional-use permit. The contractor would need to apply for a conditional-use permit to allow occasional exceedance of the noise standards for the duration of the construction period, and construction activities would need to incorporate appropriate measures to reduce noise levels as provided in mitigation measure M-NOI-1.

With implementation of mitigation measure M-NOI-1 impacts from exceeding local noise standards and temporary increases in noise levels would be less than significant.

4.13.3.1 Residual Impacts and Additional Measures Necessary to Mitigate Significant Impacts

The identified mitigation measures are sufficient to reduce project- related potential noise impacts to a less-than-significant level. Implementing these measures will also reduce the project’s contribution to the ambient noise environment and cumulative effects to the Alviso community.

4.13.4 Cumulative Effects

Past development in the Bay Area has resulted in a substantial increase in noise throughout the region, representing a cumulatively significant impact. Ambient noise levels are affected by traffic on local roads and airport operations and are quite high in some parts of the south end of the study area. As shown on Figure 4.13-1 *2010 Noise Contours near the Shoreline Phase I Study Area*, traffic noise near the study area is highest along SR 237 and decreases with the distance from the road. Figure 4.13-1 *2010 Noise Contours near* the Shoreline Phase I Study Area also shows that noise along North First Street and Zanker Road is higher than in surrounding areas. Airport noise levels in the study area are currently below the State’s standard of 65 CNEL, but the south part of the study area near Alviso would be in the 60-CNEL contour during levee construction and ecosystem restoration construction activity. Periodic train traffic on the Union Pacific Railroad track also contributes to the ambient noise environment along with vehicle traffic and air traffic noise. These sources create an ambient environment that is much noisier than the part of the study area that is farther north in the study area.

Noise and vibration effects from the construction and operation of the proposed facilities with any of the action alternatives would be limited to the immediate area surrounding the study area. Other future construction activities that could occur concurrently include SBSP

Restoration Project Phase II activity associated with Ponds A19, A20, A21, and A8 and development that is consistent with the Wastewater Facility Plant Master Plan to areas adjacent to the Shoreline Phase I Project work area. Ongoing noise sources that would contribute to the cumulative condition include traffic noise associated with local roads and airport noise associated with the international airport.

Construction activity associated with the SBSP Restoration Project and Wastewater Facility projects would be required to comply with the city and county noise standards and mitigate for exceedances of those standards, if necessary. Like the Shoreline Phase I Project, these projects could result in and be permitted for temporary exceedances in compliance with a conditional-use permit, which means that all three projects could lawfully exceed the City's standards at times. SBSP Restoration Project construction areas would be farther removed physically from the Shoreline Phase I Project work areas, but work at the Wastewater Facility would be physically closer to the Shoreline Phase I Project work areas.

The chance that Shoreline Phase I Project construction would be concurrent with either the SBSP Restoration Project or Wastewater Facility construction is unlikely. Even if construction were concurrent, it is unlikely that the combined noise effect of the projects would exceed the City's standards at the same receiver at the same time. This is especially true for the SBSP Restoration Project because it is farther removed physically from residential areas associated with Alviso than either the Shoreline Phase I Project or the Wastewater Facility. The more likely scenario is that noise associated with construction of the Shoreline Phase I Project could combine with noise from construction and operation at the Wastewater Facility and thereby affect receivers in Alviso.

Because of the proximity of Alviso to area roads, the airport, the Union Pacific Railroad track, and the Wastewater Facility, the cumulative noise impacts experienced by people in the town could be significant, particularly if Shoreline Phase I Project construction activity is concurrent with construction activity at the Wastewater Facility. These impacts would be short term, and the construction season and time-of-day restrictions associated with the Shoreline Phase I Project would further limit the potential for cumulative effects to specific times of the day and year.

The Shoreline Phase I Project could result in noise impacts that contribute to the ambient noise environment and significantly affect people living in Alviso. Mitigation measure M-NOI-1 would reduce the incremental contribution of the project to overall noise in the area.

4.13.5 Summary

Table 4.13-5 *Noise NEPA Impact Conclusions* summarizes the project effects under the NEPA.

Table 4.13-5. Noise NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
NOI-1: Expose people to or generate noise levels in excess of standards established in the City of San José's municipal code for land inside the city limits or the Santa Clara County Code standards for land in unincorporated areas of Santa Clara County	Negative	Minor	Short term	Possible	Limited
NOI-2: A substantial temporary or periodic increase in ambient noise levels in the project vicinity due to construction activities	Negative	Minor	Short term	Probable	Limited
NOI-3: Expose people to or generate excessive ground-borne vibration or ground-borne noise levels	Negative	Minor	Short term	Probable	Limited
NOI-4: A substantial permanent increase in ambient noise levels or vibration in the project vicinity above existing levels without the project	Negative	Minor	Long term	Possible	Limited
NOI-5: Exposure of people residing or working in the study area to excessive aircraft-generated noise levels	No Impact	None	None	None	None

Table 4.13-6 *Noise CEQA Impact Conclusions* summarizes the project effects under the CEQA.

Table 4.13-6. Noise CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
NOI-1: Expose people to or generate noise levels in excess of standards established in the City of San José's municipal code for land inside the city limits or the Santa Clara County Code standards for land in unincorporated areas of Santa Clara County	AMM-NOI-1: Work Hours AMM-NOI-3: Noise Best Management Practices	S	M-NOI-1	LTS
NOI-2: A substantial temporary or periodic increase in ambient noise levels in the project vicinity due to construction activities	AMM-NOI-1: Work Hours AMM-NOI-2: Wildlife Buffers AMM-NOI-3: Noise Best Management Practices	S	M-NOI-1	LTS
NOI-3: Expose people to or generate excessive ground-borne vibration or ground-borne noise levels		LTS	None	LTS
NOI-4: A substantial permanent increase in ambient noise levels or vibration in the project vicinity above existing levels without the project		LTS	None	LTS
NOI-5: Exposure of people residing or working in the study area to excessive aircraft-generated noise levels		No Impact	None	No Impact

LTS = less than significant
S = significant

4.14 Public Health and Aviation Safety

This section discusses the impacts of the Shoreline Phase I Project on public health and aviation safety. This section primarily focuses on the potential health effects associated with mosquitoes, which are a common disease vector. Also included is a discussion of potential effects on aircraft-bird strike hazards.

4.14.1 Affected Environment

This section describes the public health and aviation safety physical setting. The description focuses on the Shoreline Phase I Study Area and neighboring residential areas of Alviso and is based on the condition in 2013.

4.14.1.1 Regulatory Setting

The regulatory setting for public health, including vector management, includes State and local requirements and/or guidelines, as described in the following sections. The regulatory environment for aircraft-bird strike hazards is based on Federal requirements.

4.14.1.1.1 Federal

The Federal Aviation Administration (FAA) regulates many aspects of aviation safety. However, its regulatory authority over land use beyond the boundaries of aviation facilities is limited.

Certain land uses such as wetlands may affect wildlife abundance and movement across airport flight paths, and in doing so could create or increase the risk of hazardous aircraft-wildlife collisions (aircraft-wildlife strikes). This issue has generated concern about proper planning and coordination of land use proposals, to avoid creating or increasing such hazards. A memorandum of agreement between the FAA, the U.S. Army, the U.S. Fish and Wildlife Service, and other agencies (Federal Aviation Administration et al., 2003) requires coordination between the identified agencies on the issue of aircraft-wildlife strikes.

The most recent Federal Aviation Administration (FAA) guidance on this subject, Advisory Circular 150/5200-33B, Hazardous Wildlife Attractants On or Near Airports (Federal Aviation Administration, 2007) addresses this concern and provides recommendations to avoid or minimize such hazards. In general, FAA concerns are greatest within 5,000 feet of airports serving piston-driven aircraft and within 10,000 feet of airports serving turbine-driven aircraft (jet and turboprop aircraft). Beyond these zones, FAA concerns extends out five miles from the airport if land uses may cause or increase bird movements into or across approach or departure airspace.

4.14.1.1.2 State

State regulations governing public health and vector management are described below.

4.14.1.1.2.1 California Occupational Safety and Health Administration

The California Occupational Safety and Health Administration (Cal/OSHA) assumes primary responsibility for developing and enforcing workplace safety regulations in California. Cal/OSHA regulations pertaining to the use of hazardous materials in the workplace (CCR, Title 8) include requirements for safety training, accident- and illness-prevention programs, hazardous substance exposure warnings, preparation of emergency action and fire-prevention plans, and availability of safety equipment, including personal protective equipment to shield individuals from exposure to harmful chemicals, such as those used for vector management.

4.14.1.1.3 Local

4.14.1.1.3.1 Santa Clara County Vector Control District

The Santa Clara County Vector Control District (Vector Control District) was formed in 1988 and is one of 12 special vector control districts in the San Francisco Bay Area. These special districts are charged with providing mosquito and general vector control pursuant to California Department of Health and Safety codes and California government codes. The Vector Control District is one of six special districts in the State wherein the County Board of Supervisors acts as trustee and funding is through a special property tax assessment. The Vector Control District offers a variety of services and information to help residents protect themselves and their families from animals and insects of medical importance (vectors).

These services include the following:

- Detection of the presence and prevalence of vector-borne diseases, such as plague, West Nile virus, rabies, and Lyme disease, through ongoing surveillance and testing
- Routine inspections, and treatment as necessary, of known mosquito and rodent sources
- Response to customer-initiated service requests for identification, advice, and/or control measures for mosquitoes, rodents, wildlife, and miscellaneous invertebrates (ticks, yellow jackets, cockroaches, bees, fleas, flies, etc.)
- Free educational presentations for schools, homeowners' associations, private businesses, civic groups, and other interested groups
- Free informational material on all vectors and vector-borne diseases

The Shoreline Phase I Study Area includes two Vector Control District technician zones, with one technician responsible for the salt marshes and community in the Alviso and Milpitas areas and one technician assigned solely to control mosquitoes at the Wastewater Facility. The vector-control districts provide services to non-Federal land in the study area region.

4.14.1.2 Physical Setting (CEQA Baseline)

The primary disease vector of concern within the study area is the mosquito. The Goals Project's Baylands Ecosystem Species and Community Profiles report (Maffei 2000a; Maffei 2000b; Maffei 2000c; Maffei 2000d; Maffei 2000e) discusses in detail the ecology of mosquitoes in the South Bay area, including preferred habitats, salinity tolerances, reproductive rates, flight characteristics, adult hosts, and vector/nuisance potential. Adult females feed on blood; the hosts vary depending on the species but include mammals, birds, reptiles, and amphibians. Adult males feed on plant juices, while larvae generally feed on particulate matter, unicellular algae, and other microorganisms. Larvae serve as prey for a variety of aquatic organisms, shorebirds, and waterfowl; birds such as the swallow and other insects feed on adult mosquitoes. Larval survivorship is typically low, with most losses attributable to predation. The rate of larval development is often a function of water temperature and food availability.

Mosquitoes cannot breed successfully in flowing water, but require stagnant water, persisting for 1 to 2 weeks to complete the life cycle. Mosquito larvae associated with permanent bodies of water generally live where the water is shallow (1 foot or less), and weeds, debris, emergent grasses or some sort of aquatic vegetation shelters the mosquito larvae from fish and other predators. Relatively few mosquito species actually breed in permanent bodies of water such as marshes or swamps; rather, they breed in temporary pools along the margins of these habitats. Marshes that lack vigorous tidal flow can provide suitable mosquito breeding habitat. However, marshes with sufficient tidal flow, lacking isolated puddles of stagnant water, would not provide mosquito breeding habitat.

Salt marshes at the southern end of San Francisco Bay produce a single seasonal brood of the winter salt marsh mosquito and multiple broods of the summer salt marsh mosquito each season. Because both of these mosquito species can fly considerable distances and are aggressive biters, control of mosquitoes at the source (i.e., in salt marshes) is necessary to reduce inconvenience and health concerns to humans in the South Bay area.

The Vector Control District's mosquito-control operations rely on an Integrated Mosquito Management strategy that considers and implements all possible mosquito-reduction techniques: biological, physical, and chemical control measures. Treatments are made only to areas surveyed via dipper and containing significant mosquito numbers. Some sites are inventoried and routinely surveyed during the year; other sites are discovered following public complaints. Physical control is achieved by working with wetland managers, such as the USFWS, the Santa Clara Valley Water District, and the Wastewater Facility to "design out" mosquito production or modify their operations to reduce mosquito potential. In salt marshes, attempts to control mosquito populations by ditching have resulted in marsh degradation. Ditching is not necessary to reduce mosquito populations in tidal marshes. Rather, well-functioning tidal marshes do not provide high-quality habitat for the most troublesome mosquito species in the San Francisco Bay Area, and maintenance and restoration of natural tidal flushing in these marshes is effective at limiting mosquito populations while sustaining the natural hydrology of the marsh (San Francisco Bay Joint Venture 2004).

Chemical control consists of various biorational compounds, which are pest-control materials that are relatively nontoxic with few ecological side effects: *Bacillus thuringiensis* var. *israelensis* (BTI), *Bacillus sphaericus* (BS), methoprene, and "duplex" (a combination of methoprene and BTI). New formulations called Fourstar are a combination of BTI and BS in slow-release briquettes. Surface-acting agents used included Agnique and refined petroleum distillates, which target nonfeeding late fourth instar larvae and pupae that are largely unaffected by bacterial toxins.

Mosquito-control practices by the Vector Control District within the Shoreline Phase I Study Area during the past 5 years have included hand, truck, and aerial applications. Application methods included hand-based treatments of granules and briquettes, "handcan" applications of liquid larvicide, truck or all-terrain vehicle (ATV)-based larvicide applications (both solid and liquid formulations), spreader applications of solid granules, and occasional helicopter and high-pressure sprayer applications. Those areas treated include Alviso Marsh, Arzino Ranch, Guadalupe River, Liberty storm drain, McCarthy Ranch Pump Station, New Chicago Marsh, Owens Corning Marsh, Pampered Farms, Wastewater Facility, Smith Yard Marsh, VTA Ponds, and Zanker Landfill Marsh.

Agreements made between the Vectors Control District and USFWS for the Refuge have excluded the use of amphibious or tracked aquatic ATVs from marshes at the Refuge, although travel on levies is allowed during the dry season. Thus, to effectively treat the diked the NCM for aggressive salt marsh mosquitoes, the Vector Control District must use a helicopter to reach otherwise inaccessible areas.

Use of petroleum distillates and Agnique, both surface-acting agents, is avoided where natural mosquito enemies such as diving beetles or nontarget waterboatmen (*Corixidae*) and brine flies (*Ephydridae*) are present.

Mosquitoes serve as vectors for several diseases that pose health concerns for humans and domestic animals. The western encephalitis mosquito is a vector of avian malaria and the main vector of western equine encephalitis and St. Louis encephalitis in the western United States (Maffei 2000f). Anopheles mosquitoes carry the organism that causes malaria. The West Nile virus is a mosquito-borne disease that has been found in parts of Asia, Eastern Europe, Africa, and the Middle East. First detected in the United States in 1999 in New York City, West Nile virus has since spread through most of the United States. West Nile virus is typically spread from an infected mosquito, usually in the genus *Culex*, to a bird that then disperses or migrates, spreading the virus after being bitten by other mosquitoes. Most people and domestic animals that become infected with the virus have few or no symptoms, but in rare cases they can become seriously ill. In 2006, West Nile virus was detected in 54 of 58 California counties, with 276 human infections from 30 counties in California (State of California 2006). In 2006, 58 infections of horses from 23 counties in California were reported, along with 1,446 dead birds that tested positive for the virus.

FAA land use concerns with respect to wildlife extend up to five miles from the operational area of airports. Two airports are within five miles of the study area: Norman Y. Mineta San José International Airport and Moffett Federal Airfield. No airport is within 10,000 feet of the study area (Figure 4.14-1. Vicinity of Project to Moffett Federal Airfield and San Jose International Airport).

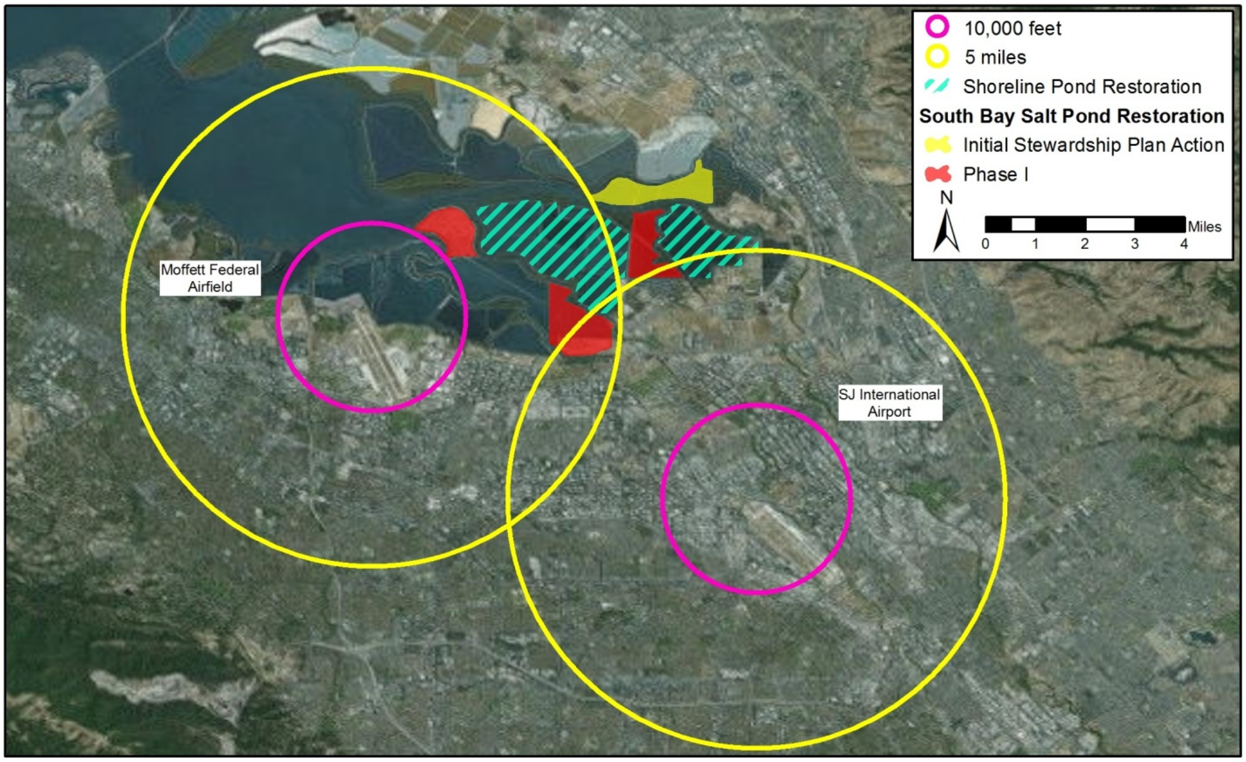

Figure 4.14-1. Vicinity of Project to Moffett Federal Airfield and San Jose International Airport

Both airports serve turbine-powered aircraft. Norman Y. Mineta San José International Airport is a major civilian airport and served 9,385,212 passengers in 2014. Moffett Federal Airfield is a joint civilian-military airfield owned and operated by NASA Ames Research Center.

4.14.1.3 National Environmental Policy Act and Engineer Regulation 1105-2-100: *Planning Guidance Notebook* Baseline Condition

For public health and aviation safety, the NEPA and the Planning Guidance Notebook baseline condition is determined by projecting how the condition might change between the current condition discussed in Section 4.14.1 *Affected Environment* and the start of construction. Because the amount and type of suitable mosquito and bird habitat are not expected to change between the current condition and the baseline condition, the NEPA and the Planning Guidance Notebook baseline condition is the same as the physical setting described in Section 4.14.1.2 *Physical Setting (CEQA Baseline)*.

4.14.2 Environmental Consequences

4.14.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

Avoidance and minimization measures are those parameters that have been built into the design of the project and are committed to as part of project implementation. These measures are generally included in the alternatives description of this report (Section 3.8 *Action Alternatives*

Component Details), but, where appropriate, the specific measures related to the impact evaluations are also summarized in the resource chapters.

- **AMM-HEA-1: Coordinate with Vector Control District** – The City of San José and the Refuge will continue to coordinate with the Vector Control District and the USFWS for ongoing management of vector issues. This AMM would avoid and minimize effects associated with mosquito populations in the Shoreline Phase I Study Area.

4.14.2.2 Methodology for Impact Analysis and Significance Thresholds

Section 4.1 *Approach to the Environmental Analysis* discusses the general methodology for evaluating environmental impacts under the NEPA and the CEQA, with resource-specific content discussed in this section.

An alternative is considered to have a significant effect on public exposure to disease if it would:

- **Impact HEA-1:** Create a significant hazard to the public through exposure to disease vectors (mosquitoes).
- **Impact HEA-2:** Create a substantial increase in the need for vector (mosquito) management.

An alternative is considered to have a significant effect on aircraft-bird strike hazards if it would:

Impact ABS-1: Create a significant hazard to the public through increasing aircraft-bird strike hazards above current levels.

4.14.2.3 Alternatives Evaluation

4.14.2.3.1 No Action Alternative

Without implementation of the project, the Alviso pond complex would continue to operate as a closed pond system, and freshwater discharges from Coyote Creek and the Guadalupe River would continue. With the No Action Alternative, mosquitoes would continue to use suitable (stagnant water for breeding) habitat, the Vector Control District would continue to provide vector-control services to non-Federal land in the study area, and the USFWS would continue to manage vectors consistent with the Comprehensive Conservation Plan (CCP) and its mosquito management plan.

With the No Action Alternative, the Alviso pond complex would continue to operate as a closed pond system with current levels of bird use. Species abundance, seasonal use patterns, and bird movements would continue in a manner similar to current conditions. Aircraft-bird strike hazards would remain unchanged.

4.14.2.3.2 Action Alternatives

This section describes the public health effects resulting from the action alternatives. Section 4.14.2.3.2.1 *Construction Effects* and Section 4.14.2.3.2.2 *Operation and Maintenance Effects* describe the impacts common to all action alternatives, while Section 4.14.2.3.2.3 *Comparison of Action Alternatives* describes any differences in the impacts on public health among the action alternatives.

4.14.2.3.2.1 Construction Effects

Impact HEA-1: Create a significant hazard to the public through exposure to disease vectors

Pond preparation includes active or passive draining of managed ponds. Large areas of drained ponds would be disturbed by construction equipment, but more-isolated areas could contain shallow puddles and support temporary mosquito breeding. These areas would need to persist for 1 to 2 weeks in order to support mosquito breeding and would be a greater potential problem in warmer months. Such areas would be limited in both duration and extent as construction would continuously move along the project footprint, and many of these areas would not be close to residential areas in Alviso. People using the Refuge for recreation might be exposed to mosquitoes, but this type of exposure already exists in areas with suitable mosquito habitat. Construction of any of the action alternatives would not create a significant hazard to the public through exposure to disease vectors.

Hazards to the public through exposure to disease vectors during construction would be less than significant.

Impact HEA-2: Create a substantial increase in the need for vector management

The pond areas would continue to be monitored by the Vector Control District and the USFWS as they are under the baseline condition (AMM-HEA-1: Coordinate with Vector Control District), and the Vector Control District or the USFWS could implement or recommend corrective action to reduce or eliminate breeding habitat during construction. If additional treatment beyond what is normally administered is required, this potential increase in treatment area would be limited to active construction areas and would not be likely to result in a substantial increase in the need for vector management. This impact is less than significant.

Project impacts to increased need for vector management would be less than significant during construction.

4.14.2.3.2.2 Operation and Maintenance Effects

Impact HEA-1: Create a significant hazard to the public through exposure to disease vectors

An increase in vegetated wetlands could result in increased mosquito populations, if these wetlands support suitable mosquito breeding habitat for extended periods of time. However, well-drained tidal wetlands are not expected to host large mosquito populations, and restoration of tidal wetlands with extensive channel networks is not expected to increase mosquito numbers substantially. Tidal restoration would target the restoration of large, well-drained marshes. Restoration techniques such as breaching pond dikes in the locations of remnant sloughs and blocking borrow ditches would be implemented to facilitate the development of well-drained marshes. Local vector-control agencies have said that they would prefer to see more tidal restoration than continued pond management (EDAW et al. 2007).

Although well-drained tidal marshes are not expected to increase mosquito production, marsh ponds and pannes that are vegetated may support mosquitoes. In addition, the upland transition zones that would be created along the upper edges of restored marshes could provide pools that may support mosquitoes. As a result, there is some uncertainty regarding the effects of the ecosystem restoration on the need for vector control. Because tidal marshes generally do not support large mosquito populations and because the amount of edge habitat would not be substantial, long-term operation of the wetland area would not be likely to result in a substantial increase in the need for vector management. Long-term effects would be less than significant and may prove to be beneficial over time.

Hazards to the public through exposure to disease vectors during operation and maintenance would be less than significant.

Impact HEA-2: Create a substantial increase in the need for vector management

Similar to their activities under the existing condition, the Vector Control District and the USFWS would continue to monitor these areas, make recommendations for effective management, and take corrective action if warranted. Because current management by the Vector Control District and the USFWS is successful and is expected to continue to be successful, the Shoreline Phase I Project is not expected to create increased need for vector management.

Project impacts to increased need for vector management would be less than significant during operation and maintenance.

Impact ABS-1: Create a significant hazard to the public through creating new or increased hazards of aircraft-bird strikes

Increases in total bird numbers or specific bird species which present particular strike hazards, or new or increased movements of birds across approach or departure areas for an airport, could increase the risk of strikes between aircraft using that airport and birds. This could present an increased risk of death or injury to passengers and crew.

Management of former salt ponds and their potential conversion to tidal habitats has resulted in concerns over possible effects on risks to aircraft from birds utilizing these areas. For instance, these concerns were expressed in comments on the DEIS for the South Bay Salt Pond Study (EDAW, et al., 2007), a comment from the Air Force on the FEIS for that study (U.S. Air Force, 2008), and in the FAA comment letter on this report dated May 21, 2015 in response to the Draft Integrated Document (see Appendix H).

For any project alternatives within five miles of either airport, the letter requested an evaluation of "...whether the proposed habitat improvements could cause wildlife hazardous aircraft operations such as waterfowl, shorebirds, gulls, or raptors to move into or across approach or departure airspace..." The letter also provided additional recommendations in the event that this evaluation found that such hazards could occur.

An evaluation of bird strike analysis was performed on the potential for the alternatives to cause birds "to move into or across approach or departure airspace". This evaluation included a review of the SBSP Restoration Project's analysis of potential bird strike hazards, review of monitoring data collected during implementation of several salt ponds, and consultation with professionals responsible for the planning, implementation, and operation of ponds restored to tidal marsh habitat in the south bay. The evaluation included a review of the consideration of factors affecting bird use of differing habitats in the South Bay. In general, the managed ponds in the Don Edwards San Francisco Bay National Wildlife Refuge receive heavy bird use, including waterfowl and shorebirds, with the relative abundance of various species and guilds depending on pond conditions at a given time. Tidal mudflats can also receive substantial shorebird use at low tide, but tidal marshes in San Francisco Estuary have much lower bird numbers than other tidal habitats and generally do not favor the particular kinds of birds mentioned in the FAA letter.

This issue was discussed in EDAW, et al. (2007), Appendix O, in the master response to aircraft bird strikes for the final EIS/EIR for the South Bay Salt Pond Study. This discussion was in response to letters from Air National Guard units and others expressing concern over future management of ponds in close proximity to Moffett Federal Airfield. The EIS/EIR proposed some of the ponds for retention as ponds, and others for restoration to tidal marsh in a manner similar to the tidal marsh restoration included in the current study alternatives. With regard to the latter, the response states:

> *Bird communities are expected to shift immediately after tidal action is restored. Small shorebirds are likely to use new tidal flats for foraging, and as vegetation develops over the next several years, the bird community will likely shift to low numbers of rails, large shorebirds, and herons and egrets. This habitat is initially not likely to support songbirds or large numbers of raptors, although songbirds and Northern Harriers will use vegetated salt marsh that eventually develops within these ponds. Although water birds will use the mudflats and shallow-water habitats of ponds newly restored to tidal action, the number of water birds present in these ponds will slowly decrease as vegetated marsh develops and spreads. Eventually, the restoration of these ponds to tidal salt marsh has the potential to reduce bird strikes near Moffett Federal Airfield by reducing the number of gulls, terns, and waterfowl using the ponds immediately north of the northern end of the runway.*

The most recent bird monitoring report from the South Bay Salt Pond Restoration Project for a number of ponds in the South Bay (San Francisco Bay Bird Observatory, 2015) showed mixed results for five ponds which have been breached over the last ten years. Comparing total bird numbers in these ponds as a percentage of bird use in all ponds, adjusted for acreage, shows no clear tendency towards higher or lower bird numbers in comparison to unbreached managed ponds.

Total bird use in the breached ponds was ten percent higher per acre than for all ponds sampled, but the increase is due to a small cluster of breached ponds in the Eden Landing area in Hayward which are not representative of the Alviso ponds. The two breached ponds in the Alviso area, which are relatively similar to the current study area ponds in terms of site elevation and local environment (A6 and A19) showed a 23% to 29% lower per-acre bird use than average.

This issue was coordinated with the South Bay Salt Pond Project (John Bourgeois, 2015) and the Don Edwards San Francisco Bay National Wildlife Refuge (Cheryl Strong, 2015). These discussions corroborated the findings in the above paragraph. There is no general pattern of increased bird use in breached ponds. Based on the above information, none of the alternatives would create new wildlife attractants which could result in movement of birds across approach or departure paths for either airport.

Project impacts to aircraft-bird strike hazards would be less than significant.

4.14.2.3.2.3 Comparison of Action Alternatives

The impacts on public health are expected to be similar for all action alternatives. All of the action alternatives would be subject to vector-control services during construction, operation, and maintenance of the restored areas. All alternatives create similar habitats in the same area. None of the alternatives would create a significant hazard to the public through exposure to disease vectors, and none of the alternatives would substantially increase the need for vector management.

The impacts on aircraft-bird strike hazards are expected to be similar for all action alternatives. All alternatives would create similar habitats in the same area and would have very similar effects on bird abundance and movements.

4.14.3 Mitigation Measures

No mitigation measures are required.

4.14.3.1 Residual Impacts and Additional Measures Necessary to Mitigate Significant Impacts

Because mosquitoes in the study area would continue to be managed by the Vector Control District and the USFWS and because such management would ensure that impacts remain less than significant, there are no residual impacts that require mitigation.

While significant effects on aircraft-bird strike hazards are not expected, the monitoring and adaptive management plan for the proposed action would provide opportunity for adjustment of habitat conditions in the event of unexpected effects.

4.14.4 Cumulative Effects

Other ongoing and future restoration efforts associated with the SBSP Restoration Project are likely to contribute similarly to public health related to mosquito activity. As under the existing condition, these areas will continue to be monitored and managed by the applicable vector-control agencies, and, similar to the SBSP Restoration Project, are subject to a monitoring and management plan which includes provisions for the monitoring and management of mosquito vectors. This is not a change from the existing condition, in which vector-control agencies monitor, advise, and take corrective actions in the region as needed. Based on the above analysis, the project's incremental effects on any adverse vector-related condition in or near the study area would not be cumulatively significant.

Other ongoing and future restoration efforts associated with the SBSP Restoration Project are likely to have similar effects on bird numbers and movements as the proposed action. As under the existing condition, these areas will be monitored and managed by the applicable agency, and are subject to a monitoring and management plan which includes provisions for the monitoring and management of bird numbers. Based on the above analysis, the project's incremental effects on any adverse bird-strike-related condition in or near the study area would not be cumulatively significant.

4.14.5 Summary

Table 4.14-1 *Public Health* NEPA Impact *Conclusions* summarizes the project effects under the NEPA.

Table 4.14-1. Public Health NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
HEA-1: Create a significant hazard to the public through exposure to disease vectors	Neutral	Minor	Short term (construction) Long term (operation and maintenance)	Unlikely	Limited
HEA-2: Create a substantial increase in the need for vector (mosquito) management	Neutral	Minor	Short term (construction) Long term (operation and maintenance)	Unlikely	Limited
Impact ABS-1: Create a significant hazard to the public through creating new or increased hazards of aircraft-bird strikes	Neutral	Minor	Long term (operation and maintenance)	Unlikely	Limited

Table 4.14-2 *Public Health CEQA Impact Conclusions* summarizes the project effects under the CEQA.

Table 4.14-2. Public Health CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
HEA-1: Create a significant hazard to the public through exposure to disease vectors		LTS	None	LTS
HEA-2: Create a substantial increase in the need for vector (mosquito) management	AMM-HEA-1: Coordinate with Vector Control District	LTS	None	LTS
Impact ABS-1: Create a significant hazard to the public through creating new or increased hazards of aircraft-bird strikes	None	LTS	None	LTS
LTS = less than significant S = significant				

4.15 Cultural Resources

This section discusses the physical setting for cultural resources and the impacts of the Shoreline Phase I Project on cultural resources.

4.15.1 Affected Environment

This section characterizes cultural resources in and near the Shoreline Phase I Study Area. The general area considered for cultural resources includes the South Bay; more specific discussion is provided for prehistoric and historic resources relevant to the project study area as described in Section 1.9.1 *Study Area* (see Figure 1.9-3 *Shoreline Project Phase I Area of Impact and Biological Buffer Area* in Chapter 1 *Study Information*). The physical setting described in this section focuses on the cultural resource condition as of about 2004–2010, which is when the information used in this section was published.

4.15.1.1 Regulatory Setting

4.15.1.1.1 Federal Regulations

The Federal government has developed laws and regulations designed to protect cultural resources that may be affected by actions undertaken, regulated, permitted, or funded by Federal agencies. The National Historic Preservation Act (NHPA) of 1966 established the Advisory Council on Historic Preservation (ACHP) and State Historic Preservation Officers (SHPO) to assist Federal and state officials regarding matters related to historic preservation. Section 106 of the NHPA requires Federal agencies to consider the effects of an action on cultural resources in or eligible for listing in the National Register of Historic Places (National Register). The administering agency, the ACHP, has authored regulations implementing Section 106 in 36 CFR 800, Protection of Historic Properties (incorporating amendments effective August 5, 2004).

The USACE coordinates with the SHPO regarding defining the area of potential effects (APE) for the proposed undertaking and consults with the SHPO, the ACHP, and other interested parties, including Native American tribes, to determine ways to reduce impacts from the proposed undertaking, as warranted.

According to the NHPA (36 CFR 800), three steps are required for compliance:

1. Identification of significant resources that may be affected by an undertaking;
2. Assessment of project impacts on those resources; and
3. Development and implementation of mitigation measures to offset or eliminate adverse impacts.

All three steps require consultation with interested Native American tribes, local governments, and other interested parties.

4.15.1.1.1.1 Identification and National Register of Historic Places Evaluation

Regulation 36 CFR 800.3 discusses the consultation process. Section 800.4 sets out the steps that a Federal agency must follow to identify historic properties. Regulation 36 CFR 800.4(c)(1) sets out the process for National Register eligibility determinations.

The Historic Sites, Buildings, and Antiquities Act of 1935 required the survey, documentation, and maintenance of historic and archaeological sites in an effort to determine which resources commemorate and illustrate the history and prehistory of the United States. The NHPA expanded on the National Register and assigned the responsibility for carrying out this policy to the U.S. Department of the Interior, National Park Service (NPS). Per NPS regulation 36 CFR 60.4 and guidance published by NPS in National Register Bulletin 15, "How to Apply the National Register Criteria for Evaluation," different types of values embodied in districts, sites, buildings, structures, and objects are recognized. These values fall into the following categories:

- **Associate Value (Criteria A and B):** Properties significant for their association or linkage to events (Criterion A) or persons (Criterion B) important in the past.
- **Design or Construction Value (Criterion C):** Properties significant as representatives of the human-made expression of culture or technology.
- **Information Value (Criterion D):** Properties significant for their ability to yield important information about prehistory or history.

Cultural resources that are determined eligible for listing in the National Register, provided the determination has SHPO and Native American concurrence as applicable, are termed *historic properties* under Section 106 and are afforded the same consideration as sites nominated for and listed in the National Register.

4.15.1.1.1.2 Identification of Historic Properties

Results of literature searches, field surveys, and tribal consultation are coordinated with the SHPO staff. Regulation 36 CFR 800.4(d) stipulates that, when an agency finds that either there are no historic properties present or there are historic properties present but the undertaking will have no effect on them, then the agency will make a "no historic properties affected" determination. If the agency finds that there are historic properties that may be affected by the undertaking, the agency will make a "historic properties affected" determination.

4.15.1.1.1.3 Assessment and Resolution of Adverse Effects

Specific thresholds of significance for impacts under Section 106 are described in Section 4.15.2.1 *Avoidance and Minimization Measures Incorporated into the Alternatives*. Regulation 36 CFR 800.6 explains the provisions relating to development of a Memorandum of Agreement (MOA) that describes the resolution of adverse effects. The execution of a MOA demonstrates an agency's compliance with Section 106 of the NHPA, and the agency is obligated to follow its terms. An agreement document is prepared in consultation with the SHPO. The ACHP is notified when the agency has identified an adverse effect on a historic property and is invited to participate in the consultation. Interested Native American tribes, local governments, and other parties are provided the draft agreement and are invited to be concurring or consulting parties to the agreement. Mitigation measures defined in an agreement may include data recovery excavations involving prehistoric sites or photographic documentation and archival research for historic resources (standing buildings and structures).

4.15.1.1.2 State Regulations

The CEQA offers directives regarding impacts on historical resources and unique archaeological resources. The CEQA states generally that, if implementing a project would result in significant environmental impacts, public agencies should determine whether such impacts can be substantially lessened or avoided through feasible mitigation measures or feasible alternatives. This general mandate applies equally to significant environmental effects related to certain cultural resources.

Only significant cultural resources (e.g., “historical resources” and “unique archaeological resources”) need to be addressed. State CEQA Guidelines define a *historical resource* as, among other things, “a resource listed or eligible for listing on the California Register of Historic Resources” (CRHR; CEQA Guidelines, Section 15064.5, subdivision (a)(1); also see Public Resources Code Sections 5024.1 and 21084.1). A historical resource may be eligible for inclusion on the CRHR, as determined by the State Historical Resources Commission or the lead agency, if the resource:

- Is associated with events that have made a significant contribution to the broad patterns of California’s history and cultural heritage; or
- Is associated with the lives of persons important in our past; or
- Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or
- Has yielded, or may be likely to yield, information important in prehistory or history.

In addition, a resource is presumed to constitute a “historical resource” if it is included in a “local register of historical resources” unless “the preponderance of evidence demonstrates that it is not historically or culturally significant” [CEQA Guidelines, Section 15064.5, subdivision (a)(2)].

In addition, the State CEQA Guidelines require consideration of unique archaeological sites (Section 15064.5). (Also see Public Resources Code, Section 21083.2.) A *unique archaeological resource* is defined as:

> [A]n archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:
>
> (1) Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.
>
> (2) Has a special and particular quality such as being the oldest of its type or the best available example of its type.
>
> (3) Is directly associated with a scientifically recognized important prehistoric or historic event or person. [Public Resources Code, Section 21083.2(h)]

If an archaeological site does not meet the criteria for inclusion on the California Register but does meet the definition of a unique archaeological resource as defined in the Public Resources Code (Section 21083.2), it is entitled to special protection or attention under the CEQA. Treatment options under Public Resources Code Section 21083.2 include activities that preserve such resources in place in an undisturbed state. Other acceptable methods of mitigation under Section 21083.2 include excavation and curation or study in place without excavation and curation (if the study finds that the artifacts would not meet one or more of the criteria for defining a *unique archaeological resource*).

Section 15064.5(e) of the State CEQA Guidelines requires that excavation activities be stopped whenever human remains are uncovered and that the county coroner be called in to assess the remains. If the county coroner determines that the remains are those of Native Americans, the Native American Heritage Commission (NAHC) must be contacted within 24 hours. At that time, Section 15064.5(d) of the CEQA Guidelines directs the lead agency to consult with the appropriate Native Americans as identified by the NAHC and directs the lead agency (or applicant), under certain circumstances, to develop an agreement with the Native Americans for the treatment and disposition of the remains.

Per California Public Resources Code Section 6313, all archaeological sites and historic or cultural resources on or in submerged lands of California are vested in the State and under the jurisdiction of the California State Lands Commission.

4.15.1.1.3 Local Regulations

The Envision San José 2040 General Plan (City of San José Goal ER-10) states that the City seeks to "preserve and conserve archaeologically significant structures, sites, districts and artifacts in order to promote a greater sense of historic awareness and community identity." The primary General Plan policy that is used to help the City attain this goal and that applies to the Shoreline Phase I Project is Policy ER-10.3:

- Ensure that city, State, and Federal historic preservation laws, regulations, and codes are enforced, including laws related to archaeological and paleontological resources, to ensure the adequate protection of historic and prehistoric resources.

Part of the community of Alviso is an identified historic district, and the community contains some designated historic landmarks. The General Plan land-use policies address development and other activity adjacent to historic districts. Applicable policies include the following:

- **LU-13.1:** Preserve the integrity and fabric of candidate or designated historic districts.
- **LU-13.2:** Preserve candidate or designated landmark buildings, structures, and historic objects, with first priority given to preserving and rehabilitating them for their historic use, second to preserving and rehabilitating them for a new use, or third to rehabilitation and relocation on site. If the City concurs that no other option is feasible, candidate or designated landmark structures should be rehabilitated and relocated to a new site in an appropriate setting.
- **LU-13.4:** Require public and private development projects to conform to the adopted City Council Policy on the Preservation of Historic Landmarks.
- **LU-13.7:** Design new development, alterations, and rehabilitation/remodels within a designated or candidate historic district to be compatible with the character of the historic district and to conform to the Secretary of the Interior's Standards for the Treatment of Historic Properties, appropriate State of California requirements regarding historic buildings and/or structures (including the California Historic Building Code), and applicable historic design guidelines adopted by the city council.
- **LU-13.8:** Require that new development, alterations, and rehabilitation/remodels adjacent to a designated or candidate landmark or historic district be designed to be sensitive to its character.
- **LU-13.15:** Implement city, State, and Federal historic preservation laws, regulations, and codes to ensure the adequate protection of historic resources.

4.15.1.2 Physical Setting (CEQA Baseline)

This section summarizes the ethnographic and historic settings of the general South Bay area and discusses in more detail the prehistoric and historic resources relevant to the Shoreline Phase I Study Area. The information on sites and landscape features included here were generated through reviews of historical research and archaeological surveys conducted by the USACE and the USFWS in recent years. These studies include the following:

- South Bay Salt Pond Initial Stewardship Plan Final EIS/EIR (2004; www.southbayrestoration.org/EIR/downloads.html)
- *SBSP Restoration Project Final Cultural Resources Assessment Strategy Memorandum and Historic Context Report* (2005; www.southbayrestoration.org/EIR/downloads.html)
- South Bay Salt Pond Restoration Project Final EIS/EIR (2007; www.southbayrestoration.org/EIR/downloads.html)
- *Cultural Resources Assessment: South San Francisco Bay Shoreline Interim Feasibility Study* (2009)

4.15.1.2.1 Prehistoric Setting

The recorded traces of Native American occupation and use across the landscape in the Bay Area (cultural resources) number in the thousands, with the oldest cultural resources appearing to date to approximately 5,000 years ago, possibly older. These archaeological resources are generally represented by deposits of cultural materials known shell middens, often mounded landscape features, located around the perimeter of the bay (hence, *shellmounds*). Much evidence of the earliest occupation along the San Francisco Bay shoreline is assumed to have been inundated by rising sea levels that occurred during the period approximately 15,000 to 6,000 years ago. It is also known that, once sea level stabilized, Native American sites along the shoreline have become obscured by sediment deposition from landscape changes on the bay margins and adjacent to bay tributaries. In addition, the site locations near wetlands, marshes, and creeks over the past 6,000 years have been altered and destroyed due to urban development.

The archaeology of California has been interpreted using several chronological frameworks based on site stratigraphic differences and the presence of various cultural traits. The initial prehistoric chronological sequence (ca. 4,500 years ago to the time of European contact) developed by archaeologists to explain local and regional cultural change in central California is known as the Central California Taxonomic System (Lillard et al. 1939). This classificatory scheme consisted of three temporal horizons: Early, Transitional, and Late. Although it has been revised, the original nomenclature is still in common use (also see Fredrickson 1974). The Early Horizon dated to ca. 4,500 to 3,500 years ago, the Middle Horizon dated to about 3,500 to 1,500 years ago, and the Late Horizon dated to approximately 1,500 to 250 years ago (see Moratto 1984).

The Central California Taxonomic System was developed as a framework for comparing different archaeological sites in central California (Lillard et al. 1939; Heizer 1949). The earliest versions of the system emphasized the concept of cultural horizons. However, the horizon concept was considered too broad and was later refined with the addition of cultural patterns (Bennyhoff 1968) and subsequently further subdivided into phases or aspects. A number of refinements added more subdivisions (Willy and Phillips 1958) and broke the system up by geographical as well as temporal variation (Bennyhoff 1977).

In the early 1970s, Dr. David Fredrickson proposed a sequence of cultural manifestations or patterns for the central districts of the North Coast Ranges, placing them in a framework of cultural periods he believed were applicable to California as a whole (Fredrickson 1973, 1974). Fredrickson's idea of cultural patterns was distinct from the concepts of previous researchers who tended to emphasize assemblages of material goods as the basis of their classifications. Fredrickson took a much broader view of archaeological material culture and defined the term *pattern* as "… an adaptive mode shared in general outline by a number of analytically separable cultures over an appreciable period of time within an appreciable geographic space" (Fredrickson 1973). These different cultural modes could be characterized by:

- Similar technological skills and devices (specific cultural items);
- Similar economic modes (production, distribution, consumption), including especially participation in trade networks and practices surrounding wealth (often inferential); and
- Similar mortuary and ceremonial practices.

Fredrickson also recognized that the economic/cultural component of each pattern could be manifested in neighboring geographic regions according to the presence of stylistically different artifact assemblages. He introduced the term *aspect* as a cultural subset of the pattern, defining it as a set of historically related technological and stylistic cultural assemblages. Fredrickson argued that these temporal periods should be kept separate from the dating and definition of particular patterns given the coexistence of more than one cultural pattern operating at any given point in time in California prehistory (Fredrickson 1974). This integrative framework provides the means for discussing temporally equivalent cultural patterns across a broad geographic space.

The earliest well-documented entry and spread of humans into California occurred at the beginning of the Paleo-Indian Period (10,000 to 6000 BC). Social units are thought to have been small and highly mobile. Known sites have been identified in the contexts of ancient pluvial lake shores and coastlines evidenced by such characteristic hunting implements as fluted projectile points and chipped stone crescent forms. Prehistoric adaptations over the ensuing centuries have been identified in the archaeological record by numerous researchers working in the area since the early 1900s, as summarized by Fredrickson (1974) and Moratto (1984).

Few archaeological sites have been found in the Bay Area that date to the Paleo-Indian Period or the later Lower Archaic Period (6000 to 3000 BC); however, archaeologists have recovered a great deal of data from sites occupied by the Middle Archaic Period. The lack of sites from earlier periods may be due to high sedimentation rates, leaving the earliest sites deeply buried and inaccessible. During the following Middle Archaic Period (3000 to 500 BC), the broad regional patterns of foraging subsistence strategies gave way to more intensive procurement practices. Subsistence economies were more diversified, possibly including the introduction of acorn-processing technology. Populations were growing and occupying more diverse settings. Permanent villages that were occupied throughout the year were established, primarily along major waterways. The onset of status distinctions and other indicators of growing sociopolitical complexity mark the next period, the Upper Archaic (500 BC to AD 700). Exchange systems become more complex and formalized, and evidence of regular, sustained trade between groups was seen for the first time.

Several technological and social changes characterized the latest period, the Emergent Period (AD 700 to 1800). The bow and arrow was introduced, ultimately replacing the dart and atlatl. Territorial boundaries between groups became well established. It became increasingly common that distinctions in an individual's social status could be linked to acquired wealth. Exchange of goods between groups became more regularized with more goods, including raw materials, entering into the exchange networks. In the latter portion of this period (AD 1500 to 1800), exchange relations became highly regularized and sophisticated. The clamshell disk bead became a monetary unit for exchange, and increasing quantities of goods moved greater distances and specialists arose to govern various aspects of production and exchange.

The Middle and Upper Archaic and Emergent Periods are further broken down under the Central California Taxonomic System. These three time periods are well represented in archaeological assemblages in the general vicinity of the southern Bay Area. The assemblages are discussed in detail in Bennyhoff and Fredrickson (1969) and Moratto (1984) and are summarized here.

The Windmiller Pattern (3000 to 500 BC) peoples placed an increased emphasis on acorn use as well as a continuation of hunting and fishing activities. Ground and polished charmstones, twined basketry, baked-clay artifacts, and worked shell and bone were hallmarks of Windmiller culture. Widely ranging trade patterns brought goods in from the Coast Ranges and trans-Sierran sources as well as closer trading partners. Distinctive burial practices (ventrally extended, oriented westward) identified with the Windmiller Pattern also appeared in the Sierra foothills, indicating possible seasonal migration into the Sierra. Perforated charmstones were associated with some burials, and manos and metates and small mortars were used, but rare.

The Berkeley Pattern (200 BC to AD 700) exhibited an increase in the use of acorns as a food source than was seen previously in the archaeological record. Distinctive stone and shell artifacts differentiated it from earlier or later cultural expressions. Burials were predominantly placed in a tightly flexed position and frequently included red ochre. Minimally shaped mortars and pestles were much more prevalent than manos and metates, and non-stemmed projectile points became more common. Dating of the Berkeley Pattern varies across central California; in the Stockton region, the Windmiller Pattern continued longer than in other areas, gradually giving way to the changes that marked the Berkeley Pattern (Bennyhoff 1982). These people combined Windmiller and Berkeley pattern traits, as seen in mortuary practices and the stone tool industry.

The Augustine Pattern (AD 700 to 1800) reflected increasing populations resulting from more-intensive food procurement strategies as well as a marked change in burial practices and increased trade activities. Intensive fishing, hunting and gathering, complex exchange systems, and a wider variety in mortuary patterns were all hallmarks of this period. Mortars and pestles were more carefully shaped, and bow and arrow technology was present. Fishing implements became more common, trade increased, and cremation was used for some higher-status individuals.

Bay Area archaeological investigations have occurred in three major waves (Lightfoot 1997). The first, early in the 20th century, focused on examining the most visible prehistoric site type—shellmounds, sometimes hundreds of feet in diameter—that lined the bay shore as well as large earthen mounds found near stream outlets and banks running inland. Early archaeologists assumed that the shellmounds were the remains of large Native American villages that subsisted solely on bay and estuary resources.

The second wave of investigations took place after World War II, when mounds and other sites were investigated by archaeologists working through the various local universities, particularly the University of California at Berkeley, San José State University, and Stanford University. By this period, the research questions being asked had broadened to a wider interpretation of the region's prehistory and the connection to different geographic areas.

In the last 30 years or so, the third push in archaeological exploration has been largely the result of compliance with new cultural resources regulations. The most recent research has taken advantage of new technology and paradigms that have evolved over the course of the 20th century. Thoughts regarding the development and use of these shellmounds have changed as investigations have expanded. Nelson (1909) regarded the Bay Area as an archaeological unit. Nelson recorded 425 shellmounds along San Francisco Bay, San Pablo Bay, the Carquinez Strait, and the East Bay shoreline as well as numerous earthen mounds up and down the various drainages. He noted that, even by then, there were no undisturbed mound sites left, since they were being destroyed by agriculture and urban development, or were being mined for fertilizer. Gifford (1916) analyzed materials from 11 of the mound sites and concluded that they were created by refuse from village sites that had accumulated over hundreds or thousands of years.

Schenck (1926) assumed that the principal use of the shellmounds was for occupation rather than for mortuary complexes. Gifford (1940) suggested that the bay be separated into two areas, northern and southern, based on preferences for cremation or inhumation of burials. These analyses were focused more on the bay shore zone, with little consideration of inland sites as contributing cultural elements. There was an implicit separation being made by early archaeologists based on perceived differences in subsistence methods (Bickel 1981).

As the century progressed, questions arose regarding the duration of occupation of the shellmounds and the degree to which populations could be sustained on shellfish and estuarine resources (Lightfoot 1997). Recent archaeology including exploration of the deepest levels of the shellmounds, more-detailed analysis of mound constituents, identification of dozens of sites unassociated with mounds, and development of a more accurate chronology and assessment of occupation in the bay region have led to a more detailed picture of the true complexity of prehistoric lifeways in the bay. The rich and abundant artifact collections recovered from sites on and near the bayshore demonstrate the affluence of Native American communities living there. Shells and shell beads extracted from the bay region were exchanged for exotic raw materials obtained from as far as the Napa Valley and the eastern Sierra Nevada, materials such as obsidian, quartz crystals, schist, chert, shell, cinnabar, ocher, and other materials, all clearly indicative of an extensive trading network (Hope et al. 1996).

The current body of archeological evidence indicates that the shellmounds served multiple purposes as residential places, ceremonial locations, and burial sites with many diverse and complex aspects. Other prehistoric site types recorded in the project region include lithic scatters, quarries, bedrock mortars or other milling sites, petroglyphs, and isolated burial sites (Basin Research Associates 2004). Together, these sites form part of a larger pattern of subsistence and interaction in prehistoric San Francisco Bay which is being explored in an ever-expanding series of investigations in the Bay Area.

4.15.1.2.2 Ethnographic and Historic Settings

Before European contact, the central and southern parts of the San Francisco Bay Area were inhabited by the Costanoan Indians.

The Costanoan probably first occupied the study area beginning about 1,500 years ago. When first documented in the late 18th century, the Costanoan-speaking population lived in about 50 different, politically autonomous tribelets. A tribelet could number between 50 and 500 people, with each group having one or more permanent villages. There were apparently three Costanoan tribelets in and around the study area: the Tamyen, Alson, and Puichon. The Tamyen and Alson occupied the lands in the southeast part of the study area, extending from the lower Guadalupe River and Alviso Slough to the present-day cities of Milpitas and Newark. The Puichon held the western shore of southern San Francisco Bay, near the lower reaches of San Francisquito and Stevens Creeks, near the present-day cities of Menlo Park, Palo Alto, and Mountain View.

About 1770, when the Spanish arrived in the Bay Area, the Costanoan population was estimated at 9,800. Using an average number of individuals per tribelet, the Tamyen who lived near the South Bay may have numbered 200 at the time of European contact. Beginning in 1776 and continuing until 1823, the Spanish Catholics of the Franciscan Order established 21 missions in California, several of which were in the Bay Area. The missions closest to the study area were Santa Clara de Asis and San José de Guadalupe. Hundreds (possibly thousands) of Costanoan people were relocated to missions by the end of the 18th century. During this period, the Native American population was also significantly reduced primarily because of introduced disease.

Following Mexico's independence from Spain, the missions were secularized in 1821, and the Costanoans found work on Mexican land grants called *ranchos*. Native Americans processed salt collected from tide pools and marshes along the San Francisco Bay shore, including areas in northern Santa Clara County. Before 1850, the salt processed by the Costanoan tribelets was the only source of salt for the entire district of Mission San José. Historical information suggests that, locally, salt production occurred at the northern end of the present Dumbarton Bridge (Levy 1978).

Although the Spaniards and Mexicans also harvested salt, it was the Native Americans who started what would become a major salt-production industry in the Bay Area. For a more comprehensive history, please see “Identification and Evaluation of the South San Francisco Bay Solar Salt Industry Landscape” (Speulda-Drews and Valentine 2009) and the *SBSP Restoration Project Final Cultural Resources Assessment Strategy Memorandum and Historic Context Report* (EDAW 2005).

Just before the historic period when non–Native American settlement began in the study area, the principal ethnographic village near the Shoreline Phase I Study Area appears to have been Posolmi, probably named after the Mexican Rancho Pololmi. Rancho Pololmi, situated near the Moffett Federal Airfield facility west and outside of the study area, was granted to a Native American named Lopez Ynigo, who had lived there as early as 1834 until his death at the age of 104 in 1864 (Levy 1978).

4.15.1.3 Historic and Prehistoric Resources

4.15.1.3.1 Background

Cultural resources attributed to Euro-American land use and settlements have been documented in rural and urban contexts, principally from the Spanish, Mexican, and American periods. Archaeological sites from these periods include adobe foundations, outhouses, overwater structures, transportation corridors, and deposits of discarded domestic and industrial debris. Examples of historical resources in the study area include railroads, highways, port facilities, and the array of features of the salt evaporation pond systems, often referred to as the *built environment*.

In addition to individual sites, buildings, or structures, a relatively new movement has emphasized a broader geographical analysis of cultural resources. This is known as the cultural landscape approach, which takes into account all types of built environment resources but also vegetation patterns and earthworks that are assessed as an integrated whole.

In order to identify the historic and prehistoric cultural resources that may be affected by the Shoreline Phase I Project, USACE staff established an APE. A project’s APE is defined as the geographic area within which project construction impacts may directly or indirectly cause modifications to the character or use of significant cultural resources or historic properties (36 CFR 800.16).

To collect information to support an APE for the Shoreline Phase I Project, the USACE completed a records and literature search through the California Historical Resource Information System (CHRIS). The CHRIS contains records of known archaeological and historical sites and surveys by archaeologists and architectural historians in and near the APE, copies of historical maps, narratives of Native American culture histories, and published documents of local historical land uses. Other important sources of information about cultural resources in the APE that were searched include the National Register, the California Register, the California Historical Landmarks and Points of Historical Interest Directory, and the California Historic Properties Directory. Regional publications that were consulted include the Santa Clara County Heritage Resource Inventory; maps and atlases that show the historic locations of salt works, crude salt plants, the distribution of shellmounds, and Indian mounds; the 1876 Historical Atlas of Santa Clara County; and the 1878 Historical Atlas of Alameda County.

Once all known records were consulted, the USACE completed a field investigation of the area. The results of the records searches and field investigation were then used to assess the eligibility of identified cultural resources for listing in the State or Federal historic-site registers if the identified resources were not already listed. The USACE then used the determinations to consult consultation with the SHPO and other appropriate parties. If necessary, this consultation is intended to identify ways to avoid or minimize adverse effects on listed or eligible resources. Information about the records search and results is presented in the following section. The USACE expects that the Section 106 consultation with the SHPO for the Shoreline Phase I Project will parallel the public review process of the NEPA and CEQA documentation.

4.15.1.3.2 Records Search and Survey Results Overview

Figure 4.15-1*Area of Potential Effects for the Shoreline Phase I Project* shows the APE for the Shoreline Phase I Project.

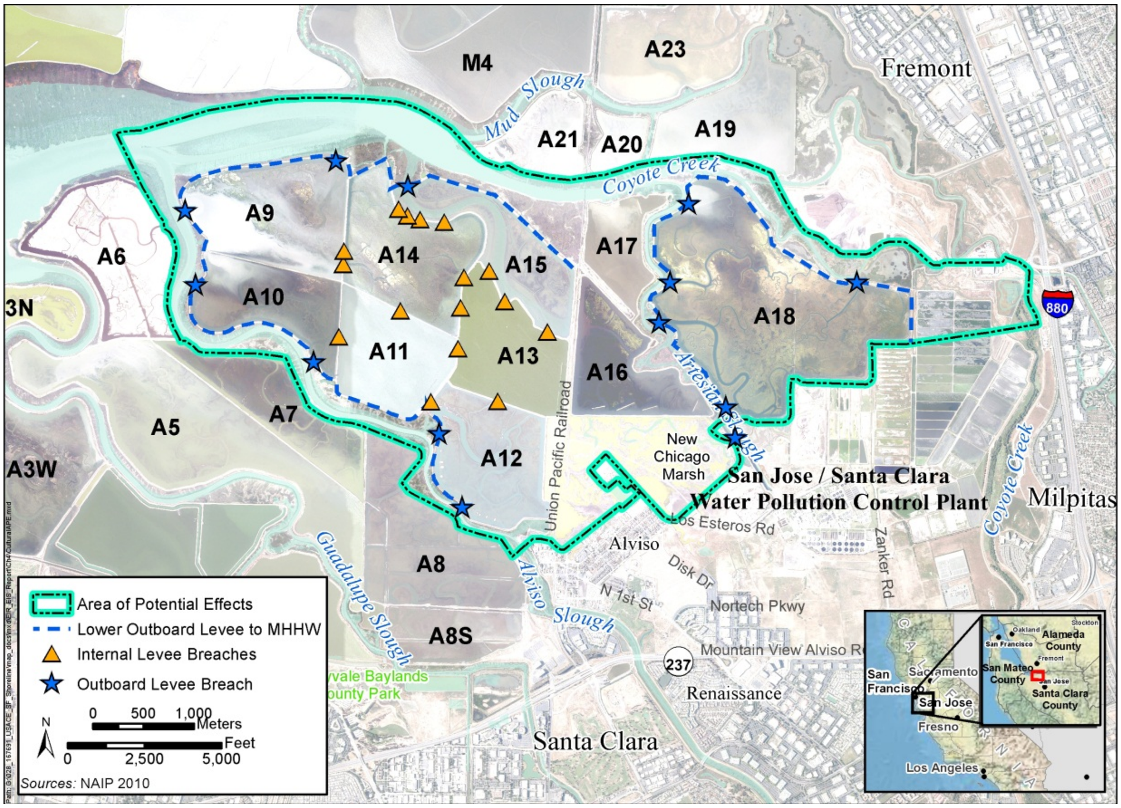

Figure 4.15-1. Area of Potential Effects for the Shoreline Phase I Project

The USACE's initial search of the CHRIS data provided information about the previously recorded prehistoric and historical archaeological resources and architectural properties that had been covered by archaeological surveys for the project vicinity. This research included the APE and areas around it. The USACE also completed an archaeological survey specifically designed to inventory cultural resources along six sections of the FRM levee for a combined distance of approximately 15 miles (Basin Research, Inc. 2008). The survey included areas in and out of the APE; five of the levee sections surveyed are located adjacent to the APE along the southern and western edges of Ponds A4 and A5, while the sixth levee section lies north of the APE near Mud Slough.

The CHRIS information showed that extensive floodplain areas landward and south of the levees and berms that separate the Refuge from developed areas have been surveyed over the past quarter century or so by archaeologists using standard techniques. The CHRIS data indicate that the Alviso area between Guadalupe River and Coyote Creek has been intensively surveyed; much of this previously surveyed area is in the Shoreline Phase I Project APE. Survey findings showed that numerous prehistoric archaeological sites representing Native

American settlements have been documented along the South Bay shoreline, including in the Shoreline Phase I Project APE. The sites are sometimes associated with elevated landforms adjacent to former tidal marshes but are also found along the streams flowing into the bay (such as Guadalupe River/Alviso Slough), which are now channelized for much of their distance.

In contrast, the area north and bayward of the developed areas along the shoreline is an expansive area of managed ponds and associated berms and levees, intersected by sinuous sloughs, forming the landscape of industrial salt production. Native American sites of sustained use and settlement do not typically appear in these intertidal areas. Rather, such areas provided seasonal marine resources, which may have been harvested and processed at nearby temporary camps. Due to the extensive landscape modifications, archaeological evidence of such seasonal-use areas would be difficult to identify.

As a result of the USACE survey of the APE and surrounding area, 52 historical features were identified and photographed; about half of these features are estimated to be 50 years of age or older. The majority of the 52 sites were considered part of the reclamation system associated with the salt-production industry in the South Bay, while the function of others could not be determined. Examples of the landscape features documented included levees, canals, floodgates, duck-hunting blinds, culverts, roads, fences, walkways, and a variety of wooden structures. The condition of the resources had generally deteriorated, with some being merely remnants of previously larger features. Thus, it is clear that resource integrity has been severely compromised, which usually precludes this type of resource from conveying its historical significance; this is an important consideration when assessing a resource's eligibility for inclusion in the National Register and the California Register.

The survey also noted several properties and facilities of historical merit in and near the APE: the Henry A. Rengstorff house, the town of Alviso, the Sunnyvale Water Pollution Control Plant, the Wastewater Facility, the Pacific Gas and Electric Company (PG&E) high-voltage transmission lines through Pond A18, and the Moffett Federal Airfield Fuel Dock.

In 2007, the USFWS completed an archaeological survey and landscape study of the South Bay as part of the SBSP Restoration Project. The survey included an area called the Alviso Unit (Speulda-Drews and Valentine 2009). The area surveyed as part of the Alviso Unit encompasses the Shoreline Phase I Project APE. The landscape assessment provided the chronological development of 20th-century salt-producing facilities, with the conclusion that the entire Alviso Unit appears eligible for listing in the National Register as a historic landscape. Section 4.15.1.3.3 *Cultural Resources Identified in and Adjacent to the APE* describes specific resources that are present in or immediately adjacent to the Shoreline Phase I Project APE.

4.15.1.3.3 Cultural Resources Identified in and Adjacent to the APE

The results of records searches and the survey indicated that the Alviso Salt Pond Historic Landscape is the only historic property in the APE and that the APE encompasses a small portion of the Alviso Historic District. There were three additional properties located adjacent to the APE: the Drawbridge townsite, a railroad bridge, and a prehistoric Native American site. This section describes the historic landscape and the historic district and the additional cultural resources, including their status with respect to eligibility for listing in the National Register and the California Register. Additional historical sites located discussed above are located well away from the APE.

Alviso Salt Pond Historic Landscape. The USFWS evaluated the Alviso Unit, concluded that it was eligible for inclusion in the National Register of Historic Places (National Register), and received concurrence from the California State Historic Preservation Officer (SHPO) that the Alviso Salt Pond Historic Landscape (Historic Landscape) is a Historic Property under Criterion A of the National Register. The USFWS technical report discussing the National Register evaluation of the Alviso Unit is entitled "Appendix E: Identification and Evaluation of the South San Francisco Bay Solar Salt Industry Landscape," a copy of which the USACE can provide.

The Alviso Unit APE was surveyed by the USFWS, which consisted of walking the outboard and inboard salt pond levees, recording archaeological features on and next to the levees as well as documenting features in the ponds through visual observations and GPS recording. The USACE technical report is entitled "Cultural Resource Assessment: South San Francisco Shoreline Interim Feasibility," which presents the results of its research and survey effort. The USFWS's landscape analysis concluded that the Alviso salt pond complex, which is managed as part of the Refuge, should be treated as a historic district eligible for listing in the National Register under Criterion A and with fair integrity. The Alviso salt pond complex reflects the land-use activities of salt production, the spatial organization (levees and ponds), and the circulation patterns unique to the solar salt industry in the Bay Area during the 1920s.

The initial efforts to reclaim lands for solar salt production in the Alviso salt pond complex occurred between the 1890s and 1910s. This early development failed when the levees were washed away. Two salt companies later operated in the Alviso salt pond complex: the Alviso Salt Company, which had lands between Alviso and Mayfield Slough in production, and the Arden Salt Company, which operated in the area east of Alviso and toward the Dumbarton Point to the north. Both companies harvested salt from the area during the 1920s. In 1929, Arden acquired Alviso Salt and its plant near the town of Alviso, and Leslie Salt became the sole operator in the Alviso salt pond complex after 1936. Cargill Company acquired the salt-production facilities in 1978 (EDAW, Inc. 2005).

The Alviso salt pond complex landscape clearly reflects the industrial zenith of the 1950s, which included the development of huge tracts of salt marsh for salt brine production. The large exterior levees and vast ponds are the signature features of the landscape. The large exterior levees and vast ponds are the signature features of the Alviso solar salt landscape. Alviso never had crystallizing or finishing ponds, and the processing plant was always located outside the ponds (Speulda-Drews and Valentine 2009).

The historic landscape encloses a number of small-scale elements such as duck-hunting blinds. Private hunting clubs were popular in the early 19th century. Land was leased or a fee was paid to the salt company for the proprietary right to hunt on the property. The clubs built hunting blinds and even clubhouses within the salt pond landscape. Most of the duck blinds are less than 30 years old. Most of the small-scale features related to duck hunting have been removed, have deteriorated, or are recently constructed.

Noncontributing elements of the historic landscape include the modern water-control structures, pump stations, hunting blinds, and piers or landings, some of which were observed during the USACE's 2007 archaeological survey. The majority of these features have severe integrity issues; many wooden structures are fragmentary and thus represent the remains of structures whose purposes cannot be determined from the surviving materials or the historic records (Basin Research, Inc. 2008).

Historic Town of Alviso. Alviso, now part of the city of San José, is a historic district listed in the National Register (Figure 4.15-2 *Community of Alviso* Historic District Map). The APE includes a portion of the recorded historic district near the marina.

Alviso is one of the oldest towns in Santa Clara County. It once was expected to be a great city because of its location on San Francisco Bay and its role as the major commercial shipping point for the wider Santa Clara County until the late 1800s. The town was almost totally deserted after the railroads diverted travel in 1865. Incorporated in 1852, Alviso includes notable buildings such as the Bayside Cannery and the South Bay Yacht Club dating from the late 19^{th} century; both of these properties are contributing elements to the historic district. The former Old Union Warehouse, which is one of the seven buildings/building clusters/sites of the Bay Side Canning Company, is one of the 94 Chinese American State of California Ethnic Sites. The Port of Alviso, which is in the northwestern corner of the town, is a State of California Point of Historical Interest (SHPI SCL-061) and is listed in the California History Plan and California Inventory of Historic Resources. The town's atmosphere, which resembles a small delta town, and the existence of early buildings and structures give Alviso a unique character.

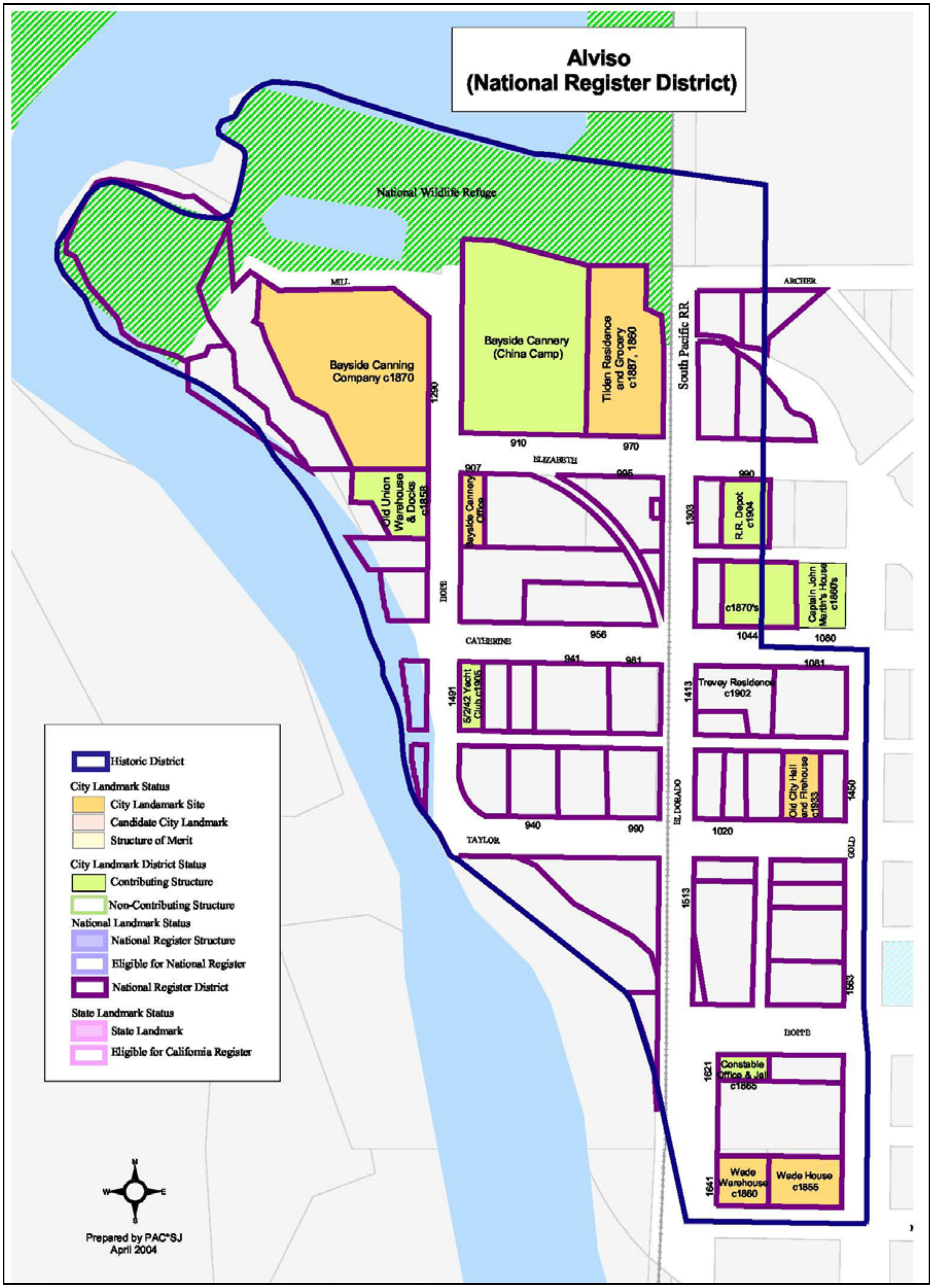

Figure 4.15-2. Community of Alviso Historic District Map

Historic Townsite of Drawbridge. The abandoned town of Drawbridge (recorded as P-01-003291) is located on Station Island (also known as Pond A21), which abuts the northern boundary of the APE. The stimulus for the initial development of the town of Drawbridge was construction of the South Pacific Coast Railroad line in the late 1870s. The community was first a railroad construction crew's camp, which then grew into a loosely organized settlement of seasonally occupied cabins for duck hunters and weekend tourists from the 1890s to the 1930s (Basin Research, Inc. 2008). The community attracted bootleggers, gamblers, and prostitution in the 1920s and 1930s. In 1926, the town had 90 private residences and two hotels.

Drawbridge was for the most part vacant by the 1950s, the last resident staying until 1978 when the Refuge was established (Speulda-Drews and Valentine 2009). Drawbridge was recorded and entered in the CHRIS in 1978. The town's architecture and history were the subjects of a master's thesis (Morrow 1984). When visited in 2008 under the USACE contract, "a total of 37 standing or former structures in various states of disrepair were present" (Basin Research, Inc. 2008; Figure 4.15-3 *Historic Town of Drawbridge*).

Figure 4.15-3. Historic Town of Drawbridge

The USACE concurs that

> Drawbridge retains integrity of location, design, and setting as well as feeling and association. Components include the topographic and visual isolation of the resource enhanced by its difficulty of access and near absence of immediate contemporary urban noise. The continuing rail service provides noise inherent with its historic setting. The surrounding and intruding bay waters provide the feel, smell, and noises associated with its former uses of duck hunting and itinerant fishing. The deteriorating buildings and their remnants associated with

> the natural cycles of sun, rain, wind, mist, and fog provide a flavor of a "ghost" town. The remnants of the built fabric are now part of a semi-protected abandonment representing day-to-day activities no longer undertaken that are now undergoing progressive entombment within and beneath the bay marshes and mud. (Basin Research, Inc. 2008)

Drawbridge is listed in the California Inventory of Historic Resources under the theme of economic/industrial and is also listed in the Historic Properties Directory for Alameda County (code 7R, submitted as part of a reconnaissance-level survey but not evaluated for the National Register). However, no information has surfaced that links Drawbridge with the lives of persons significant in Alameda or Santa Clara Counties. It appears to be eligible for National Register listing under Criterion A (associated with events that have made a significant contribution to the broad patterns of local history). The primary period of significance of Drawbridge spans the period from the 1890s to the 1930s.

There is consensus that Drawbridge represents a unique historical site associated with duck hunting and other recreation in the South Bay. Although the townsite is significant for its association with a colorful period in San Francisco Bay history during the 1890s to 1930s and also once contained many exemplary examples of vernacular architecture, the buildings have been sinking into the marsh, have deteriorated greatly from the weather, and some have been burned or vandalized and generally neglected. This has led to the current condition in which the integrity of all of the buildings has been critically diminished; original materials have disappeared or have become unrecognizable, and the design and workmanship are not clearly visible. All buildings remain open to the elements (i.e., they lack doors and window glass), and in some cases pieces of (or entire) roofs are missing. This condition is expected to continue under the current management (Basin Research, Inc. 2008).

At this time, the USACE does not intend to formally evaluate the townsite for its eligibility to be listed in the National Register because the property is not in the APE and would not be affected by restoration activities. Since the property is in the Refuge, the USFWS appears to be the responsible agency to conduct an additional archaeological assessment if there is a non-USACE restoration project in the future. Drawbridge is on land owned by the Southern Pacific Railroad (SPRR) and the USFWS. The individual parcels form a patchwork of Federal and private ownership. The site is also within an active railway right-of-way and is not accessible except with advance notification to and approval of the SPRR.

Despite the townsite's meager architectural integrity and its weak ability to convey a strong association with the historic theme of duck hunting, it is nonetheless a place of historical interest and should be identified as a significant site in local and county directories. The 1978 townsite record and the 1984 master's thesis have generated valuable information about the architecture and history of the site, and added to this are the detailed notes and photographs that the USACE work contributed in 2008.

Coyote Creek Bridge. The Coyote Creek Bridge, assigned P-01-010205 in Alameda County and P-43-001578 in Santa Clara County, is located adjacent to but outside of the APE south of the

Drawbridge townsite. The current bridge is the most recent structure constructed in this location over the past 125 years. The first bridge over Coyote Creek was a drawbridge that was begun in 1875 by the Santa Clara Valley Railroad and was later completed by the South Pacific Coast Railroad in 1876. In 1877, the Southern Pacific Railroad purchased the track and in 1905 replaced the drawbridge with a swing bridge when the track changed from narrow to standard gauge. A standard-design railroad bridge constructed by South Pacific in 1948 consisted of a fixed timber trestle substructure. It was replaced in 2001 by the current bridge, a single-track concrete bridge of precast deck sections supported by a series of steel, concrete-filled pipe piles. The foundation remnants of the 1905 wooden bridge, cut at the water line, are visible at low tide (Basin Research, Inc. 2008).

The 1948 bridge was found not eligible for listing in the National Register. In 2007, the Historic Properties Directory for Alameda County listed the 2001 bridge as code 6Y (ineligible for the National Register by consensus). The current bridge is a standard design and does not meet the minimum age of 50 years for consideration for listing in the National Register or the California Register. The USACE will therefore not conduct an additional bridge evaluation at this time.

Archaeological Site P-01-002057. This prehistoric archaeological site, recorded under the CHRIS system as P-01-002057 (formerly designated as CA-ALA-338), is located outside the APE near Mud Slough and Pond A19. Historical maps indicate that this location was originally on a small island near the tidal-marsh shoreline. The site was originally reported in 1909 by Nels C. Nelson as a mounded deposit of fragmented shellfish remains, commonly referred to as a shellmound.

Since that time, the site has been visited at least four times by professional archaeologists; Chavez (1980) described it as a “shell-midden site,” characterized as “grey powdery” soil surrounded by “medium-brown clay” that contained “extensive shell” and “some charcoal.” The shell recorded were species of clam, oyster, mussel, and horn shell. While sparsely scattered shell was noted by the USACE staff archaeologist in 1990, the amount of site constituents has apparently declined to the point that surface evidence of the shell deposit has been difficult to see by subsequent observers (Basin Research Associates, Inc. 2009; Speulda-Drews and Valentine 2009).

Although no archaeological subsurface exploration of the site has occurred, this study assumes that buried cultural materials exist. Clearly, the site has been highly disturbed due to the salt-pond construction and maintenance that began in the 1930s. Based on the existing information, it can be concluded that the site’s integrity has been severely diminished, and, therefore, the USACE has determined that P-01-003057 is not eligible for listing in the National Register or the California Register. At this time, because the site is outside the APE, no further archaeological work is recommended as part of the Shoreline Phase I Study.

4.15.1.4 National Environmental Policy Act and Engineer Regulation 1105-2-100: *Planning Guidance Notebook* Baseline Condition

For cultural resources, the NEPA and the Planning Guidance Notebook baseline condition is determined by projecting how the condition might change between the current condition discussed in Section 4.15.1 *Affected Environment* and the start of construction. The resources discussed in Section 4.15.1 *Affected Environment* would not change substantially before the baseline year, and other projects are not expected to affect the cultural resource condition before 2018. Because the condition would not change, the NEPA and the Planning Guidance Notebook baseline condition for cultural resources would not be different from what is described in Section 4.15.1 *Affected Environment*.

4.15.2 Environmental Consequences

4.15.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

Avoidance and minimization measures are those parameters that have been built into the design of the Shoreline Phase I Project and are committed to as part of project implementation. These measures are generally included in the alternatives description of this report (Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*), but, where appropriate, the specific measures related to the impact evaluations are also summarized in the resource chapters.

The following AMMs would be implemented as part of the project design and would avoid or minimize adverse effects:

- **AMM-CUL-1: Avoid Cultural Resources** – The FRM alignments and related construction activities will avoid known cultural resources, except the Alviso Salt Pond Historic Landscape, within the study area.
- **AMM-CUL-2: Discovery of Remains -**Work in areas where any burial site is found will be restricted or stopped until proper protocols are met. Upon discovering any burial site as evidenced by human skeletal remains, the County Coroner will be immediately notified. No further excavation or disturbance within 30 feet of the site or any nearby area reasonably suspected to overlie adjacent remains may be made except as authorized by the County Coroner, California Native American Heritage Commission, and/or the County Coordinator of Indian Affairs.

4.15.2.2 Methodology for Impact Analysis and Significance Thresholds

Under Section 106 of the NHPA, *effect* means alteration to the characteristics of a historic property that qualify it for inclusion in or eligibility for listing in the National Register. An *adverse effect* is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative (Advisory Council on Historic Preservation 2004).

Adverse effects on historic properties may include (1) physical destruction of or damage to all or part of the property; (2) alteration of a property that is not consistent with the Secretary of Interior's Standards for the Treatment of Historic Properties; (3) removal of the property from its historic location; (4) change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance; (5) introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features; (6) neglect of a property which causes its deterioration; and (7) transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance (Advisory Council on Historic Preservation 2004).

In accordance with 36 CFR 800.5 of the ACHP's implementing regulations on the criteria for adverse effects, impacts on cultural resources are considered significant if one or more of the following conditions would result from implementing the proposed action:

1. An undertaking has an effect on a historic property when the undertaking may alter characteristics of the property that may qualify the property for inclusion in the National Register. For the purpose of determining the type of effect, alteration to features of a property's location, setting, or use may be relevant depending on a property's significant characteristics and should be considered.
2. An undertaking is considered to have an adverse effect when the effect on a historic property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include but are not limited to:
    a. Physical destruction, damage, or alteration of all or part of the property
    b. Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for the National Register
    c. Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting
    d. Neglect of a property resulting in its deterioration or destruction
    e. Transfer, lease, or sale of the property

Under the CEQA,

> a project with an effect that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment. Substantial adverse change in the significance of an

> historical resource means physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired. The significance of an historical resource is materially impaired when a project demolishes or materially alters in an adverse manner those physical characteristics of an historical resource that convey its historical significance and that justify its inclusion in, or eligibility for, the California Register of Historical Resources. (California Office of Historic Preservation 2005)

4.15.2.3 Significance Thresholds

The thresholds for determining the significance of impacts for this analysis are based on the environmental checklist in Appendix G of the State CEQA Guidelines. These thresholds also encompass the factors taken into account under the NEPA to determine the significance of an action in terms of its context and the intensity of its impacts. The alternatives under consideration were determined to result in a significant impact related to cultural resources if they would do any of the following:

- **Impact CUL-1:** Cause a substantial adverse change in the significance of a historical or archaeological resource as defined in CEQA Guidelines Section 15064.5 or 36 CFR 800.5 of the ACHP's implementing regulations
- **Impact CUL-2:** Cause a disturbance of human remains, including those interred outside of formal cemeteries.

4.15.2.4 Alternatives Evaluation

This section evaluates the impacts on cultural resources resulting from the alternatives, as further described below.

4.15.2.4.1 No Action Alternative

Without construction of the FRM levee or implementation of tidal marsh restoration activity, the cultural resources and historic properties in and adjacent to the APE would not be affected. Some properties, such as the architectural features of the buildings at the Drawbridge townsite, would continue to deteriorate. In the future, the USFWS would continue managing Refuge land consistent with its Refuge Master Plan and with Federal regulations that protect cultural resources.

Under the No Action Alternative, continued maintenance activities of the former salt ponds and levees may reveal additional sites not previously recorded. In the absence of levee construction and restoration efforts, the Alviso Salt Pond Historic Landscape could be affected by ongoing Refuge management, ongoing management of Pond A18 by the City of San José, and work already underway as part of the SBSP Restoration Project. Most of the APE, though, would generally remain unchanged (i.e., levees would remain in place, and ponds would continue to be managed as open water and not tidal marsh).

Without construction of the FRM levee, the Alviso Historic District would continue to be susceptible to tidal flooding, which could damage historic resources. In the very far future, SLC could worsen tidal flooding events, causing even greater damage.

4.15.2.4.2 Action Alternatives

This section describes the effects on cultural resources resulting from construction, maintenance, and operation of the action alternatives. The impacts on cultural resources would be the same for all action alternatives.

In 2012, the USFWS consulted with the California State Historic Preservation Office (SHPO) regarding the restoration program for the entire Alviso Unit, and consequently, satisfied the requirements of Section 106 of the National Historic Preservation Act (NHPA), pursuant to 36 C.F.R. § 800, by executing a Memorandum of Agreement (MOA) that included a Historic Property Treatment Plan (HPTP) (See Appendix B9 *Pertinent Correspondence*). The Alviso Unit, however, does not include Pond A18. The conversion of Pond A18 does not represent a significant incremental change to the historic landscape and is the subject of ongoing consultation (see initial consultation letter in Appendix B9 *Pertinent Correspondence*).

Impact CUL-1: Cause a substantial adverse change in the significance of a historical or archaeological resource as defined in CEQA Guidelines Section 15064.5 or 36 CFR 800.5 of the ACHP's implementing regulations

4.15.2.4.2.1 Construction Effects

FRM Levee

Under all of the action alternatives, construction of the FRM levee would require work near and possibly in the Alviso Historic District. For all of the alternatives, the levee would begin near the Alviso Marina, which is in the historic district. The Recommended Plan levee alignment follows the alignment of an existing non-engineered levee; however, the new levee will have engineered dimensions and will be larger. The Alviso North levee is situated far from the town to reduce the level of adverse visual effects. This integrated document includes simulation photos that show the view of the new levee from different points around Alviso. The addition of a new levee would not cause an adverse effect to the individual contributing elements to the historic district. The levee would cause a minor change in the character, setting, and possibly use of the historic district. However, the introduction of a new levee is not out of character with the existing conditions, and would not diminish the integrity of the district's significant historic features. USACE has therefore determined that the project will not cause an adverse effect to the Alviso historic district.

Ecosystem Restoration

The Alviso Salt Pond Historic Landscape would be adversely affected by ecosystem restoration activity associated with any of the action alternatives. Construction of any alternative would require removing and/or altering part of the salt pond and levee complex as part of restoring selected areas to tidal marsh. The impacts would take place over time as restoration activity is phased, but, when all ecosystem restoration construction activity is considered collectively, there would be one-time adverse effects on the historic landscape from construction. Operation and maintenance effects are discussed in Section 4.15.2.4.2.2 *Operation and Maintenance Effects*.

Ecosystem restoration activity associated with Pond A12 would occur near the Alviso Historic District. The planned Pond A12 levee breach is far downstream of the historic district and is not expected to cause direct or indirect effects on the District. Construction of the transitional habitat (either the bench associated with Alternatives 2, 4, and 5 or the 30:1 ecotone associated with Alternative 3) would occur north of Alviso and would not cause direct effects on the District. One of the proposed construction staging areas (Staging Area #4) is along the east shore of Pond A12, but this area is also north of Alviso, and its use would not directly affect the historic district.

Construction traffic would likely access the project area through Alviso, since the community currently provides one of the few access points to this part of the Refuge. Traffic would be limited to that needed to access the Staging Area #4 and would not be constant. Because construction would be phased over time, there would be pulses of traffic associated with different elements as restoration progresses for a period of about 20 years. For example, construction-related traffic might be very light (a few vehicles per day) when one or two equipment operators are working on pond preparation before breaches. However, while a pond is being breached, daily traffic might increase as more workers access the site.

Although construction might increase traffic through the community, the number of vehicles traveling through the town would not be substantial, and any increases would be short term. The short-term traffic changes would not adversely affect the characteristics that qualified the Alviso Historic District for the National Register.

Construction of the ecosystem restoration elements would have a significant impact on the Alviso Salt Pond Historic Landscape. Mitigation measures to address this impact are discussed in Section 4.15.3 Mitigation Measures. *Impacts to the Alviso Historic District would be less than significant.*

Recreation Elements

The project would include constructing recreation elements such as pedestrian bridges over Artesian Slough and the Union Pacific Railroad tracks, benches, and observation platforms. The pedestrian bridges would be placed in the Alviso Salt Pond Historic Landscape. Construction of these elements would have similar impacts as discussed for FRM levee construction.

4.15.2.4.2.2 Operation and Maintenance Effects

Long-term operation and maintenance of the FRM levee would not result in any direct or indirect impacts on the Alviso Salt Pond Historic Landscape or the Alviso Historic District. Refuge and city personnel and volunteers accessing the project area for maintenance would use already established access points. The Refuge and City currently perform maintenance of the area, so continuing this type of use is not out of character with the Alviso Salt Pond Historic Landscape. Periodic maintenance activity of the FRM levee would not alter the characteristics of the properties or diminish the integrity of the property.

Long-term operation and maintenance of restored areas and recreation features would also require periodic access by Refuge and City personnel and volunteers. Routine maintenance would be performed using existing access points. The Refuge and City currently perform routine maintenance of the area, so continuing this practice is not out of character with the Alviso Salt Pond Historic Landscape.

The Refuge is currently used by recreationists for activities such as hiking, bicycling, hunting, boating, environmental education and wildlife viewing. These activities would continue while the recreational features of the restored areas (trails, bridges, benches, and platforms) are maintained. The Refuge currently also supports the EEC, which is assumed would continue to be maintained in the future. Continuing these recreation uses would not be out of character with the Alviso Salt Pond Historic Landscape.

In summary, long-term operation and maintenance of the FRM levee, restored areas, and recreational features and uses would not directly or indirectly alter the characteristics of the property that originally qualified it for inclusion in the National Register, nor would they diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

Operations and maintenance of the project would have a less-than-significant impact on the Alviso Salt Ponds Historic Landscape.

Impact CUL-2: Cause a disturbance of human remains, including those interred outside of formal cemeteries

The site was historically tidal marsh and it is unlikely that burials took place in areas where levees would be constructed. In the event that remains are discovered the contractor will implement AMM-CUL-2: Discovery of Remains. Ecosystem restoration activities would involve breeches in the existing levees which were created from adjacent bay mud. It is unlikely that remains would be discovered in the pond dikes.

With the implementation of AMMs, the impact from the disturbance of human remains would be less than significant.

4.15.2.4.2.3 Comparison of Action Alternatives

All alternatives would have similar impacts to cultural resources. Each alternative would result in a FRM levee that would have less than significant impacts on the Alviso Historic District as the levee would be located north of the historic district. Ecosystem restoration would impact the Alviso Salt Ponds Historic Landscape through construction and the long-term conversion of salt ponds to marsh. This restoration will slowly erase features that make up the salt ponds landscape.

4.15.3 Mitigation Measures

The project includes additional measures intended to reduce the potentially negative effects of the proposed action. These measures, which would be adopted as part of any alternative, include the following:

- **M-CUL-1:** In 2012, the USFWS consulted with the California State Historic Preservation Office (SHPO) regarding the restoration program for the entire Alviso Unit under the SBSP Restoration Project, and consequently satisfied the requirements of Section 106 of the National Historic Preservation Act (NHPA), pursuant to 36 C.F.R. § 800, by executing a Memorandum of Agreement (MOA) that included a Historic Property Treatment Plan (HPTP). Information from the USFWS Section 106 compliance has direct impact on the current Shoreline Study effort to comply with Section 106. Through ongoing consultation with SHPO, the Shoreline Study may have to develop a HPTP for Section 106 purposes to resolve any unforeseen adverse effects to the Alviso Salt Pond Historic Landscape and the Alviso Historic District prior to initiation of construction.

4.15.3.1 Residual Impacts and Additional Measures Necessary to Mitigate Significant Impacts

The restoration of the salt ponds to tidal marsh will eliminate features that comprise the historic landscape. However, as the objective of the project is to restore tidal marsh which would replace the historic landscape, there are no measures available to avoid the impact or to restore or rehabilitate the landscape. The mitigation measures identified in the USFWS 2012 MOA reduces the severity of this impact.

4.15.4 Cumulative Effects

The area considered for cumulative land-use effects is the APE, parts of Alviso that are not in the APE, and parts of the Alviso Salt Pond Historic Landscape that are not in the APE. This area focuses on similar physical settings and includes the entirety of the historic district and historic landscape.

Past, present, and reasonably foreseeable future actions considered by this cumulative effects analysis focus on residential and non-residential development in the cumulative study area that could affect cultural resources, specifically ongoing development associated with the Wastewater Facility and SBSP Restoration Project actions that could affect cultural resources that are present in the SBSP Restoration Project and Shoreline Phase I Study Area.

The Shoreline Phase I Project, in conjunction with the SBSP Restoration Project, would alter the Alviso Salt Pond Historic Landscape by converting the salt pond and levee complex to tidal marsh. These effects are cumulatively considerable, and the project would contribute to adverse impacts on this historic property. Mitigation measure M-CUL-1 would reduce this impact, but the cumulative contribution of the project would remain considerable.

The community of Alviso is built out, with ongoing development limited to infill. The City of San José encourages infill development to follow established design guidelines to ensure compatibility with the elements that contribute to the historic nature of the community. Property owners seeking to make changes to historic structures (as opposed to new construction) must apply for a Historic Preservation Permit from the City. The design guidelines that are applied as part of a Historic Preservation Permit are an effort to maintain the historic character in the Alviso Historic District (San José State University 2009).

Because ongoing development is expected to be compatible with the historic nature of the community, it is not expected to adversely affect the historic district. The impacts of the Shoreline Phase I Project on the Alviso Historic District would not combine with the effects of other past, present, and reasonably foreseeable future actions to cause or contribute to a cumulative impact on the features that contribute to the District's designation.

4.15.5 Summary

As previously discussed, the USFWS consulted with the California State Historic Preservation Office (SHPO) regarding the restoration program for the entire Alviso Unit under the SBSP Restoration Project, and consequently satisfied the requirements of Section 106 of the National Historic Preservation Act (NHPA), pursuant to 36 C.F.R. § 800, by executing a Memorandum of Agreement (MOA) that included a Historic Property Treatment Plan (HPTP). The USFWS consultation did not include Pond A18. The Alviso Historic District would experience minor changes in character and setting with the conversion of Pond A18 and the introduction of the FRM levee, however, this change does not constitute an adverse effect under 36 CFR Part 800.

Table 4.15-1 *Cultural Resources NEPA Impact Conclusions* summarizes the project effects under the NEPA.

Table 4.15-1. Cultural Resources NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
CUL-1: Cause a substantial adverse change in the significance of a historical or archaeological resource as defined in CEQA Guidelines Section 15064.5 or 36 CFR 800.5 of the ACHP's implementing regulations	Negative	Minor	Long term	Probable	Local
CUL-2: Cause a disturbance of human remains, including those interred outside of formal cemeteries	Negative	Minor	Short term	Unlikely	Limited

Table 4.15-2 *Cultural Resources CEQA Impact Conclusions* summarizes the project effects under the CEQA.

Table 4.15-2. Cultural Resources CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
CUL-1: Cause a substantial adverse change in the significance of a historical or archaeological resource as defined in CEQA Guidelines Section 15064.5 or 36 CFR 800.5 of the ACHP's implementing regulations	AMM-CUL-1: Avoid Cultural Resources	S	M-CUL-1	LTS
CUL-2: Cause a disturbance of human remains, including those interred outside of formal cemeteries	AMM-CUL-2: Discovery of Remains	LTS	None	LTS

LTS = less than significant
S = significant

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4.16 Public Utilities and Service Systems

This section discusses the impacts of the Shoreline Phase I Project on public utilities and service systems.

4.16.1 Affected Environment

This section describes the physical setting of the project and evaluates potential project impacts with a focus on utilities and public service systems. The public service systems discussed in this section are police, fire protection, and emergency services. Utilities include solid waste, electricity, gas, wastewater, storm drains, and railroads. Also see Section 4.9 *Transportation* for a discussion of railroad transit. Parks are discussed in Section 4.11 *Recreation*. Libraries, schools, and other public service systems not mentioned above are not addressed because the project would not use these services or directly affect the use of these services or facilities.

The following discussion focuses on the Shoreline Phase I Study Area and areas of San José that surround the study area. The physical setting is based on the 2013 condition.

4.16.1.1 Regulatory Setting

The regulatory setting for public service systems and utilities focuses on State and local requirements; no applicable Federal requirements have been identified. However, individual utilities may be subject to additional Federal regulation.

4.16.1.1.1 State

Overhead Electrical Transmission Lines. General Order 95 from the California Public Utilities Commission includes rules governing line clearance for overhead electrical transmission lines. The code states the following:

- Rule 11. Water areas not suitable for sailboating must have a line clearance of at least 25 feet (8 meters) above high water.
- Rule 12. Water areas suitable for sailboating, with a surface area over 2,000 acres, must have a line clearance of at least 47 feet (14 meters) above high water.

General Order 95 states that Rule 11 can be applied to areas where sailboating is prohibited and where other boating activities are allowed.

4.16.1.1.2 Local

The following jurisdictions within the study area have goals and policies related to public services and utilities in their respective general plans.

4.16.1.1.2.1 City of San José General Plan

The City of San José General Plan, Envision San José 2040 General Plan (2011), includes strategies, goals, and specific policies related to utilities and public services for both existing and future development.

Major Strategy 8 emphasizes a fiscally strong city:

> Establish a land use planning framework that promotes the right fiscal balance of revenue and costs to allow the City to deliver high-quality municipal services, consistent with community expectations. … San José will maintain a fiscally strong city … by focusing new growth in developed areas where existing infrastructure (e.g., sewers, water lines, and transportation facilities) and city facilities and services (e.g., libraries, parks and public safety) are already available, resulting in maximum efficiency.

Major Strategy 11 emphasizes design for a healthful community, embodying a wide range of topics, including supporting the provision of health care and safety services.

The environmental resources sections of the General Plan emphasize protection of water resources and provision of utilities with respect to environmental hazards. One of the relevant goals and policies is as follows:

- **Goal ER-9 on Water Resources:** Protect water resources because they are vital to the ecological and economic health of the region and its residents.

The Infrastructure section of the General Plan addresses the following topics: Provision of Infrastructure; Management of Infrastructure; Water Supply, Sanitary Sewer, and Storm Drainage; Wastewater Treatment and Reclamation; Solid Waste – Materials Recovery/Landfill; and Telecommunications. Selected goals and policies include:

- **Goal IN-1 – General Provision of Infrastructure:** Provide and maintain adequate water, wastewater, stormwater, water treatment, solid waste and recycling, and recycled water infrastructure to support the needs of the city's residents and businesses.
- **Goal IN-1.1:** Provide and maintain adequate water, wastewater, and stormwater services to areas in and currently receiving these services from the City.
- **Goal IN-1.10:** Locate and design utilities to avoid or minimize impacts to environmentally sensitive areas and habitats.
- **Goal IN-4 – Wastewater Treatment and Water Reclamation:** Provide, maintain, and operate wastewater treatment and water reclamation facilities to support city development goals and planned future growth through the implementation of innovative technologies and operational practices and to fulfill all applicable local, State, and Federal regulatory requirements.

Additional policies emphasize collaboration among agencies and utilities in support of joint-use for recreation:

- **PR-8.7:** Actively collaborate with school districts, utilities, and other public agencies to provide for appropriate recreation uses of their respective properties and rights-of-way. Consideration should be given to cooperative efforts between these entities and the City to develop parks, pedestrian and bicycle trails, sports fields, and recreation facilities.
- **TN-2.10:** Work with the Santa Clara Valley Water District and the utilities, including PG&E, to explore opportunities to develop trails, joint-use facilities, and/or other recreational amenities along their rights-of-way.

The General Plan also includes goals, policies, and implementation actions for various public services, including public safety (police and fire protection) and emergency management.

4.16.1.1.2.2 Santa Clara County General Plan

The County of Santa Clara General Plan for 1995–2010 (1994) provides public-services-related strategies and policies. Policy C-EC 8(g) recognizes the need for providing adequate and efficient public services.

4.16.1.2 Physical Setting (CEQA Baseline)

4.16.1.2.1 Public Services

Public services in and near the Shoreline Phase I Study Area, including police, fire protection, and emergency services and solid waste services, are provided mainly by local jurisdictions. These public service areas are described below.

4.16.1.2.1.1 San José

Police Services

Police services for San José, including the community of Alviso, are provided by the San José Police Department. Department headquarters are located at 201 West Mission Street in San José. Three community policing centers are located in San José and one in Alviso. More than 1,300 sworn officers serve the department and the city’s population of 1,006,892 people (City of San José 2010a).

Fire Protection and Emergency Services

Emergency fire protection, prevention, rescue, and emergency medical services for San José, including the Alviso pond complex, are provided by the San José Fire Department (SJFD). The SJFD serves the city’s population of 1,006,892 people over an area of 205 square miles. Services are provided by 35 fire stations throughout the city (City of San José 2010b). The SJFD employs 794 people, including captains, chiefs, paramedics, and engineers (Guerrero pers. comm. 2012).

Solid Waste Services

Norcal Waste Systems provides solid waste collection, disposal, and recycling for most of the residential and commercial customers in San José (City of San José 2005b). The remaining portion of the city is served by the GreenTeam. The Zanker Material Processing Facility provides solid waste disposal and recycling services to the Alviso area. The facility is operated under the jurisdiction of the City of San José. The study area is served by the Newby Island Sanitary Landfill in Milpitas (see the section titled *Solid Waste Services* in Section 4.16.1.2.1.2 *Santa Clara County*).

4.16.1.2.1.2 Santa Clara County

Police Services

The Santa Clara County Sheriff's Department provides police services to the unincorporated areas of Santa Clara County. The Sheriff's Department headquarters are located at 55 West Younger Avenue in San José, and the department employs approximately 1,800 sworn and non-sworn personnel (County of Santa Clara Website 2012).

Solid Waste Services

Green Valley Disposal and Recycling provides garbage collection, disposal, and recycling services to residential and commercial customers in the unincorporated portion of Santa Clara County (Waste Management 2010). The study area is served by the Newby Island Sanitary Landfill in Milpitas. The landfill has a total permitted capacity of 65.92 million cubic yards and accepts approximately 1.47 million cubic yards annually, with an expected closure date of 2025 or later (City of San José 2009). Current capacity is estimated at just over 19 million cubic yards.

4.16.1.2.2 Utilities

Electric, wastewater, storm drain, gas, and railroad utility features are present throughout and adjacent to the study area. Utilities in the study area include storm drain outfalls on Coyote Creek and the Guadalupe River/Alviso Slough (Moffatt & Nichol Engineers 2005). Major utility features include PG&E transmission lines, treatment and support features for the Wastewater Facility, and the traversing railroad line, all of which are further discussed below and presented in Figure 4.16-1 *Major Utility Structures in the Shoreline Phase I Study Area*.

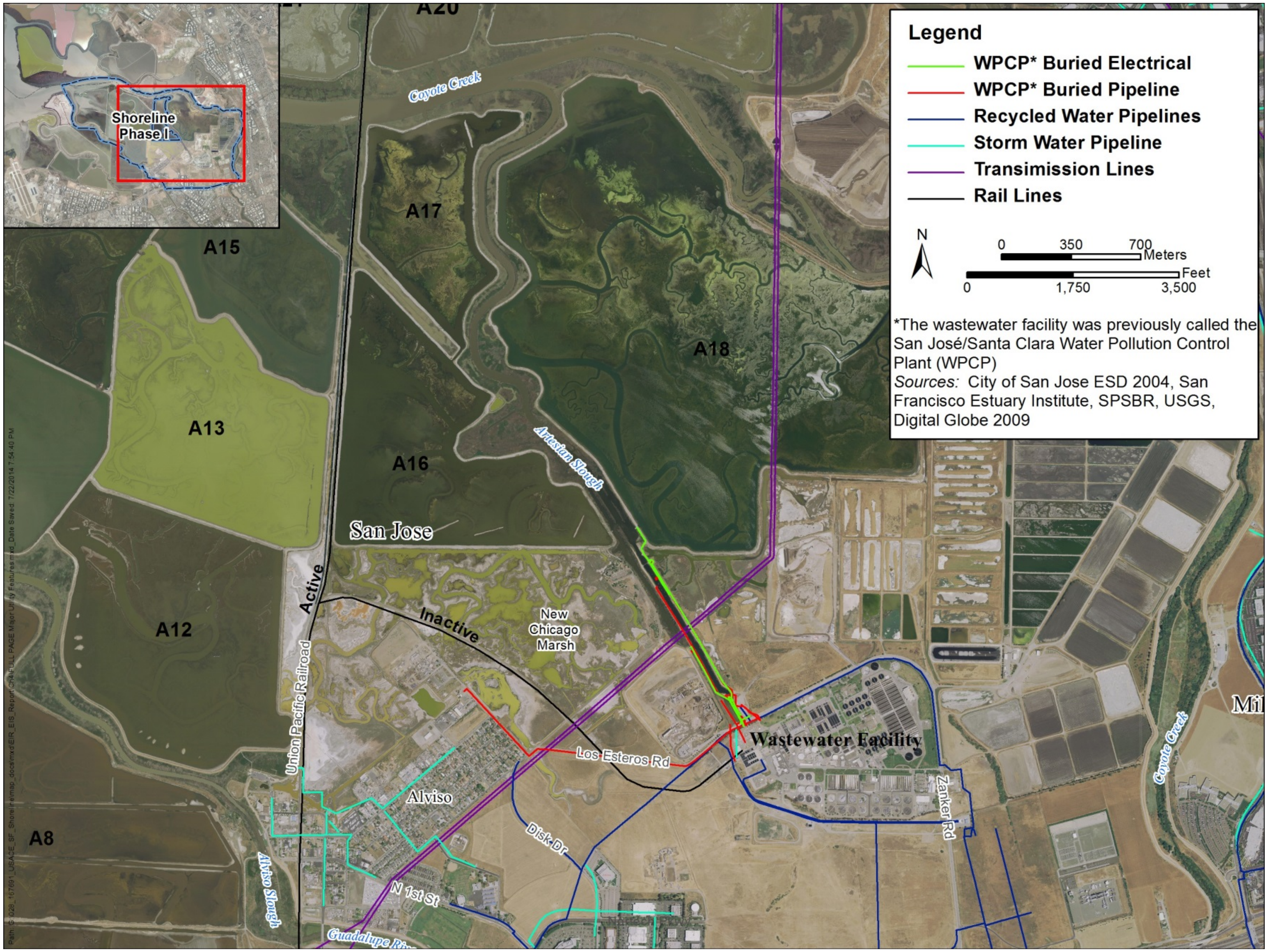

Figure 4.16-1. Major Utility Structures in the Shoreline Phase I Study Area

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PG&E provides gas and electricity service to all cities in the South Bay area. In most jurisdictions, utility customers are served directly. PG&E provides wholesale service to the City of Santa Clara, which in turn provides service to individual customers through a combination of PG&E and city transmission lines. The City of Santa Clara also owns and operates small networks of transmission lines, distribution lines, and receiving stations. PG&E overhead power transmission lines traverse the study area, including a power line that runs south through Pond A18, crosses Artesian Slough, and runs along the southern side of Grand Boulevard. Ground towers, located along the transmission lines, provide access to overhead transmission lines for inspections, repairs, and emergency maintenance (EDAW et al. 2007).

Water and wastewater services are provided on both the local and regional levels. The facilities and infrastructure that support water-related services are maintained by specific service providers. Water-service facilities and infrastructure include a wastewater treatment plant and discharge facility, wastewater pipelines, and storm-drainage facilities. Pipelines are generally located under city streets, with the exception of wastewater force mains that pass through the Alviso pond complex. Pipes carry runoff from developed areas and discharge into tidal sloughs or channels by means of gravity-driven flow or lift stations (EDAW et al. 2007).

The Wastewater Facility is located between Artesian Slough and Coyote Creek and covers 2,684 acres including Pond A18 (City of San José 2012). The Wastewater Facility provides water treatment services to eight South Bay cities including San José, Santa Clara, and Milpitas and discharges treated effluent to Artesian Slough at an average daily discharge flow of approximately 88.9 million gallons per day (City of San José 2014). At least 61 known utility features are associated with the Wastewater Facility, including treatment facilities, pipe works directly related to treatment systems (water, brine, effluent, etc.), recycled water, electric supply lines, and abandoned lines (HDR 2011). A large concentration of features is located along both sides of Artesian Slough between the Wastewater Facility and the Refuge EEC.

The City adopted a Plant Master Plan for the facility in 2013. This plan will guide improvements for the Wastewater Facility through 2040 (City of San José 2013). The Wastewater Facility Plant Master Plan addresses the facilities, processes, and land uses within the Wastewater Facility site including Pond A18. Key components of the plan include repair/replacement of aging infrastructure; new facilities to accommodate planned growth; new facilities to meet existing and future regulatory requirements; and a long-range land-use plan that balances economic development, environmental restoration, and recreation opportunities. The land-use plan provides a mix of retail, office, and light industrial uses and assumes construction of a new FRM levee. The goals in the Plant Master Plan include agency cooperation, FRM, wildlife restoration, and recreation. These goals are listed below.

- Allow the beneficial use of Wastewater Facility effluent through multiple effluent release points and creation of freshwater habitats.
- Allow complementary recreational uses, including interconnected trails to the bay, environmental education, and addressing regional recreational needs.

- In partnership with other agencies, protect, enhance, and/or restore habitat, including upland areas, wetlands, and riparian vegetation near creeks.
- Allow Pond A18 to provide water quality, ecosystem benefits, and FRM benefits.
- Promote access to recreational, educational, and economic development uses by improving transportation connections through the Wastewater Facility land.
- In partnership with other agencies, protect the Wastewater Facility from flooding and risks associated with SLC.

Union Pacific Railroad owns railroad tracks and right-of-way that run roughly north-south through the study area and past the west side of Alviso. The single track is highly used, with Union Pacific Railroad operating regular freight trains and also allowing passenger rail service. See Section 4.9 *Transportation* for a discussion of railroad transit. A railroad spur also connects from the Union Pacific Railroad line north of Alviso (close to the junction of Ponds A12 and A13) and proceeds east through the NCM to connect with the Wastewater Facility). In the past, the Wastewater Facility used the spur to deliver chemicals and materials to the Wastewater Facility; however, the tracks are no longer being used for this purpose, and future use has not been determined.

4.16.1.3 National Environmental Policy Act and Engineer Regulation 1105-2-100: *Planning Guidance Notebook* Baseline Condition

For public services and utilities, the NEPA and the Planning Guidance Notebook baseline condition is determined by projecting how the condition might change between the current condition discussed in the Affected Environment above and the start of construction. Because the amount and type of public services and utilities are not expected to change between the current and baseline condition, the NEPA and the Planning Guidance Notebook baseline condition is the same as the physical setting described in Section 4.16.1.2 *Physical Setting (CEQA Baseline)*.

4.16.2 Environmental Consequences

4.16.2.1 Avoidance and Minimization Measures Incorporated into the Alternatives

Avoidance and minimization measures are those parameters that have been built into the design of the project and are committed to as part of project implementation. These measures are generally included in the alternatives description of this report (Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*), but, where appropriate, the specific measures related to the impact evaluations are also summarized in the resource chapters.

The following AMMs would be implemented as part of the project design and would avoid or minimize adverse effects:

- **AMM-UTL-1: Reuse Materials –** Reuse earth materials (existing levees, etc.) to reduce the amount of import material, stockpile and landfill material.
- **AMM-UTL-2: Flood Warning Signs –** Install public warning signs and sirens to improve public awareness and response to inundation emergencies (floods and tsunamis).
- **AMM-UTL-3: Relocate Utilities –** Relocate utilities in conflict with FRM features either before or in conjunction with construction of FRM features to minimize impacts.

4.16.2.2 Methodology for Impact Analysis and Significance Thresholds

This section evaluates effects on utilities and public services to compare the effects of the No Action and action alternatives.

An alternative would be considered to have a significant effect if it would:

- **Impact UTL-1:** Result in a substantial adverse physical impact associated with the provision of or need for new or physically altered emergency services facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for fire protection, police services, or other public services or facilities.
- **Impact UTL-2:** Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs.
- **Impact UTL-3:** Require or result in the construction of new utility facilities or expansion of existing utility facilities, the construction of which could cause significant environmental effects.
- **Impact UTL-4:** Substantially reduce the ability to access PG&E towers, stations, or electrical transmission lines or reduce the integrity of PG&E's utility infrastructure; or reduce clearance between waterways and electrical transmission lines such that navigation of watercraft or regulatory compliance is affected.
- **Impact UTL-5:** Interfere with rail transportation or operations
- **Impact UTL-6:** Require or result in the construction of new water, wastewater treatment, or stormwater drainage facilities, or expansion of existing facilities, the construction of which could cause significant environmental effects.

4.16.2.3 Alternatives Evaluation

This section evaluates the impacts on utilities and public service systems resulting from the alternatives, as further described below.

4.16.2.3.1 No Action Alternative

Under the No Action Alternative, none of the proposed management measures, such as the FRM levee, pond marsh restoration, or recreation features, would be implemented. Existing ponds berms would continue to be maintained and would provide some measure of FRM, but FRM would not improve over the existing condition unless other FRM measures are implemented.

Lack of a FRM levee in particular would continue to expose existing structures and facilities, including a City of San José Fire Station, an elementary school in Alviso, and the Wastewater Facility, to flood risk. Without the FRM levee, the Wastewater Facility would be vulnerable without improved FRM.

The No Action Alternative would avoid construction impacts associated with the action alternatives, including temporary impacts on railroads and utility service lines, utility relocation, and water use.

Maintenance of a FRM levee would not be necessary under the No Action Alternative, while maintenance associated with the managed ponds would be similar to maintenance under the action alternatives. Maintenance would primarily involve sustaining the earthen managed pond dikes and would not affect utilities. Public service needs would be limited to emergency service if maintenance worked needed assistance.

4.16.2.3.2 Action Alternatives

This section describes the effects on utilities and public service systems resulting from construction of the action alternatives.

Impact UTL-1: Result in a substantial adverse physical impact associated with the provision of or need for new or physically altered emergency services facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for fire protection, police services, or other public services or facilities

During construction, emergency services would be provided by the City of San José and its reciprocal partners, if needed. Construction activity is not expected to require an increased need for emergency service providers, since the number of workers on site at any one time would not be substantial (20 people maximum assumed at any one time) and work would not be performed year-round.

Long-term operation and maintenance of the area would not require additional emergency services or affect existing service providers.

Construction of the FRM levee would improve FRM in the study area. The project also includes the installation of public warning signs and sirens in the event of floods (AMM-UTL-2: Flood Warning Signs).This could reduce the future need for emergency response to areas subject to flooding under the baseline condition. Regardless, the City of San José would maintain the police and fire stations that service the area in order to provide response for other types of emergencies.

The project would have less-than-significant impacts to police, fire, and other emergency services.

Impact UTL-2: Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs

The bulk of the construction work would involve earthwork. Some demolition could occur that produces waste such as metal or concrete culverts and other small concrete structures, wood from raised pathways, railings from roads and pathways, and utility poles. However, the quantity of waste generated would be small and could easily be accommodated at local waste disposal facilities, which have adequate permitted capacity. Existing earthen material would be reused to the extent practical, thereby reducing both the amount of import material needed for the project and the export of materials to waste sites (AMM-UTL-1: Reuse Materials**)**. The operation and maintenance of the facilities and ponds would generate minimal waste, similar to amounts generated under the existing condition.

Impacts from construction waste on landfill capacity would be less than significant.

Impact UTL-3: Require or result in the construction of new utility facilities or expansion of existing utility facilities, the construction of which could cause significant environmental effects

This study included reviewing utility databases (the Wastewater Facility geographic information system database and the City of San José utility database) and aerial and street photographs to provide preliminary identification of utility features that may be affected by proposed FRM features (HDR 2011). Based on this review, over 80 known utility features may be affected, including approximately 61 features associated with the Wastewater Facility, especially those concentrated along both sides of Artesian Slough. Other potentially affected utility features include a PG&E-owned power line that runs north-south through Pond A18 and across Artesian Slough, storm drains, sanitary sewers, and other utilities along the west and east sides of Alviso and along Grand Boulevard. Affected utilities would be relocated before or in conjunction with construction of FRM features, and relocations would be performed to minimize impacts on utility providers and customers (AMM-UTL-3: Relocate Utilities**)**. Work to relocate or replace utilities would be similar to other earthwork necessary for the project.

Each utility provider would determine the best construction approach for relocation and may be able to serve customers via parallel facilities. In some instances, replacement facilities may need to be constructed to provide continued service before existing facilities are abandoned.

Regardless of the relocation approach, utilities are expected to remain in service during relocation and construction without any disruption to utility customers.

Operation and maintenance of the FRM levee and restored areas would require minimal ground disturbance associated with activities such as vegetation management. If adaptive management requires activities such as additional levee breaches or ground-disturbing maintenance of former pond areas, this activity could directly affect utilities if they are present in active work areas. Before any ground disturbing activities took place, Refuge managers would verify the location of utilities and plan maintenance activities to either avoid the utilities or relocate utilities (in coordination with the affected provider). Coordination and planning would ensure that this impact is less than significant.

The project would not require new or expanded utilities, and the impact would be less than significant.

Impact UTL-4: Substantially reduce the ability to access PG&E towers, stations, or electrical transmission lines or reduce the integrity of PG&E's utility infrastructure; or reduce clearance between waterways and electrical transmission lines such that navigation of watercraft or regulatory compliance is affected

PG&E overhead power transmission lines and towers are located throughout the Shoreline Phase I Study Area. PG&E currently maintains and accesses these facilities, and the same type of maintenance and access would continue concurrent with implementation of the Shoreline Phase I Project. Access to these towers and stations is provided by light vehicles and boardwalks in most instances, although boat or helicopter access is also used.

PG&E facilities and access to towers outside of Pond A18 would be largely unaffected by construction and restoration activities because PG&E can access overhead lines and towers located near Pond A18 and across Artesian Slough for maintenance or repair using heavy equipment along or near the existing pond berms that would not be affected by the project. Maintenance and repair activities include aerial and ground patrols and inspections, insulator washing and replacement, management of problems associated with bird roosting and nesting materials, repairs due to bird electrocutions or collisions, and foundation and structural repairs.

Towers within Pond A18 are currently accessed by boardwalks in the pond or by small boats. The restoration of tidal habitat proposed by the project would affect access to PG&E's lines and towers within Pond A18 due to physical and biological changes in the restored area. Access to the towers would be reduced by tidal inundation, which could make boat access infeasible in the short term due to tidal currents within the pond and in the long term as the ponds fill in with sediment and marsh vegetation. The existing boardwalks themselves could be inundated as a result of restored tidal action, requiring reconstruction and/or relocation.

In addition, the restoration of salt marsh in Pond A18 would reduce and/or change the methods and timing of access to PG&E facilities in the future because required maintenance activities would have the potential to result in disturbance, injury, or mortality of Endangered or

Threatened wildlife species that might move into the restored marsh area as a result of the project.

The structural integrity of PG&E towers in Pond A18 could be affected by increased inundation and associated corrosion, or by scour around the marine foundation. Increases in water levels and tidal action due to levee breaching could affect PG&E towers if the concrete cover were not adequate to protect the base of the steel structure from saline bay water. Inundation or wind wave splash on steel portions of the tower would potentially accelerate corrosion and reduce the strength of the material. Protecting tower foundations against corrosion may necessitate increasing the amount of concrete armoring around steel elements.

Where the structural integrity of towers would be adversely affected by breached ponds, the project proponents will coordinate with PG&E to ensure that all necessary upgrades are completed prior to breaching Pond A18 including, but not limited to, replacing damaged steel, towers, and footings; repairing concrete footings; or raising and modifying towers.

Where the methods of access are adversely affected by breached ponds, the project proponents will coordinate with PG&E to provide sufficient alternative equivalent access to any existing utility infrastructure that may be affected by the project. The Proposed Action includes raising the existing boardwalks in Pond A18 to provide clearance from tides and storm surges. Additional modifications could entail the construction of new boardwalks or further improvements to the existing boardwalks to ensure that the boardwalks stay above the level of the tides and to minimize maintenance-related disturbance of sensitive species to the greatest degree possible. All infrastructure improvements would be completed prior to breaching Pond A18.

PG&E currently has an agreement with the USFWS for its operation and maintenance activity on the Refuge to protect natural resources consistent with the polices of the Refuge, but Pond A18 is not part of the Refuge and thus would not be a part of the USFWS agreement, although maintenance would likely be consistent with the procedures and conditions in the agreement. In order to minimize impacts to utility infrastructure in Pond A18, impacts on PG&E's ability to access this infrastructure, and indirect impacts to biological resources from ongoing and future PG&E maintenance and repair activities, the project proponents will coordinate with PG&E, along with other regulatory agencies including the CDFW, the RWQCB, the BCDC, the USFWS, and the NMFS, to obtain all necessary permits.

Coordination would include the inclusion of PG&E facility improvements and access requirements in permits applications, identification of appropriate times and methods to access the lines and towers for maintenance and repair (e.g., restriction of work during breeding seasons), or alternative methods of access (e.g., use a helicopter instead of ground-based equipment). These AMMs would be included in all applicable permits. The project proponents will also coordinate with PG&E and the USFWS to ensure that PG&E's ongoing maintenance and operations activities in and around Pond A18 are included in the Biological Opinion for the project.

Pond A18 is surrounded by levees and is upstream of an existing Union Pacific Railroad bridge over Coyote Creek, which will restrict sailboat access from the pond. Any reduction in line clearance associated with increased water surface level would not affect navigation of watercraft. The minimum clearance between overhead electrical transmission lines and navigable water in areas not suitable for sailboating is 8 meters (25 feet), and tidal restoration would not reduce line clearance below this level. Therefore, the project would not require changes to the transmission line system to increase clearance.

Impacts associated with access to electrical towers, stations, and line and clearance requirements for power lines would be less than significant.

Impact UTL-5: Interfere with Rail Transportation or Operations

Levee segments would be constructed on each side of the active, north-south railroad right-of-way. A temporary railroad crossing would be required for trucks to deliver fill material for the FRM levee and construct the levee segment west of the railroad. Short-term closure of the railroad line would be needed during construction of the temporary crossings. The short-term closure would be coordinated with Union Pacific Railroad and rail transit providers to minimize impacts on commerce and transit. See Section 4.9 *Transportation* for further discussion of coordination and transit.

For Alternative 3, an existing, unused railroad spur would be removed and could no longer be used for rail purposes. The Wastewater Facility historically used this spur, but no longer uses it and has no plans to reactivate rail use on the spur. Without the spur, the Wastewater Facility would continue to use other surface transportation facilities for deliveries to its plant.

The project would not substantially interfere with rail transportation or operations; the impact would be less than significant.

Impact UTL-06: Require or result in the construction of new water, wastewater treatment, or stormwater drainage facilities, or expansion of existing facilities, the construction of which could cause significant environmental effects

Construction would result in the temporary increase in water use. This would include water for the construction process, for dust suppression, and for construction employees' consumption. This volume would be limited in quantity and time and would come from existing sources. The project would use potable water obtained by water trucks from a nearby hydrant fitted with a temporary meter.

Water use during project construction would depend on weather conditions and would be primarily limited to earthwork operations. A project of this type and magnitude would typically use two water trucks per day during earthwork operations at 2,500 gallons per truck. Earthwork operations for this project are estimated at this feasibility level of development to be about 750 days, which equates to approximately 3.75 million gallons of construction water. These uses would not require the construction of new water facilities and sufficient water supplies are available to serve the project from existing entitlements and resources.

It should be noted that construction operations such as these often make use of recycled water. The Wastewater Facility is within the project boundary and produces high-quality, tertiary treated recycled water. The recycled water is distributed throughout the area for irrigation and other approved purposes as part of the discharge permit, and this would be a viable, available, conservation-minded source.

The project would not require the use of stormwater or sanitary sewer services.

The project would not require the construction or expansion of water, wastewater, or stormwater facilities. This impact would be less than significant.

4.16.2.3.2.1 Comparison of Action Alternatives

The impacts on public service systems would be similar for all action alternatives. Assuming that flood and tsunami warning signs and sirens are provided and FRM is improved by the project, the need for emergency response may be reduced for all action alternatives compared to the baseline condition. Emergency response may be slightly higher for alternatives that provide less FRM (for a 12.5-foot NAVD 88 levee for Alternative 2) compared to alternatives that address risks associated with a 15.2-foot NAVD 88 levee (Alternatives 3, 4, and 5).

Table 4.16-1 *Summary of Short-Term Construction Impacts on Utility Lines from the Action Alternatives* lists the short-term construction impacts on utility lines, identifying those features that are potentially in conflict with proposed FRM features and likely to require relocation. Note that, while impacts on utility service providers vary by alternative, service to utility customers could be affected by temporary utility outages associated with any of the alternatives. Alternatives 2 and 3 would equally have the least impact on utilities, while Alternative 5 would have the greatest impact since it would be located closer to Alviso and its associated infrastructure.

Table 4.16-1. Summary of Short-Term Construction Impacts on Utility Lines from the Action Alternatives

Alternative	Impact Summary
2 – Alviso North with 12.5-foot Levee and Bench	Would have the least impact on utilities: • Conflicts with storm drains: near El Dorado St. • Conflicts with power lines: north-south via Pond A18 • Conflicts with power transmission lines: power transmission line to Wastewater Facility
3 – Alviso North with 15.2-foot Levee and 30:1 Ecotone	• Same as Alternative 2
4 – Alviso Railroad with 15.2-foot Levee and Bench	Conflicts with utility features: along Grand Blvd., though to a lesser extent than Alternative 5; along Spreckles Ave. Conflicts with storm drains: near El Dorado St. Conflicts with power lines: north-south via Pond A18; crossing Grand Blvd.; crossing Artesian Slough Conflicts with sewer lines: along Grand Blvd. to Essex Rd. Conflicts with power transmission lines: power transmission line to Wastewater Facility
5 – Alviso South with 15.2-foot Levee and Bench	Would have the greatest impact on utilities: • Conflicts with utility features: along Spreckles Ave.; along Grand Blvd. • Conflicts with storm drains: near El Dorado St.; near Spreckles Ave.; south of Los Esteros Ave. • Conflicts with power lines: north-south via Pond A18; crossing Grand Blvd.; crossing Artesian Slough • Conflicts with sewer lines: along Spreckles Ave. to Grand Blvd; along Grand Blvd. to Essex Rd. • Conflicts with power transmission lines: power transmission line to Wastewater Facility

Table 4.16-2 *Summary of Impacts on Railroad Lines from the Action Alternatives* lists the effects on railroad lines. Alternative 4 would have the greatest impact on railroads, and impacts under Alternatives 2, 3, and 5 would be minor. Alternative 4 would have the greatest impact on railroads because it would preclude future rail use of an inactive railroad spur.

Table 4.16-2. Summary of Impacts on Railroad Lines from the Action Alternatives

Alternative	Railroad Lines Impacts
2 – Alviso North with 12.5-foot Levee and Bench	Temporary railroad crossing during construction near southern end of Ponds A13 and A16
3 – Alviso North with 15.2-foot Levee and 30:1 Ecotone	Same as Alternative 2
4 – Alviso Railroad with 15.2-foot Levee and Bench	Would have the greatest impact on railroads: • Temporary railroad crossing during construction near southern end of Ponds A13 and A16 • Eliminates inactive railroad spur from active line to Wastewater Facility
5 – Alviso South with 15.2-foot Levee and Bench	Same as Alternative 2

4.16.3 Mitigation Measures

No mitigation measures are required.

4.16.3.1 Residual Impacts and Additional Measures Necessary to Mitigate Significant Impacts

Because of the project design and incorporation of measures to avoid impacts (i.e., retain utility services throughout the construction period, improve public safety with early-warning signs and sirens) there are no residual impacts that require mitigation.

4.16.4 Cumulative Effects

There is no substantial cumulative impact for utilities considering all past, current, and known future projects. The region has adequate public services, landfill capacity, utilities and water supplies and is anticipated to continue to do so into the future.

4.16.5 Summary

Table 4.16-3 *Public Services and Utilities NEPA Impact Conclusions* summarizes the project effects under the NEPA.

Table 4.16-3. Public Services and Utilities NEPA Impact Conclusions

Effect	Nature	Magnitude	Duration	Potential for Occurrence	Geographical Extent
UTL-01: Police and Emergency Services	Negative	Minor	Short term	Possible	Local
UTL-02: Construction Waste and Landfill Capacity	Negative	Minor	Short term	Possible	Local
UTL-03: Construction of New or Expanded Utilities	Negative	Minor	Short term	Possible	Limited
UTL-04: Power Transmission Lines and Towers	Negative	Minor	Long term	Probable	Limited
UTL-05: Interfere with Rail Transportation or Operations	Negative	Minor	Short term	Possible	Limited
UTL-06: Water Use	Negative	Minor	Short term	Probable	Local

Table 4.16-4 *Public Services and Utilities CEQA Impact Conclusions* summarizes the project effects under the CEQA.

Table 4.16-4. Public Services and Utilities CEQA Impact Conclusions

Effect	Avoidance and Minimization Measures	Significance	Mitigation	Significance after Mitigation
UTL-01: Police and Emergency Services	AMM-UTL-2: Flood Warning Signs	LTS	None	LTS
UTL-02: Construction Waste and Landfill Capacity	AMM-UTL-: Reuse Materials	LTS	None	LTS
UTL-03: Construction of New or Expanded Utilities	AMM-UTL-3: Relocate Utilities	LTS	None	LTS
UTL-04: Power Transmission Lines and Tower		LTS	None	LTS
UTL-05: Interfere with Rail Transportation or Operations		LTS	None	LTS
UTL-06: Water Use		LTS	None	LTS

LTS = less than significant
S = significant

Construction of the alternatives would not require the construction of new or expansion of existing utility systems such as water, power, or solid waste and would not require new or physically altered emergency services facilities, such as police stations. Construction could affect PG&E's access to electric transmission lines and towers in Pond A18, an area that is not subject to an operation and maintenance agreement with the USFWS. PG&E would continue to coordinate with the USFWS, the NMFS, and the CDFW consistent with the Santa Clara Valley HCP or on a project-by-project basis to ensure that its operation and maintenance activity in Pond A18 does not affect Threatened or Endangered species.

5.0 National Environmental Policy Act/California Environmental Quality Act Considerations and Other Required Analyses

5.1 Overview of Additional NEPA/CEQA Requirements and Approach to Analyses

This chapter addresses other topics required by National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) in this Integrated Document. The sections of this chapter address a summary of cumulative impacts (NEPA and CEQA; details for each resource are presented in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures*); growth-inducing impacts (CEQA); and other required analyses. The other required analyses include unavoidable adverse impacts (CEQA); irreversible and irretrievable commitments of resources (NEPA and CEQA); the relationship of short-term uses and long-term productivity (NEPA); and the identification of the environmentally superior alternative (CEQA).

Executive Order 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* requires Federal agencies to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies, and activities on minority and low-income populations. Appendix B12 *Environmental Justice Appendix* contains a detailed analysis of the potential for environmental justice impacts, consistent with Executive Order 12898 and the Council on Environmental Quality's guidance for identifying environmental justice populations.

5.2 Potential Cumulative Impacts of the Action Alternatives on Resources (NEPA and CEQA)

The past, present, and reasonably foreseeable future actions considered in the cumulative impacts analyses are described in Section 4.1.8 *Cumulative Impacts Setting*. As described throughout Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures*, the Shoreline Phase I Project effects would contribute to cumulative adverse effects associated with the following resources:

- **Tidal flood risk (Section 4.4 *Hydrology and Flood Risk Management*):** Opening up restoration areas to tidal action could exacerbate predicted scour in creeks and sloughs, which could potentially increase tidal flood risks. The extent of the project's contributions to cumulative, adverse changes in bathymetry and hydrodynamics is unknown. Sea level change is expected to affect bathymetry and hydrodynamics, and the effects of numerous restoration projects, including the Shoreline Phase I Project, could contribute to long-term change. Mitigation required as part of the Shoreline Phase I Project (M-HYD-1a, 1b, 1c) will require future monitoring and corrective action if necessary, which will avoid significant impacts from scour. With mitigation, the project does not substantially contribute to a cumulative impact

- **Adverse effects to habitat in New Chicago Marsh (Section 4.7 *Terrestrial Biological Resources*):** Alternatives 4 and 5 would cause significant adverse effects to the NCM due to hydrologic changes that, when combined with SLC, could permanently change marsh habitat over time. Measures to address this cumulative effect would be the same for the impact identified at the project level; implementation of measure MM-TBR-3. There is uncertainty of successfully maintaining connectivity the two sides of the marsh bisected by the levee with this measure. The bayward side would be not be protected from tidal flooding and rising sea levels, while the landward side would be cut off from the bay and would need to depend on the pumps or culverts to maintain its current level. This uncertainty leads to a conclusion that the cumulative impact is unavoidable.
- **Loss of nesting habitat for western snowy plover (Section 4.7 *Terrestrial Biological Resources*):** Restoration of circulation ponds to tidal marsh would result in a loss of western snowy plover nesting habitat due to inundation and loss of suitable nesting substrate. The exact acreage of habitat loss is not known, due to uncertainty in what currently constitutes suitable, occupied habitat. Because activities would be phased, direct habitat losses would occur over time. When combined with the losses associated with the South Bay Salt Pond (SBSP) Restoration Project, this loss could be considerable.

  Applying measure MM-TBR-2c and future restoration would be planned to ensure that adequate habitat to allow successful nesting by western snowy plovers is available. As a result, long-term, cumulative impacts on western snowy plovers would be less than significant.
- **Loss of pond habitat used by pond-specialist bird species (Section 4.7 *Terrestrial Biological Resources*):** The Shoreline Phase I Project would result in the loss of a substantial amount of human-created managed pond habitat that is used by managed-pond-specialist waterbirds for foraging and roosting. The magnitude of effects would depend on the long-term success of the Shoreline Phase I Project and other restoration projects in the region, population trends, and adaptability of the pond-specialist species. The cumulative loss of managed pond habitat could adversely affect pond specialists, waterfowl, and some species of shorebirds. Due to the scale of the Shoreline Phase I Project relative to other projects considered in this cumulative impacts analysis, the incremental impact of the Shoreline Phase I Project would be cumulatively significant.
- **Views from Alviso (Section 4.12 *Aesthetics*):** The construction of the levee for alternatives 4 and 5 would reduce the aesthetic value of the marsh from Alviso and this impact is cumulatively considerable. There is no mitigation available to reduce the impact of a levee in close proximity to Alviso. Alternatives 4 and 5 would have an unavoidable cumulative impact.
- **Noise (Section 4.13 *Noise*):** Because of the proximity of residential receivers to area roads, the airport, the Union Pacific Railroad track, and the Wastewater Facility, cumulative noise impacts experienced by people in the town could be significant,

particularly if Shoreline Phase I Project construction activity is concurrent with construction activity at the Wastewater Facility. Mitigation measure M-NOI-1 would reduce the incremental contribution of the project to overall noise in the area.

In some cases, the project would result in beneficial, long-term effects that would have a positive impact on the cumulative condition. These cases include:

- Improved FRM associated with project would combine with improved flood fluvial risk management actions completed for Coyote Creek, upper Guadalupe River, and Permanente Creek.
- Project-related tidal marsh restoration would combine with SBSP Restoration Project actions and other, smaller restoration projects in the region to contribute to an increase in tidal marsh habitat, an important habitat type, and more extensive habitat connectivity in the South Bay. This would improve habitat for many common resident wildlife species and for special status species that use the study area for nesting, foraging, or roosting.
- Tidal marsh restoration would combine with other ongoing activity near the community of Alviso (such as restoration associated with the SBSP Restoration Project and Alviso Slough and the Wastewater Facility's ongoing implementation of the Plant Master Plan improvements) to improve the visual character of the Alviso Pond Complex.

5.3 Growth-Inducing Impacts (NEPA and CEQA)

The State of California CEQA Guidelines require an Environmental Impact Report (EIR) to discuss the ways in which a Proposed Project could foster economic or population growth or require the construction of additional housing, either directly or indirectly, in the surrounding environment. This includes ways in which the Proposed Project would remove obstacles to population growth or trigger the construction of new community services facilities that could cause significant effects (CEQA Guidelines §15126.2).

The NEPA requires an Environmental Impact Statement (EIS) to examine the potential of the Proposed Project to significantly or adversely affect the environment; potential impacts could be either direct or indirect. Indirect effects [NEPA, 40 CFR 1508.8(b)] may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air, water, and other natural systems including ecosystems. The analysis presented in Sections 5.3.1 *Direct Growth-Inducing Impacts* and 5.3.2 *Indirect Growth-Inducing Impacts* focuses on whether the Proposed Project would directly or indirectly induce growth in the surrounding area.

5.3.1 Direct Growth-Inducing Impacts

The project would directly induce growth if it would directly foster economic or population growth or the construction of new housing in the surrounding environment (e.g., if it would remove an obstacle to growth by expanding existing infrastructure).

Because most of the Shoreline Phase I Study Area is former salt pond area and Don Edwards San Francisco Bay National Wildlife Refuge (Refuge) property, the City of San José designates most of the study area as Parks and Open Space. Other planned uses include Public/Quasi-Public (the Wastewater Facility properties), Industrial and Commercial (around the Nortech Parkway and Gold Street north of SR 237 and south of the developed community of Alviso and on the south side of the Wastewater Facility property), Residential (in the Alviso community area), Light Industrial (solid waste sites, power facility, and an area that abuts the NCM), and small areas of Community Commercial near the I-880/SR 237 interchange and along SR 237.

The city's Urban Growth Boundary and Urban Services Area boundary bisect the study area; these boundaries generally follow the Refuge boundary on the west and Wastewater Facility property on the west. The City of San José's General Plan (General Plan) has long identified the Wastewater Facility and adjacent commercial, industrial, and light industrial for urban (developed) uses. The most recent General Plan, which was adopted in 2011, identifies the area south of SR 237 as an employment growth area. The area north of SR 237 is part of the designated Alviso Master Plan area. The Wastewater Facility Plant Master Plan also identifies areas for office, research and development, light industrial, and commercial uses south of the Wastewater Facility operations areas and north of SR 237. The General Plan land-use designations have been updated since adoption of the 2011 and reflect the non-public/non-quasi-public uses of that part of the Wastewater Facility property (City of San José 2015).

The Alviso Master Plan was adopted in 1998. The plan has been amended with the new land-use plan adopted as part of the 2011 General Plan. San José still uses the principles of the 1998 plan to guide development in the Alviso area. As described in the 2040 General Plan, the expanded job growth capacity is in the area west of the Wastewater Facility along the SR 237 corridor. The 1998 plan shows the same general types of uses in the area, so the update is not really a change in focus from the 1998 plan. The Alviso area land-use principles remain unchanged; these principles focus on maintaining community character and making sure new uses are carefully integrated into the existing community. Like the 2040 General Plan policies for environmental protection and resource management, the community plan policies recognize the importance of intact riparian areas and the effects of tidal flooding.

The City of San José's growth projections for the period 2012–2016 show minimal commercial development in the Alviso community (about a million square feet of new commercial space). The mixed commercial/light industrial areas will likely develop based on the future market condition.

The Alviso plan objectives do not include establishing new flood risk management features but rather encourage uses that are compatible with the existing environment. The plan recognizes past discussions with the USACE regarding FRM, as follows:

> The U.S. Army Corps of Engineers investigated the possibility of providing tidal flood protection to the communities along the south end of the San Francisco Bay. These studies found that such flood protection would be financially infeasible. As a result, tidal flooding remains a potential concern in Alviso. [Page 19 of the Alviso Master Plan (City of San José 1998)]

The remainder of the 1998 Master Plan assumes that the USACE will not provide FRM measures in the future. This assumption has influenced ongoing and future development plans, including those reflected in the 2011 General Plan. In spite of the USACE's reconsideration for FRM in the South Bay, the plans continue to reflect development patterns that would be suitable without additional tidal FRM. The flooding-related policies and action items included in the 2011 General Plan encourage the City to cooperate and coordinate with flood-control agencies (local and Federal) but do not assume that FRM features such as those proposed as part of the Shoreline Phase I Project will be constructed in the General Plan time frame.

In summary, the planned development patterns reflect an assumption that new tidal FRM features will not be constructed and thus will not provide FRM that would induce growth beyond that currently planned. The City would need to change its General Plan map and policies to change the existing growth focus for the area.

However, the Shoreline Phase I Project, along with the primary goals to provide flood risk management and ecosystem restoration, does not directly foster economic or population growth or the construction of new housing in the surrounding environment. Therefore, the Shoreline Phase I Project would not directly induce local or regional growth.

5.3.2 Indirect Growth-Inducing Impacts

The project would indirectly induce growth if it would foster economic or population-expanding activities that would lead to further development by taxing existing facilities and eventually requiring the construction of new facilities (e.g., an increase in population as a result of development authorized by approval of a general plan).

The Shoreline Phase I Project itself does not include activity that would directly result in new residential or non-residential development. The City's current General Plan does not assume that the project will occur and thus does not reflect how the project benefits that are related to better flood risk management could affect regional development patterns. It is possible that the City will update its General Plan to reflect the improved flood risk management in the area. However, even if a General Plan update were to occur, new development would be limited by proximity to the Wastewater Facility, proximity to San Francisco Bay, the City's Urban Growth and Urban Services Area boundaries, the City's stated desire to protect the baylands from development, and land availability (areas to the south of SR 237 are already developed, so new development would be mostly infill).

The Wastewater Facility Plant Master Plan First Amendment to the Draft EIR states that the Shoreline Phase I Project "…levee is considered an integral part of the PMP that would be implemented in partnership with other agencies and the Plant Master Plan EIR evaluates it as such." (City of San José 2013a) However, the Plant Master Plan EIR Amendment goes on to state that facility upgrades and other proposed land uses (e.g., retail and light industrial) would occur with or without the levee construction:

> The City reasonably expects that the levee will be implemented through the South Bay Shoreline Study (Shoreline [Phase I] Study); the City has been an active participant in the Shoreline Study effort led by the Army Corps of Engineers and local sponsors Santa Clara Valley Water District (SCVWD) and California Coastal Conservancy for the past several years and a Draft EIR/ Environmental Impact Statement (EIS) will be published in the fall/winter of 2013.
>
> In the event that implementation of the proposed coastal levee is delayed or in any event until the proposed levee is constructed or not constructed, implementation of City Standard floodproofing requirements coupled with project design features identified in the EIR would ensure that the effects of coastal flood hazards on proposed WPCP improvements and other land uses on the PMP lands would not expose people or structures to an unacceptable risk of loss from flooding.

The City of San José adopted the Plant Master Plan in 2013, and the City's General Plan land-use plan adopted in 2011 has been updated to reflect some of the land-use changes shown on the Plant Master Plan's land-use map (City of San José 2015).

Because the Shoreline Phase I Project would not cause an increase in local growth, it would not result in an increased demand for growth-supporting resources (such as additional utility service and new roadways). The project would use existing utilities and roadways and would not require the construction of new infrastructure to support its construction and operation. Long-term use as a wildlife refuge will not require additional infrastructure.

The Shoreline Phase I Project would not indirectly induce local or regional growth.

5.4 Other Required Analyses

5.4.1 Energy Conservation – CEQA Appendix F

Per Public Resources Code Section 21100(b)(3), in order to ensure that energy implications are considered in project decisions, CEQA requires that an EIR include a discussion of the potential energy impacts of the proposed project, with particular emphasis on avoiding or reducing inefficient, wasteful, and unnecessary consumption of energy. Potentially significant energy implications of a project are to be considered in the EIR to the extent relevant and applicable to the project.

Appendix F of the State CEQA Guidelines outlines issues related to energy conservation and includes potential project description considerations, types of impacts applicable to energy use, and potential mitigation measures to reduce wasteful, inefficient, and unnecessary consumption of energy.

Energy conservation can be accomplished by reducing energy consumption (e.g., natural gas and oil) and increasing reliance on renewable energy sources. Energy used during project construction, operation, and maintenance would be expended in the form of electricity, gasoline, and diesel fuel, which would be used primarily by construction equipment and trucks.

Energy would be used wisely and efficiently during project construction, operation, and maintenance because, in all cases, the potential adverse environmental effects of the project would be reduced to a less-than-significant level through project design, construction practices, preconstruction surveys and analysis, regulatory requirements, and best management practices. Further, applicable proposed avoidance and minimization and mitigation measures identified in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures* of this EIR would ensure that energy is conserved to the maximum extent possible. Measures that have been included in the project that would contribute to energy conservation include the following:

- Fuel management plan
- Use on-site material and natural sedimentation processes to fill in low areas of ponds
- Minimize footprint of disturbance
- Truck delivery and regular construction work hours would be outside the AM and PM peak traffic hours
- Minimize idling times
- Maintain construction equipment in accordance with manufacturer's specifications
- Require Best Available Control Technology on all construction equipment, including diesel vehicles
- Contractors must use equipment that meets Air Resources Board standards for off-road heavy-duty diesel engines
- Maintain construction equipment
- Reuse materials

The measures identified above would contribute to energy conservation by reducing vehicle trips, improving fuel efficiency, and limiting the size of construction areas and reusing materials where practical. Together, the project design features, construction practices, compliance with regulatory requirements, and implementation of avoidance and minimization and mitigation measures would ensure that the project would not result in the inefficient, unnecessary, or wasteful consumption of energy, and impacts would be less than significant.

5.4.2 Unavoidable Adverse Impacts (NEPA and CEQA)

Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures* describes the potentially significant project-related effects on the built and natural environments. The analyses in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures* identify a number of potentially significant effects associated with the action alternatives; most of those effects could be reduced to a less-than-significant level with the application of additional measures designed to address the impacts. The action alternatives would result in the following unavoidable adverse effects:

- **Incompatibility with the *New Chicago Marsh Water Management Plan*** (Section 4.3 *Land Use and Planning*) – Alternative 5 only
- **Loss/Disruption of Marsh Habitat in the NCM** (Section 4.7 *Terrestrial Biological Resources*):
  - Levee bisecting the NCM effect on wildlife movement and habitat connectivity – Alternative 4 only
  - Levee alignment leaving all/part of the NCM subject to tidal flooding effect on population and habitat trends – project and cumulative impact for Alternatives 4 and 5
  - Incompatible with biological components of *New Chicago Marsh Water Management Plan* – Alternatives 4 and 5
- **Violate Air Quality Standard for Nitrogen Oxides and Reactive Organic Gases** (Section 4.10 *Air Quality/Greenhouse Gases*) – all action alternatives
- **Short-term negative effect on visual character** (Section 4.12 *Aesthetics*) – Alternatives 4 and 5
- **Long-term negative effect on visual character from Alviso** (Section 4.12 *Aesthetics*) – project and cumulative impact for Alternatives 4 and 5
- **Substantial adverse effect to the Alviso Salt Ponds Historic Landscape** (Section 4.15 *Cultural Resources*) – project and cumulative impact for all action alternatives
- **Cumulative loss of pond habitat used by pond-specialist bird species** (Section 4.7 *Terrestrial Biological Resources*) – all action alternatives
- **Cumulative temporary increase in noise levels** (Section 4.13 *Noise*) – all action alternatives

5.4.3 Irreversible and Irretrievable Commitments of Resources (NEPA and CEQA)

Section 15126(c) of the CEQA Guidelines requires an EIR to address any significant irreversible environmental changes and irretrievable commitment of resources that may occur as a result of alternative implementation. Resources that are irreversibly or irretrievably committed to a project are those that are typically used on a long-term or permanent basis; however, some are considered short-term resources that cannot be recovered and are thus considered irretrievable. This includes use of nonrenewable resources (e.g., fuel, wood, or other natural or cultural resources), the commitment of future generations to similar uses, and irreversible damage, which can result from environmental accidents associated with the project. Irreversible changes associated with all of the alternatives include the use of building materials, nonrenewable energy sources, and labor required to operate trucks, machinery, and other equipment. The unavoidable destruction of natural resources which limit the range of potential uses of that particular environment would also be considered an irreversible or irretrievable commitment of resources.

The Proposed Project would constitute an irreversible or irretrievable commitment of nonrenewable or depletable resources for the materials, time, money, and energy expended during activities implementing the Proposed Project. Under all alternatives except the No Action Alternative, there would be irreversible and irretrievable commitments of resources. The following paragraphs summarize the particular irreversible and/or irretrievable impacts of the Shoreline Phase I Project.

- Project construction and long-term maintenance of the study area would require consumption of fossil fuels and energy. Fossil fuels (gasoline and diesel oil) would be used to power construction equipment and vehicles and, possibly, equipment used during long-term maintenance (e.g., portable pumps, all-terrain vehicles used to access the study area). The energy consumed for project construction and operation represents a permanent and nonrenewable commitment of these resources.
- All of the materials used for the construction of the proposed levee would come from off-site sources. This would constitute a long-term, nonrenewable investment by the Federal and non-Federal sponsors. Other materials used for constructing accessory structures, such as the tide gates, would require obtaining and using nonrenewable materials. Construction and maintenance activities are considered a long-term nonrenewable investment of these resources.
- Some of the materials used for transitional habitat construction (Pond A12 materials) would come from on-site sources. The majority of the material (transitional habitat fill for A18) would need to be imported, but an agreement between the local project sponsor and the USACE notes that such material would be imported at no cost to the sponsors. For the Proposed Project, if insufficient free fill material to construct the 30:1 ecotone is acquired by proposed construction dates, the transitional habitat would be reduced in size to the 50-foot bench (as included in all other alternatives); in either case there would be no associated investment by the sponsors for transitional habitat material. Other materials used for constructing accessory structures, such as

recreational features (benches and kiosks), would require obtaining and using nonrenewable materials. Construction and maintenance activities are considered a long-term nonrenewable investment of these resources.

- Land that would be physically altered by construction would be committed to the new use for the foreseeable future and would represent a permanent commitment of the land for the life of the project. Since the restoration areas are generally not suitable for urban development, the project would not decrease the amount of open land available for urban uses. Access to some of the study area would be restricted or prevented; this would diminish or eliminate the availability of some areas of the project for passive or active recreational use.
- The capital and labor required for construction would be an irreversible and irretrievable commitment of financial resources.

These commitments of resources could have been applied to projects other than the Proposed Project. However, the Proposed Project would not result in the use of a substantial amount of resources. Project activity would occur periodically through phases and would not be continuous. Many of the effects of project activity would be short-term and limited to active construction areas. Additionally, no natural resources would be permanently destroyed, and flood risk management would be considered beneficial to the region.

5.4.4 Relationship of Short-Term Uses and Long-Term Productivity (NEPA)

The CEQ Guidelines that implement the NEPA regulations (40 CFR 1500 et seq.) require that an EIS discuss issues related to environmental sustainability. The discussion relates to environmental consequences, including consideration of “the relationship between local short-term uses of (our) environment and the maintenance and enhancement of long-term productivity” (42 USC 4332(C)(iv)).

The Proposed Project has USACE objectives and local sponsor objectives. The USACE objectives are to:

- Contribute to NED while remaining consistent with protecting the Nation’s environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements; and
- Contribute to the Nation’s ecosystems (or NER) by restoring degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition.

The non-Federal sponsors’ objectives are to provide FRM and ecosystem restoration benefits in the study area to the extent that it is economically justified, and in consideration of planning constraints such as maintenance of existing wildlife populations. Increased recreation access is a subordinate goal and would be constrained by the need to protect sensitive wildlife populations and public safety.

The project would result in construction of the FRM levee designed to address risk associated with either a 1-percent ACE event or a 4-percent ACE event, would restore tidal marsh ecosystems in the study area, and would install compatible recreation features. Building the FRM levee and completing ecosystem restoration would support the USACE NED and NER objectives by supporting economic development in the Alviso area and restoring a previously degraded area to tidal action. With the exception of Alternative 4, the project is also consistent with policies contained in the Refuge Comprehensive Conservation Plan, the Refuge's New Chicago Marsh Water Management Plan, and the City of San José's General Plan. The project would also meet the stated project need.

Implementation of the Proposed Project or any alternative would not result in any environmental impacts that would significantly narrow the range of beneficial uses of the environment or pose long-term risks to health, safety, or the general welfare of the public communities surrounding the Shoreline Phase I Study Area. Rather, the project would enhance long-term safety in and productivity of both the built and natural environments. The Shoreline Phase I Project would provide near- and long-term FRM that is better than that currently projected within the project study period and would restore and enhance productivity associated with tidally influenced ecosystems in and near the study area.

5.4.5 Identification of Environmentally Preferable Alternative (NEPA) and Environmentally Superior Alternative (CEQA)

5.4.5.1 Approach

Detailed analysis of the No Action Alternative and the four action alternatives impacts is presented in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures*. Table 5.4-1 *Comparison of Alternatives* compares the environmental outcomes expected for each alternative in addition to the No Action Alternative. Resource specific results were integrated to identify the alternative offering the best overall outcome across all resources.

Table 5.4-1. Comparison of Alternatives

Characteristic	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Alternative Description (feet in NAVD 88)	No Action	Alviso North with Tentative 13.5-foot Levee and Bench	Alviso North with 15.2-foot Levee and 30:1 Ecotone	Alviso Railroad with 15.2-foot Levee and Bench	Alviso South with 15.2-foot Levee and Bench
Geology, Soils, and Seismicity	No impact	Less-than-significant impacts from soil erosion and risk from liquefaction following ground shaking.			
Land Use	No impact	Consistent with land-use policies.		Inconsistent with San José General Plan policies and the NCM Water Management Plan.	Inconsistent with the NCM Water Management Plan.
Hydrology	No impact	Long-term channel scour along parts of Coyote Creek, Artesian Slough, and Alviso Slough and near the railroad bridge.			
Flood Risk	The ability of the existing dike-pond systems to prevent tidal flooding declines significantly and rapidly with SLC	Provides protection against 1% tidal flooding event for the existing condition but not for future SLC.	Provides protection against the 1% tidal flooding event for 50-year life of the project even with projected SLC.		
Water Quality	No impact	Negative short-term impacts from temporary increase in salinity in sloughs and remobilization of mercury in ponds and sloughs; positive long-term effects for ponds as system equilibrates.			
Aquatic Biological Resources	No impact	Minor negative construction-related impacts; potential positive long-term effects with new tidal marsh habitat used by aquatic species.			
Terrestrial Biological Resources	Continued strain on species from limited habitat and refugia	Substantial positive effects over the long term; potential for minor and temporary negative effects during construction.	Substantial positive effects over the long term including 30:1 ecotone; potential for minor and temporary negative effects during construction.	Same as Alternative 2 for most species; however, moderate permanent negative impacts for species found in NCM.	
Hazards and Hazardous Materials	No construction related impacts. Continued risk from flooding	Minor impacts from use of hazardous materials during construction and chance of discovering unknown hazardous materials in ground disturbing activities. Reduction of flood risk for inland areas; Alternatives 3, 4, and 5 provide increased protection versus Alternative 2.			
Traffic and Transportation	No impact	Short-term adverse effects on intersection function and freeway operation during construction.			
Air Quality/Greenhouse Gases	No impact	Significant negative construction-related impacts. Amount of construction related emissions depend on size of levee, amount of ecotone, and alignment of levee.			
Recreation	No impact	Short-term nuisance effects (noise, dust, and access) during construction. Net loss of 2.2 miles of trails. Includes construction of new segment of Bay Trail with long-term contribution to the regional trail system.			
Aesthetics	No impact	Minor negative temporary construction-related impacts.		Substantial construction and permanent negative effects due to levee proximity to Alviso community.	
Noise	No impact	Minor negative temporary construction-related impacts.			

Table 5.4-1. Comparison of Alternatives

Characteristic	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Alternative Description (feet in NAVD 88)	No Action	Alviso North with Tentative 13.5-foot Levee and Bench	Alviso North with 15.2-foot Levee and 30:1 Ecotone	Alviso Railroad with 15.2-foot Levee and Bench	Alviso South with 15.2-foot Levee and Bench
Public Health and Safety	Continued risk of tidal flooding, especially as the sea level changes. Ponded areas would continue to support mosquito breeding habitat, and long-term vector control would continue.	Would reduce potential public health and safety risks associated with flooding. Tidal areas could continue to support mosquito breeding habitat, so long-term vector control would continue.			
Cultural Resources	No impact	Significant long term impact to Alviso Salt Ponds Historical Landscape.			
Utilities and Public Services	Fire station, school, Wastewater Facility, railroad, and utilities would continue to be subject to flood risk	Long-term benefit to Wastewater Facility by providing increased flood protection. Potential reduced need for emergency response related to flood incidents. Potential short-term utility service interruption effects during construction. Alternative 4 would result in loss of railroad spur, although this is a less-than-significant impact.			

Alt.=Alternative; NCM = New Chicago Marsh; Wastewater Facility = San José–Santa Clara Regional Wastewater Facility

5.4.5.2 Results

Based on the comparison in Table 5.4-1 *Comparison of Alternatives*, Alternative 3 is identified as environmentally superior. Alternatives 2 and 3 both avoid land use and biological impacts to New Chicago Marsh from a levee alignment that splits the marsh (Alternative 4) and leaves the marsh a risk from tidal flooding (both Alternatives 4 and 5). Also avoided are aesthetic impacts from locating the levee close to the community of Alviso that would block views. The No Action Alternative is deemed to have substantial long-term impacts to flood risk and terrestrial biological resources when compared to the action alternatives, and not considered environmental superior to Alternatives 2 and 3.

Alternative 2 would have incrementally less adverse impacts related to construction compared to Alternative 3 based on the slightly smaller footprint of the levee. This would result in slightly less impacts to construction related traffic, air quality, and noise, and less area of tidal wetlands and managed ponds in the construction footprint. However, Alternative 2 does not meet the flood protection objective of the CEQA Lead Agency (the Santa Clara Valley Water District) to provide 100-year tidal flood protection over 50 years with assumed SLC. Alternative 3 would meet all the project objectives with only slightly increased construction related impacts, while also providing long term beneficial impacts to sensitive habitats and endangered species with the addition of the 30:1 ecotone. This feature will provide much needed transitional habitat and upland refugia for marsh dependent species.

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6.0 Public Involvement, Review, and Consultation

The U.S. Army Corps of Engineers (USACE), the U.S. Fish and Wildlife Service (USFWS), and the non-Federal sponsors, the California State Coastal Conservancy (State Coastal Conservancy), and the Santa Clara Valley Water District (SCVWD), completed the reconnaissance phase of the South San Francisco Bay Shoreline Study (Shoreline Study) in 2005 and subsequently initiated a Feasibility Study that is the subject of this report.

This section summarizes the public involvement activities conducted since the overall study began, but focuses on activities proposed as part of the South San Francisco Bay Shoreline Phase I Interim Feasibility Study that was initiated in 2011.

6.1 Public and Agency Involvement Background

Public involvement for the Shoreline Study began in January 2006 with release of a Notice of Intent (NOI) in the Federal Register and issuance of a Notice of Preparation (NOP) to the California State Clearinghouse. A public scoping meeting was also held in 2006 (described below in Section 6.2.1 *Scoping Activities*) to collect public comments.

In 2011, a "study reset" was conducted by the USACE and non-Federal sponsors in order to identify actions that would result in a faster and less costly study and authorization. The study reset resulted in a smaller geographic scope and confirmed the three project purposes: FRM, ecosystem restoration, and recreation. The reset process did not involve the general public but included representatives from the City of San José as well as landowning agencies. After identifying the new geographic scope, public outreach was conducted to discuss the reasons for and outcome of the study reset and solicit input on preliminary and final alternatives tailored to the smaller geographic area (see Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*).

Following the 2011 study reset, efforts were focused on the actions proposed in this South San Francisco Bay Shoreline Phase I Interim Feasibility Study with Environmental Impact Statement/Environmental Impact Report (referred to collectively in this document as the Integrated Document).

6.2 Public Involvement

Public involvement for the Shoreline Study includes ongoing stakeholder coordination and opportunities to comment on the scope and content of this report. Public involvement for the Shoreline Study has occurred and will continue to occur through a stakeholder forum originally convened for the South Bay Salt Pond Restoration Project (SBSP Restoration Project). Forum meetings occur once a year and are open to the public. This Integrated Document considers information that has been presented by the stakeholder forum that is applicable to the Recommended Plan.

Agency representatives involved in the development of the Recommended Plan also participate in the Alviso and Santa Clara County Working Group, which provides study progress updates to and collects comments from interested stakeholders. The following paragraphs describe the project scoping phase that occurred in 2006 and the draft Integrated Document public review cycle that ended in February 2015.

6.2.1 Scoping Activities

The USACE and the USFWS (NEPA co-lead agencies) and the State Coastal Conservancy and the SCVWD (2006 CEQA lead and cooperating agency, respectively) initiated a 30-day scoping process for the Proposed Project with release of the NOI/NOP on January 6, 2006. In the NOI and the NOP, the agencies asked for public comment on project scope and document content. The NOI was published in the Federal Register (71 FR 924–927). The NOP was distributed through the State Clearinghouse to trustee and interested agencies. The State Coastal Conservancy and the SCVWD also published the NOI and the NOP at southbayrestoration.org and www.southbayshoreline.org.

As a result of the NOI/NOP postings, eight written comments were received by postal mail and email (see Appendix A2 *Shoreline Notice of Preparation Comment Letters*). The comments provided information for consideration during planning, requested agency inclusion in document distribution, and/or provided information on aviation safety.

Pursuant to the NEPA [40 CFR 1506.6(c)] and the CEQA (14 CCR §21083.9), a public scoping meeting was sponsored on January 25, 2006, from 5:30 to 8:30 PM, at the Milpitas Community Center, Milpitas, California. Meeting presentations and materials provided an overview of the Shoreline Study, the NEPA/CEQA process, and an explanation of the relationship between the Shoreline Study and the SBSP Restoration Project. The non-Federal sponsors provided opening remarks, gave brief presentations, and provided a question and answer period. Thirty-six people attended the meeting.

Appendix A1 *Public Comments Received at Scoping Meeting on January 25, 2006* provides a list of comments and questions received at the meeting and by postal mail and email.

After the geographic footprint was reduced and the SCVWD took over as the CEQA Lead Agency, the SCVWD issued a revised NOP on September 8, 2014. The NOP was open for a 30-day period for agencies and the public to comment on the revised project scope and the document content. Six letters were received during this comment period and are attached as part of Appendix A2 *Shoreline Notice of Preparation Comment Letters*.

6.2.1.1 Summary of Public Concerns

6.2.1.1.1 2006 Notice of Intent/Notice of Preparation Comments

Scoping comments received in 2006 were for the original Shoreline Study area that included a much larger footprint in the South Bay (see Section 1.5 *Project Background and Physical Study Area Setting* for details regarding the 2006 study area and subsequent refinement). Comments and concerns raised during scoping in 2006 are listed below:

- Study timeline and responsibility for meeting schedules;
- Integration with the SBSP Restoration Project, San Francisquito Creek Study, Steven's Creek and Charleston Slough projects, and other local projects;
- Potential impacts on environmental resources for consideration, such as:
  - Impacts associated with potential flooding of wastewater treatment plants in the Silicon Valley,
  - Consideration for sensitive species in 100-year floodplain,
  - Levee use as trails,
  - Potential for increased bird strikes at Moffett Field, and
  - Greenhouse gas emissions analysis.
- Flooding impacts to communities, including local landfills and potential to remove businesses and residents from FEMA floodplain;
- Necessary permits for construction for State Lands Commission and Caltrans coordination; and
- Cost, responsibility for funding, and cost-effectiveness of study.

6.2.1.1.2 2014 Notice of Preparation Comments

Six letters were received during SCVWD's re-scoping activities in September 2014. The main comments included:

- Environmental impacts, such as construction traffic, noise, and impacts to sensitive species and historic sites;
- Impacts and assessment related to sea level change;
- Local plans initiated and/or approved since 2006, such as the Wastewater Facility's Plant Master Plan;
- Maximizing availability of outboard wetland areas for sensitive species;
- Public use of levees as part of local trail system; and
- Vector control for mosquitoes.

6.2.2 Draft Integrated Document Review

During a 60-day period that ran from December 19, 2014, to February 23, 2015, the public was asked to submit written comments on the content and findings of the draft Integrated Document.

In addition to seeking written comment, the agencies held a public meeting on January 14, 2015, on the draft Integrated Document. The USACE and non-Federal sponsors presented the findings of the Integrated Document, and the public was able to provide comments on and express views about the study results.

Public comments generated as a result of public and agency review of the draft Integrated Document are included in this final Integrated Document. Appendix I *Public Comments and Responses on Draft Integrated Document* includes an overview of the process, master responses to comments raised by multiple reviewers, scans of all comment letters received and coded to separate different issues raised within a letter, and responses provided by the USACE, the USFWS, and non-Federal sponsors. A total of 40 letters were received during this public review cycle.

Public comments fell into 15 primary categories, including questions and concerns regarding:

- Other options for levee alignments and/or tidal flood risk options that do not include a levee structure
- Portrayal of existing and future pedestrian trail systems in and adjacent to the Shoreline Phase I Study Area (study area)
- Loss of existing loop trails within the study area and the proposed additional trails
- Residual risk of tidal flooding after the proposed levee is constructed
- Level of analysis that was conducted on fluvial flood risk in the study area and for adjacent communities
- Potential for construction impacts to listed aquatic and terrestrial species as well as other resident and migratory bird species
- Availability of design details for specific project features (e.g., the tide gate closure system at Artesian Slough)
- Phasing of restoration actions in ponds following levee construction (including either bench or ecotone)
- Analysis of sea level change as it pertains to this study
- Hydrological and hydraulic analyses that were completed as part of the study
- Potential for future phases of the Shoreline Phase I Study outside Economic Impact Area 11 (EIA11)

- Potential impacts of the proposed construction activities on current San José–Santa Clara Regional Wastewater Facility (Wastewater Facility) activities and its plans for future upgrades (as proposed in the Wastewater Facility Plant Master Plan)
- Coordination with PG&E to allow continued operations and maintenance of facilities in the study area
- Relationship of this study to the South Bay Salt Pond Restoration Project (SBSP Restoration Project) and the geographically overlapping Monitoring and Adaptive Management Plans
- Federal and non-Federal sponsors' funding and long-term maintenance responsibilities for the various study features.

6.3 Institutional Involvement

6.3.1 Agencies and Organizations Consulted

Table 6.3-1 *South San Francisco Bay Shoreline Phase I Study Project Delivery Team* lists the PDT members associated with the draft Integrated Document. The detailed roles of each agency and organization are described in Section 1.7 *Study Sponsors, Participants, and Other Coordination*.

Table 6.3-1. South San Francisco Bay Shoreline Phase I Study Project Delivery Team

Agency or Organization	Role	Primary Area of Concern
USACE San Francisco District	Federal co-lead agency, Federal sponsor	Feasibility of FRM and ecosystem restoration
USFWS	Federal co-lead agency, landowner in Study Area, Section 7 consultation, Fish and Wildlife Coordination Act consultation	How flood risk management and ecosystem restoration could affect refuge land managed by the USFWS and species subject to Federal protection
SCVWD	State lead agency, local sponsor	How FRM and ecosystem restoration could affect current and future operation of the agency's system; how the Proposed Project could affect or be coordinated with the SCVWD's ongoing FRM and ecosystem restoration/management activities
State Coastal Conservancy	Responsible agency, local sponsor	To protect and enhance the coast of California and San Francisco Bay. The State Coastal Conservancy is the lead coordinating agency for the SBSP Restoration Project. The Conservancy is participating in the Shoreline Study in order to advance its restoration and enhancement goals for the natural and recreational resources of the bay.

6.3.2 Coordination with Other Organizations

Table 6.3-2 *Other Organizations Participating in the South San Francisco Bay Shoreline Study* lists other organizations involved in conducting the feasibility study and developing the Integrated Document.

Table 6.3-2. Other Organizations Participating in the South San Francisco Bay Shoreline Study

Organization	Context of Participation
City of San José	SBSP Restoration Project Stakeholder Forum, individual meetings
City of Sunnyvale (Water Pollution Control Plant)	Individual meeting[a]
FEMA	Individual meetings, ongoing coordination
National Aeronautics and Space Administration (NASA)	Early meetings[a]
SBSP Restoration Project Stakeholder Forum	Annual meetings of Alviso and Santa Clara County working groups
SBSP Restoration Project Management Team	Study reset process
USACE South Pacific Division	Study reset process
USACE Sacramento District	Study reset process
USACE Los Angeles District	Study reset process

[a] The City of Sunnyvale and the NASA dropped out of the project process following the study reset in 2011 when their service areas were removed by reducing the study area.

In addition to these report participants, a number of Federal and State agencies are coordinating the NEPA and CEQA processes as required by Federal and State law. Table 6.3-3 *Agency Coordination for the NEPA and CEQA Processes* summarizes these coordination efforts.

Table 6.3-3. Agency Coordination for the NEPA and CEQA Processes

Agency	Responsibility or Interest
California State Historic Preservation Officer	Administers Section 106 of the National Historic Preservation Act
San Francisco Bay Conservation and Development Commission (BCDC)	Implements State McAteer-Petris Act in the study area; issues concurrence with Federal consistency determination under Federal Coastal Zone Management Act
National Oceanic and Atmospheric Administration Fisheries Service (also known as National Marine Fisheries Service)	Administers Marine Mammal Protection Act; administers Federal Endangered Species Act for pelagic and anadromous fisheries; administers Magnuson-Stevens Fishery Conservation And Management Act; consulting party for Fish and Wildlife Coordination Act
U.S. Coast Guard	Administers Section 9 of the Rivers and Harbors Act (bridge permits); consultation and permits as needed for modifications to or construction of bridges over jurisdictional waters
San Francisco Bay Regional Water Quality Control Board	Administers Federal Clean Water Act Section 401 Water Quality Certification program and issues certifications; administers State's Porter-Cologne Water Quality Control Act
State Lands Commission	Trustee agency that manages sovereign land in the study area; issues leases
California Department of Fish and Wildlife	Trustee agency under the CEQA; implements State Fish and Game Code; issues stream alteration permits; consulting party for Federal Fish and Wildlife Coordination Act
Bay Area Air Quality Management District	Air permit(s)

6.4 Report Circulation

A draft of the Integrated Document was released on December 19, 2014. The draft report can be viewed or downloaded online from the following websites:

- www.spn.usace.army.mil/Library/FreedomofInformationAct/FOIAHotTopics.aspx
- www.valleywater.org/PublicReviewDocuments.aspx

The report is also available in DVD format. To request a copy, please send a request to:

Mr. Caleb Conn, Project Manager
U.S. Army Corps of Engineers1455 Market St, 16th Floor
San Francisco, CA 94103
Caleb.B.Conn@usace.army.mil

6.4.1 Agencies and Officials

Pursuant to the NEPA, the USACE filed a draft Integrated Document with the U.S. Environmental Protection Agency and a notice of availability for the draft Integrated Document was published in the Federal Register on December 19, 2014. Pursuant to the CEQA, the California State Clearinghouse distributed a notice of completion to interested and trustee agencies. Table 6.4-1 *Distribution of Reports and Notices to Agencies* lists the agencies and officials who received a copy of this report, a notice of availability, and/or a notice of completion.

6.4.2 Other Organizations and Interested Persons

Appendix B9 *Pertinent Correspondence* lists the other organizations and individuals who received either a copy of the draft Integrated Document or a notice that the report was available for review.

Table 6.4-1. Distribution of Reports and Notices to Agencies

Agency or Organization	Method of Distribution or Notification
Bay Area Air Quality Management District	NOC via State Clearinghouse
U.S. EPA Region IX	DVD copy
National Marine Fisheries Service – Santa Rosa Office	DVD copy
California State Lands Commission	NOC via State Clearinghouse
San Francisco Regional Water Quality Control Board	NOC via State Clearinghouse
FEMA	NOA via FR, DVD copy
California Department of Fish and Wildlife	NOC via State Clearinghouse
California Department of Transportation	NOC via State Clearinghouse
California Department of Conservation	NOC via State Clearinghouse
California Department of Toxic Substances Control	NOC via State Clearinghouse
California Department of Water Resources	NOC via State Clearinghouse
State Coastal Conservancy	NOC via State Clearinghouse
California State Parks Division of Boating and Waterways	NOC via State Clearinghouse
California Natural Resources Agency	NOC via State Clearinghouse
California Emergency Management Agency	NOC via State Clearinghouse
California Office of Historic Preservation	NOC via State Clearinghouse
City of San Jose – Planning Department	NOC via State Clearinghouse
Santa Clara County Planning Office	NOC via State Clearinghouse
City of Milpitas	NOC via State Clearinghouse
Native American Heritage Commission	NOC via State Clearinghouse
Santa Clara County Vector Control District	NOC via State Clearinghouse
BCDC	NOC via State Clearinghouse
Union Pacific Railroad Company	DVD copy
USFWS Sacramento Ecological Services Office	DVD copy
U.S. Dept. of Interior	NOA via FR
US Coast Guard	NOA via FR

6.5 District Quality Control, Agency Technical Review, and Independent External Peer Review

All work products and reports, evaluations, and assessments undergo review through the District Quality Control (DQC) process. Subsets of work products undergo Agency Technical Review (ATR), and Independent External Peer Review (IEPR). ATR is mandatory for decision documents, such as this Integrated Document, and is undertaken to ensure the quality and credibility of the government's scientific information. The IEPR is another critical element in ensuring the reliability of scientific analyses. The USACE uses a peer review process outlined in agency guidance and Federal Office of Management and Budget guidance.

Engineering Circular (EC) 1165-2-214 *Civil Works Review*, dated December 15, 2012, describes how to plan for and conduct appropriate reviews of all Civil Works project documentation. The review process is described in a Review Plan, which describes how the agency will review a decision document (Feasibility Report and EIS/EIR), interim milestone planning documents, and key technical analyses as they pertain to the level of review and planning coordination with the appropriate USACE planning center of expertise (PCX). Consistent with EC 1165-2-214, the Review Plan was made available for public comment.

The USACE San Francisco District Commander approved the Review Plan, which has been updated as needed, on April 23, 2009. On April 30, 2013, the South Pacific Division approved the most recent update which is available at www.spn.usace.army.mil/Missions/ProjectsandPrograms/ProjectReviewPlans.aspx.

EC 1165-2-214 sets forth thresholds that trigger the required use and type of IEPR review. Type I reviews are independent peer reviews that are conducted for projects that have or involve public safety concerns, significant controversy, a high level of complexity, or significant economic, environmental, and social effects to the nation. The Shoreline Phase I Study Integrated Document is subject to a Type I IEPR review.

For the Shoreline Phase I Study, there are public safety concerns related to the dense development of Silicon Valley immediately adjacent to the former salt evaporation ponds. There is a high level of complexity in analyzing and managing the risk of flooding in an area immediately adjacent to the bay, which has 15 local streams running through it. This complexity is heightened by the potential effects of global climate change. There is significant interagency interest in the study because the single largest landowner in the study area is the Federal government: the USFWS manages the Refuge. The NASA's Moffett Federal Airfield is also close to, although not within, the study area. Finally, this Integrated Document includes an EIS/EIR for the Shoreline Phase I Study, and the likely total project cost is in excess of a $45-million threshold. For all of these reasons, the USACE determined that a Type I IEPR review was necessary for the Shoreline Phase I Study.

The Battelle Memorial Institute (Battelle), through a contract with the U.S. Army Engineer Institute for Water Resources, conducted the IEPR. The IEPR panel consisted of four individuals selected by Battelle with technical expertise in the following categories: civil works planning/economics, environmental and ecological evaluation, hydraulic engineering, and geotechnical engineering.

The IEPR panel reviewed the South San Francisco Bay Shoreline Phase 1 Study Draft Integrated Interim Feasibility Study and Environmental Impact Statement/Report (Integrated Document) dated December 2014. The Final Report from the IEPR panel was issued March 23, 2015. Overall, 18 final comments were identified and documented. Of the 18 comments, six were identified as having medium/high significance, five were identified as having medium significance, five were identified as having medium/low significance, and three were identified as having low significance.

All of the 18 IEPR comments were resolved through a series of discussion between the USACE and the IEPR panel members. While recommendations from the IEPR panel included options for additional analysis and/or field investigations, options that leveraged existing analysis and datasets were deemed sufficient to resolve comments. Typical comment resolution resulted in improvements to the descriptions of, and conclusions drawn, from both environmental and engineering efforts. Further details on each comment, such as the Basis for Comment, Significance, and Recommendations for Resolution are found in the IEPR Final Report posted on the San Francisco District's website at www.spn.usace.army.mil/Missions/ProjectsandPrograms/IndependentExternalPeerReviewReports.aspx.

7.0 List of Preparers

The individuals listed in the following table were primarily responsible for the preparation of this report.

Name	Discipline	Role in Preparing Report
U.S. Army Corps of Engineers (USACE)		
Judy McCrea	Planner	PDT representative for USACE; lead for Plan Formulation; author of Executive Summary; co-author of Chapters 3 and 9
Bill DeJager	Biologist	PDT representative for USACE; lead for Environmental and NEPA
Stacie Auvenshine	Biologist	Plan Formulation; co-author of Chapters 3 and 9
Brad Foster	Biologist/Planner	Plan Formulation; co-author of Chapters 3 and 9; District Quality Control (DQC) reviewer
Caleb Conn	Physical Scientist/Project Manager	Project Manager ; PDT representative for USACE
Patrick O'Brien	Coastal Engineer	Sea level change, coastal climate impacts and adaption Subject Matter Expert/Lead; co-author of Civil Design and Water Resources Engineering Appendices; general review and updates for coastal engineering text incorporated into Integrated Document
Nick Malasavage	Civil Engineer	Author of Geotechnical Appendix; co-author of Civil Design and Water Resources Engineering Appendices; general review and updates for geotechnical text incorporated into Integrated Document
Mark Bierman	Economist	Co-author of Economics and Water Resources Engineering Appendices; general review and updates for economics text incorporated into Integrated Document
Mike Hallisy	Economist	Co-author of Economics and Water Resources Engineering Appendices; general review and updates for economics text incorporated into Integrated Document
Craig Conner	Engineer/Planner	Co-author of Water Resources Engineering Appendix; general review and updates for coastal engineering text incorporated into Integrated Document
Kathleen Ungvarsky	Cultural Resources	Co-author of Cultural Resources section in Integrated Document
Bonievee Delapaz	Real Estate Specialist	PDT representative for USACE; author of Appendix W Real Estate Plan; general review and updates for Real Estate text incorporated into Integrated Document
Matt Young	Cost Engineer	Co-author of Civil Design Appendix; general review and updates for cost engineering text incorporated into Integrated Document
Eric Jolliffe	Biologist	Environmental and NEPA support
U.S. Fish and Wildlife Service (USFWS)		
Anne Morkill	Refuge Complex Manager	Executive team representative for Refuge; general document QC
Eric Mruz	Refuge Manager	PDT representative for Refuge; general document QC
Melisa Amato	Wildlife Refuge Specialist	PDT representative for Refuge; general document QC
Cheryl Strong	Wildlife Biologist	General review and updates of text in Integrated Document
Rachel Tertes	Wildlife Biologist	General review and updates of text in Integrated Document
Jennifer Heroux	Visitor Services Specialist	General review and updates of text in Integrated Document

Name	Discipline	Role in Preparing Report
Patricia Roberson	Planner/NEPA Coordinator	General review and updates of text in Integrated Document; environmental NEPA support
Santa Clara Valley Water District (SCVWD)		
Rechelle Blank	Civil Engineering	PDT representative for SCVWD; general document QC
Michael Martin	Environmental Planning	General document QC; air quality modeling and section update; CEQA Notice of Preparation re-release in 2014; environmental CEQA support
California State Coastal Conservancy (State Coastal Conservancy)		
Brenda Buxton	Project Planner	Project Delivery Team (PDT) representative for State Coastal Conservancy; author of some project site description elements.
John Bourgeois	Restoration Ecologist	Provided information related to South Bay Salt Pond Restoration Project; Integrated Document QC.
HDR Engineering, Inc. Team		
Sergio Jimenez	Project Manager	Civil Engineering PDT representative for HDR; Plan Formulation and Alternative Development, Civil Design lead, Cost Estimates
Dawn Edwards	Deputy Project Manager	Environmental documentation PDT representative for HDR; Integrated Document Project Manager; co-author of Chapter 3 (with USACE); client contact for Environmental Resources
Sue Lee	Environmental Planner	Contributing author for various resource sections; author of Chapters 6 and 8, and 404(b)(1) draft
Daniel Teak	Professional Engineer	Emissions and truck trip estimates; costing support
Vinson Russo	Professional Engineer	Development of alternative civil engineering figures
Brian DeLemos	Civil Engineer	Co-author of Hydrology and Flood Risk Management section
Dustin Watson	Senior Noise & Air Quality Specialist	Co-author of noise and air quality resource sections
Susan Haupt	Senior Environmental Planner	Contributing author for various resource sections
Christine Jacobs-Donahue	Senior Environmental Planner	Contributing author for various resource sections
Becky Holloway	Aquatic Biologist	Author of Aquatic Biological Resources section
Adrian Pitts	Biologist	Fisheries QC; response to DQC comments
Betty Dehoney	CEQA, NEPA Lead	EIS/EIR QC
Brandon Jones	Geographic Information Systems (GIS)	GIS Technical Lead
Adrienne Moore	Graphic Artist	Development of visual simulations, tables, and charts
Kolton Kammerer	Graphic Artist	Development of visual simulations, tables, and charts
Eric Chase	Physical Scientist	Co-author of Geology, Seismicity, and Hydrogeology section
Nick Bonzey	Soil Scientist	Co-author of Geology, Soils, and Seismicity section
Mark Spencer	Professional Engineer, Principal (W-Trans)	Client contact for traffic and transportation resource section; Transportation QC
Jaspreet Anand	Professional Engineer (W-Trans)	Author of transportation resource section and Construction Traffic Access Route Plan
Carrie Ulrich	Technical Editor	Initial copy editing and document formatting

8.0 Compliance with Applicable Laws, Policies, and Plans

The Federal government has established several statutes and guidelines (collectively referred to as *regulations*) that address the management and protection of environmental resources. Many of these statutes and guidelines apply to the Shoreline Phase I Study. State laws and regulations and regional and local planning policies need to be considered for the Shoreline Phase I Study as well.

This chapter describes the regulatory requirements identified in the U.S. Army Corps of Engineers (USACE) Engineering Regulation (ER) 1105-2-100 *Planning Guidance Notebook* and the Principles and Guidelines (P&G) that are addressed in the Integrated Document. It also describes the applicable statutes, guidelines, and policies that apply to the study area and that are implemented by Federal, State, regional, and local agencies.

8.1 Status of Federal Agency Coordination Efforts

Since the release of the Draft Integrated Document on December 19, 2014, additional required agency consultation and coordination efforts have been completed and are briefly described in this section. The locations of referenced letters and documents that are included in the appendices to this Integrated Document are also provided.

8.1.1 Draft U.S. Fish and Wildlife Service Refuge Compatibility Determination for Levee Construction on Don Edwards San Francisco Bay National Wildlife Refuge Lands

Provides issuance of a right-of-way to the SCVWD to allow project sponsors to construct, operate, and maintain an engineered flood risk management (FRM) levee along the footprint of the Recommended Plan that falls on Don Edwards San Francisco Bay National Wildlife Refuge (Refuge) lands (eastern side of Ponds A12/A13 and the southern border of Pond A16). Public review on the draft Compatibility Determination was conducted for 30 days. The Compatibility Determination was signed on September 4, 2015 and is included in Appendix B3 *Flood Risk Management Coordination with the USFWS*.

8.1.2 U.S. Fish and Wildlife Service Biological Opinion

When the USFWS drafted the Biological Opinion (BO), it was necessary to draft separate BOs for USACE restoration efforts on the City of San José's lands (Pond A18) and USFWS restoration actions on USFWS lands (Ponds A9–A15) because implementation guidance for Section 1025 of WRRDA had not yet been released. Both BOs can be found in Appendix B8 *Endangered Species Act Compliance* and were received on April 27, 2015. Both BOs identified the same avoidance and minimization measures specific to listed species that may be present in the study area, as well as some conservation recommendations. All conservation recommendations provided in the BO were determined to be acceptable with the exception of the placement of clean fill to raise pond bottoms. Recommendations will require further evaluation to determine cost effective means and methods to deliver the appropriate level of functionality. The placement of clean fill on pond bottoms was determined to be cost prohibitive considering land- and water-based delivery methods.

8.1.3 National Marine Fisheries Service Section 7(a)(2) Concurrence Letter and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

Similar to the USFWS BOs, the National Marine Fisheries Service (NMFS) Concurrence Letter was drafted assuming separate USACE (Pond A18) and USFWS (Ponds A9–A15) implementation of restoration actions; in both cases, the NMFS concurred with the USACE's and the USFWS's determination that the Recommended Plan was not likely to adversely affect listed fish and designated critical habitat in a letter of concurrence on May 19, 2015.

Under the Magnuson-Stevens Act, the NMFS determined that the proposed plan would adversely affect Essential Fish Habitat (EFH). However, the NMFS acknowledged that the effects would be localized and would be temporary and minimal in nature and that, in the long term, the proposed actions would benefit EFH by restoring tidal connectivity and creating tidal marsh in South San Francisco Bay.

8.1.4 Federal Aviation Administration Coordination Letter

In a letter dated May 21, 2015, the Federal Aviation Administration (FAA) requested evaluation of the "separation distance between the Air Operations Areas (nearest point of the runway) of these airports (Norman Y. Mineta San José International Airport and Moffett Federal Airfield) and the proposed habitat improvements for each alternative described in the EIS" (Appendix B9 *Pertinent Correspondence*). Where any project alternatives fall within 5 miles of these airports, the FAA would like an evaluation of the potential impacts to aircraft operations that could be caused by wildlife moving into or across approach or departure airspace. This Final Integrated Document includes the information as requested by the FAA in Section 4.14.

8.1.5 USACE Regulatory Process Documentation: Clean Water Act Section 404(b)(1)

Section 404 of the Clean Water Act (CWA) regulates placement of dredged or fill material into waters of the United States (Title 33, United States Code, Section 1344) and requires permits for these activities. The 404(b)(1) evaluation was prepared and is located in Appendix B10 *Clean Water Act Section 404(b)(1) Evaluation*. The 404(b)(1) evaluation will satisfy requirements under Section 404(r) of the Clean Water Act.

8.1.6 U.S. Fish and Wildlife Service Coordination Act Report

A draft Fish and Wildlife Coordination Act Report (CAR) was received on June 25, 2015 and a Final CAR on July 22, 2015. Please see Appendix B7. All conservation recommendations provided in the CAR were determined to be acceptable with the exception of the placement of clean fill to raise pond bottoms. Recommendations will require further evaluation to determine cost effective means and methods to deliver the appropriate level of functionality. The placement of clean fill on pond bottoms was determined to be cost prohibitive considering land- and water-based delivery methods.

8.2 Planning Guidance Notebook and Principles and Guidelines Requirements

Table 8.2-1 *Regulatory Requirements for USACE Feasibility Studies* lists the regulatory requirements identified in the Planning Guidance Notebook and the P&G and where they are addressed in the text. In some cases, regulations identified in the Planning Guidance Notebook and the P&G are not applicable to the Shoreline Phase I Project. These items are listed in the table along with an explanation of why they do not apply.

Table 8.2-1. Regulatory Requirements for USACE Feasibility Studies

Regulation	Summary of Requirement	How Addressed for the Shoreline Phase I Study
Water Resources Development Act (WRDA)	The WRDA authorizes specific water resources projects. Section 904 identifies required considerations when developing alternative plans (part of Step 3 of the USACE Planning Process). These include NED, EQ, the well-being of the people of the United States, the prevention of the loss of life, and the preservation of historic and cultural values.	Addressed throughout this Integrated Document, but primary discussion is in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*, which describes the planning process. Flooding, which presents the biggest risk that could result in loss of life, is discussed in Section 4.4 *Hydrology and Flood Risk Management*. Cultural resources are discussed in Section 4.15 *Cultural Resources*. The Recommended Plan is in compliance with this Act.
National Environmental Policy Act (NEPA)	Federal legislation that established environmental policy for the nation. Requires Federal agencies to consider the potential effects of implementing their regulations, policies, and programs, as well as alternatives to the proposed actions.	This Integrated Document includes the necessary elements to meet the requirements of the NEPA. Public scoping meetings occurred in 2006, with the draft Integrated Document released for public review between December 19, 2014 and February 23, 2015. See Chapter 6 for more information on public involvement throughout the study. The Recommended Plan is in compliance with this Act.

Table 8.2-1. Regulatory Requirements for USACE Feasibility Studies

Regulation	Summary of Requirement	How Addressed for the Shoreline Phase I Study
National Historic Preservation Act	Requires Federal agencies to consider historic and cultural resources and values during planning, design, and permitting actions.	Section 4.15 *Cultural Resources* addresses historic properties in the study area. Significant cultural resources exist and have been identified and considered within the vicinity of the project area. Consultation is ongoing through Section 106 through an initial consultation letter (see Pertinent Correspondence Appendix B9). The coordination letter incorporates information provided in 2012, when the USFWS consulted with the California State Historic Preservation Office (SHPO) regarding the restoration program for the entire Alviso Unit, and consequently, satisfied the requirements of Section 106 of the National Historic Preservation Act (NHPA), pursuant to 36 C.F.R. § 800, by executing a Memorandum of Agreement (MOA) that included a Historic Property Treatment Plan (HPTP). This has direct impact on the current USACE effort to comply with Section 106. The only area outside of the USFWS APE is Pond A18, which is under ongoing consultation (see Pertinent Correspondence Appendix B9). The Recommended Plan will be in compliance prior to construction.
Native American Graves Protection and Repatriation Act (NAGPRA)	Establishes requirements for the treatment of Native American human remains and sacred or cultural objects found on Federal land.	Not applicable to the Shoreline Phase I Project; the NAGPRA does not apply to lands in which the USACE has obtained access from a landowner and/or local sponsor. The USFWS would appear to have NAGPRA responsibilities if Native American remains were discovered on Federal lands.
A Presidential Memorandum on Government-to-Government Relations (1994)	Directs Federal agencies to operate within a government-to-government relationship with Federally recognized Indian tribes.	Coordination with all tribes in the area is ongoing and will continue through the NHPA Section 106 consultation.
Fish and Wildlife Coordination Act	Requires Federal agencies to coordinate with the USFWS and local state fish and wildlife agencies when any stream or body of water is proposed to be impounded, diverted, or otherwise modified.	The USACE has been and will continue coordinating with the USFWS, the CDFW, and the NMFS throughout the project planning process. The USACE received a Planning Aid Letter from USFWS on October 21, 2014, supporting the study and a draft CAR on June 25, 2015. A Final CAR was received on July 22, 2015. The Recommended Plan is in compliance with this Act.

Table 8.2-1. Regulatory Requirements for USACE Feasibility Studies

Regulation	Summary of Requirement	How Addressed for the Shoreline Phase I Study
Clean Water Act (Sections 102, 303, 320, 401, 402, and 404)	Section 102 requires the USEPA Administrator to prepare or develop comprehensive programs for preventing, reducing, or eliminating the pollution of the navigable waters and ground waters and improving the sanitary condition of surface and underground waters … Section 303 requires States to adopt numeric criteria for specific, priority toxic pollutants if those pollutants could interfere with the designated beneficial uses of a state's waters. It also requires States to identify water bodies that do not meet water quality standards and the pollutants or factors that impair them. Section 320 establishes the National Estuary Program. This program requires Federal assistance and development programs to be consistent with the goals of the Comprehensive Conservation and Management Plan. Section 401 sets forth requirements and procedures for obtaining state water quality certification for activities that result in any discharge into navigable waters. Section 402 regulates direct discharges into navigable waters. Section 404 defines wetlands and other waters of the United States that are subject to regulation (known as "jurisdictional features") and the procedures for regulating discharges to such waters. See Table 8.3-1 *Applicable Federal Regulations That Apply to the Shoreline Phase I Study* for more detail on CWA applicability.	Programs and standards developed pursuant to Section 102 are discussed in Section 4.5 *Surface Water and Sediment Quality*. Sections 303, 401, and 402 are discussed in Section 4.5 *Surface Water and Sediment Quality*. USACE will obtain all Water Quality Certification under Section 401; this will be via the San Francisco Bay Regional Water Quality Control Board Section 320 is discussed in Section 4.3.1.1.5.2 *Comprehensive Conservation and Management Plan – The San Francisco Estuary Project*. Section 404 resources are discussed in Section 4.6 *Aquatic Biological Resources* and Section 4.7 *Terrestrial Biological Resources*. A Section 404(b)(1) evaluation is in Appendix B10 *Clean Water Act Section 404(b)(1) Evaluation*. The Recommended Plan is in compliance with this Act.
1970 River and Harbor and Flood Control Act (Section 122)	Requires guidelines designed to ensure that possible economic, social, and environmental effects relating to any proposed project have been fully considered and that final decisions are made in the best overall public interest, taking into consideration the need for flood control, navigation, and the associated purposes.	The USACE has developed regulatory guidance to ensure that the potential economic, social, and environmental effects of its proposed projects are fully considered. This document has been prepared consistent with such regulatory guidance. The Recommended Plan is in compliance with this Act.
Rivers and Harbors Act of 1899	Addresses projects and activities in navigable waters and harbor and river improvements.	Information provided throughout the Integrated Document will support the Section 10 permitting process if it is initiated. Section 9 of the act applies because the Shoreline Phase I Project would construct a dam or dike across an interstate navigable water. However the approval process for this dam or dike would be satisfied by the approval process for the project. The Recommended Plan is in compliance with this Act.

Table 8.2-1. Regulatory Requirements for USACE Feasibility Studies

Regulation	Summary of Requirement	How Addressed for the Shoreline Phase I Study
Marine Protection, Research and Sanctuaries Act of 1972 (Sections 102 and 103)	Regulates regulate ocean dumping of industrial wastes, sewage sludge, and other wastes and outlines the process for establishing marine sanctuaries.	Discharges to bay waters are discussed in Section 4.5 *Surface Water and Sediment Quality*. There are no marine sanctuaries in the study area. The Recommended Plan is in compliance with this Act.
Magnuson-Stevens Fishery Conservation and Management Act	Requires Federal agencies to consult with the NMFS on all actions, or proposed actions, authorized, funded, or undertaken, that may adversely affect EFH.	Potential effects on EFH are addressed in Section 4.6 *Aquatic Biological Resources*. Consultation with the National Marine Fisheries Service was conducted in tandem with consultation under the Endangered Species Act and concluded on May 19, 2015. In their conclusions, the NMFS had no practical EFH Conservation Recommendations for the project (Appendix B8 *Endangered Species Act Compliance*). The Recommended Plan is in compliance with this Act.
Federal Endangered Species Act	Protects Endangered and Threatened species by prohibiting Federal actions that would jeopardize the continued existence of such species or result in the destruction or adverse modification of habitat of such species.	The ESA is addressed in Section 4.6 *Aquatic Biological Resources* and Section 4.7 *Terrestrial Biological Resources*. Consultation with the USFWS was initiated on December 22, 2014, and concluded on April 27, 2015 upon receipt of a biological opinion from the USFWS. Consultation with NMFS was initiated on December 15, 2014, and was concluded on May 19, 2015, with a letter of concurrence that the Recommended Plan "is not likely to adversely affect the subject listed species and designated critical habitats." (Appendix B8 *Endangered Species Act Compliance*). The Recommended Plan is in compliance with this Act.
Food Security Act of 1985	Includes "Swampbuster" provisions that discourage the conversion of wetlands into non-wetland areas for agricultural production.	Not applicable to the Shoreline Phase I Project.
Coastal Zone Management Act	Requires that Federal agencies conducting, supporting, or undertaking development activities that are in, or directly affect, the coastal zone of a state shall ensure that the project is, to the maximum extent practicable, consistent with approved state management plans.	The CZMA is discussed in Section 4.3 *Land Use and Planning* and Section 4.11 *Recreation*. Discussions with the applicable CZMA agency, the Bay Conservation and Development Commission have been initiated. A letter of support was received on September 4, 2015. A consistency determination under this Act has been prepared and is located in Appendix A8. The Recommended Plan is in compliance with this Act.

Table 8.2-1. Regulatory Requirements for USACE Feasibility Studies

Regulation	Summary of Requirement	How Addressed for the Shoreline Phase I Study
National Wildlife Refuge System Administration, as amended by the National Wildlife Refuge System Improvement Act of 1997	The Secretary of the Interior can issue use permits for activities performed on National Wildlife Refuges whenever he or she determines that such uses are compatible with the major purposes for which such areas were established.	Much of the study area is part of a designated Federal wildlife refuge. Coordination with the USFWS, which administers the Federal wildlife refuge, has been ongoing throughout project planning and development. The USFWS is a joint NEPA lead agency for the Shoreline Phase I Study. The Recommended Plan is in compliance with this Act.
Clean Air Act	Requires that Federal agencies ensure that their activities are in conformance with Federally approved state implementation plans for geographical areas designated as “nonattainment” and “maintenance” areas under the Clean Air Act.	Compliance with this act is discussed in Section 4.10 *Air Quality/Greenhouse Gases*. The Recommended Plan is in compliance with this Act.
Wild and Scenic Rivers Act	Establishes a National Wild and Scenic Rivers System and prescribes the methods and standards through which additional rivers may be identified and added to the system.	Not applicable; there are no wild and scenic rivers in the study area.
CEQ Memorandum: Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act	Defines prime and unique agricultural land and recommends how potential impacts to such land should be identified.	Not applicable to the Shoreline Phase I Project; the project would not affect any prime or unique agricultural land.

The Planning Guidance Notebook also identifies Executive Orders that must be addressed through the feasibility study process. These and other applicable Executive Orders are listed in Section 8.3 *Other Federal Regulations*.

Table 1.8-2 in the P&G suggests a format for measuring the potential effects of the selected plan on regulated resources. Table 8.2-2 *Effects of the Recommended Plan on Natural and Cultural Resources* repeats the P&G table and includes the suggested measurements.

Table 8.2-2. Effects of the Recommended Plan on Natural and Cultural Resources

Authority	Measurement of Effect
Clean Air Act	Project construction activity could temporarily affect local air quality. Construction would comply with best management practices to ensure that construction-related air quality effects are minimized.
Coastal Zone Management Act	Federal activities that would affect the coastal zone require a determination of consistency with the coastal plan, and concurrence on this determination by the coastal zone agency. Included in this process is a permitting process for the non-Federal sponsors of the federal project. The consistency determination review is in process and will be completed before the USACE issues the NEPA ROD.
Federal Endangered Species Act	The following FESA-listed or candidate species are present or could be present in the study area: • Steelhead – California Central Coast (CCC) DPS (distinct population segment; Threatened; designated critical habitat in study area) • Green sturgeon – Southern DPS of North American green sturgeon (Threatened designated critical habitat in study area) • Longfin smelt – San Francisco Bay-Delta DPS (Candidate) • Salt marsh harvest mouse (Endangered) • California Ridgway's rail (Endangered) • California least tern (Endangered) • Western snowy plover (Threatened) The project would temporarily affect critical habitat for steelhead CCC DPS and green sturgeon Southern DPS. The project would not cause a long-term loss of critical habitat for either species. The USACE developed appropriate avoidance and minimization measures in coordination with the USFWS and the NMFS through Section 7 consultation that was completed on April 27, 2015 and May 19, 2015 respectively.
Executive Order 11988, Floodplain Management	The FRM levee would provide flood risk management for the community of Alviso and industrial, light industrial and commercial land south of the former salt pond complex. Analyses show that, under the USACE High Sea Level Change (SLC) scenario (consistent with NRC Curve III and the State's planning requirements) and an area currently within an area with 0.2% ACE floodplain, the Recommended Plan would reduce the cost of flood loss damage to structures and contents and losses related to traffic delays by about $38.6 million annually compared to the without-project scenario. These savings would be realized for a population at risk of 2,200 residents and another 3,400 people who work in the potentially affected area.
National Historic Preservation Act	The part of the Project that would remove or alter the former salt pond and levee complex elements and restore the area to tidal action would result in moderate- and long-term adverse effects to the Alviso Salt Pond Historic Landscape. The USFWS previously addressed the adverse effects in 2012 through the SBSP Restoration Project and executed a Memorandum of Agreement with the State Historic Preservation Officer (SHPO). The Historic Landscape has been documented in accordance with the standards of the Historic American Landscape Survey. The USACE has included this documentation in its current consultation with the SHPO. The Alviso Historic District would experience minor changes in character and setting with the introduction of the FRM levee. The contributing elements and buildings of the District would not be affected. The FRM would not diminish the integrity of the District's significant historic features. The USACE is currently coordinating with the SHPO to complete the Section 106 process, which will address these effects.
CEQ Memorandum: Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act	No effect.

Table 8.2-2. Effects of the Recommended Plan on Natural and Cultural Resources

Authority	Measurement of Effect
Clean Water Act Sections 303, 401, and 402	The Project would not affect the current water quality classifications for any water bodies in the study area and would not cause exceedances of adopted TMDLs. Water quality certification under CWA Section 401 would be required. Project construction would require compliance with the State's general permit for construction-related discharges (CWA Section 402) because the construction area would exceed 1 acre.
Executive Order 11990, Protection of Wetlands, and Clean Water Act Section 404	The Recommended Plan would cause permanent losses of waters of the United States associated with construction (17.4 acres of wetlands and 120.2 acres of other waters). Losses would be offset by the creation of up to approximately 2870 acres of tidal wetlands. In accordance with the Clean Water Act, a Section 404(B)(1) Evaluation has been completed and is contained in Appendix B10.
Wild and Scenic Rivers Act	No effect.

8.3 Other Federal Regulations

Table 8.3-1 *Applicable Federal Regulations That Apply to the Shoreline Phase I Study Environmental Review* provides a list of Federal regulations applied to construction projects with the potential to impact environmental resources. Section 8.3.1*Executive Order 11988* and Section 8.3.2 *Executive Order 12898* following the table provide information about other applicable USACE regulations not identified in Table 8.2-1 *Regulatory Requirements for USACE Feasibility Studies*.

Table 8.3-1. Applicable Federal Regulations That Apply to the Shoreline Phase I Study Environmental Review

Regulation	Summary of Requirement	How Addressed for the Shoreline Phase I Study
Fish and Wildlife Service Compatibility Policy (50 CFR Parts 25, 26, and 29; Fish and Wildlife Service Manual Section 603 FW2)	Requires the Don Edwards San Francisco Bay National Wildlife Refuge manager to make a determination regarding compatibility of proposed and existing uses of the refuge. Refuge manager must make a determination regarding the compatibility of the new use and prepare a compatibility determination prior to allowing the levee on Refuge land.	Not addressed in this document; Refuge Manager will make compatibility determination for selected plan before levee construction begins.
Migratory Bird Treaty Act (MBTA; 16 USC 703–711)	The act makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations. The USFWS administers the act's permit program.	Study area supports many species of birds that are protected by the MBTA. Section 4.7 *Terrestrial Biological Resources* addresses migratory birds. Protection measures will be implemented in construction as needed. The Recommended Plan is in compliance with this Act.
Bald and Golden Eagle Protection Act (16 USC 668)	Prohibits the take or commerce of any part of bald and golden eagles without a permit. The USFWS administers the act's permit program.	Bald eagles occasionally use the study area, but the project is unlikely to result in the take of bald eagles. Section 4.7 *Terrestrial Biological Resources* addresses raptors such as the bald eagle. The Recommended Plan is in compliance with this Act.

Table 8.3-1. Applicable Federal Regulations That Apply to the Shoreline Phase I Study Environmental Review

Regulation	Summary of Requirement	How Addressed for the Shoreline Phase I Study
Marine Mammal Protection Act of 1972 (16 USC 1361–1407)	Prohibits, with certain exceptions, the take of marine mammals in United States waters and by United States citizens on the high seas and the importation of marine mammals and marine mammal products into the United States. The act protects marine mammals, including cetaceans (whales, dolphins, and porpoises), pinnipeds (seals, sea lions, and walruses), and other marine mammal species.	Harbor seals, which are protected under the Marine Mammal Protection Act, use areas along Coyote Creek on the north side of the study area. Harbor seals are addressed in Section 4.7 *Terrestrial Biological Resources*. Protection measures will be implemented in construction as needed. The Recommended Plan is in compliance with this Act.
General Bridge Act of 1946 (33 USC 525)	Requires approval of location and plans of bridges prior to the start of construction. The U.S. Coast Guard is the Federal regulatory agency responsible for permitting bridges under the provisions of this Act.	The Commandant of the Coast Guard provided advance approval to the location and plans of bridges to be constructed (the proposed crossing of Artesian Slough at mile 2.0 and adjacent unnamed ditch). Approval was received during the public review cycle of the Integrated Document; notification can be found in Appendix I *Public Comments and Responses on Draft Integrated Document* coded as comment letter *012_USGS*. The Recommended Plan is in compliance with this Act.

8.3.1 Executive Order 11988

Executive Order 11988 requires Federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective:

> Each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities.

The Water Resources Council Floodplain Management Guidelines for implementation of Executive Order 11988, as referenced in USACE ER 1165-2-26, require an eight-step process that agencies should carry out as part of their decision-making on projects that have potential impacts to or within the floodplain. The eight steps reflect the decision-making process required in Section 2(a) of the Executive Order. The eight steps and responses to them are summarized below.

1. **Determine if the proposed action is in the base floodplain.**

   The proposed action is located in the base floodplain, which is defined as the 1-percent ACE floodplain. The Recommended Plan would construct a flood risk management levee along existing pond dikes that could be overtopped from tidal flows due to future sea level change (SLC). The proposed levees would prevent tidal flows from surpassing USFWS Refuge lands into the community of Alviso. Under the without-project condition, the community of Alviso is located in the floodplain.

2. **If the action is in the base floodplain, identify and evaluate practicable alternatives to the action or to location of the action in the base floodplain.**

   Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection* of this document presents an analysis of alternatives. Due to the nature of the flood hazard, any structural or nonstructural action to manage flood risk must be located within the floodplain. All of the levee alignments analyzed would separate the source of potential tidal flood from the low-lying areas behind them (the community of Alviso and the water treatment plant), which are located in the base floodplain. Regarding ecosystem restoration, the ponds that would be restored to tidal action are bayward of the potential flood risk management levees and the mechanism by which they would be restored to tidal marsh would be to open them to tidal exchange. These ponds represent an opportunity to reconnect historic flows and reestablish valuable historic marsh habitat.

   The Recommended Plan was evaluated in accordance with Section 308 of WRDA 1990, which required that structures built in the 1-percent ACE floodplain with a first floor elevation less than the 1-percent ACE flood elevation not be included in the benefit base for justifying Federal flood risk management projects. The Recommended Plan does not include the value of structures built in the base floodplain after 1991.

3. **If the action must be in the floodplain, advise the general public in the affected area and obtain their views and comments.**

   Public involvement activities are described in Chapter 6 *Public Involvement, Review, and Consultation*. The study effort has regularly engaged the general public throughout the planning process.

4. **Identify beneficial and adverse impacts due to the action and any expected losses of natural and beneficial floodplain values. Where actions proposed to be located outside the base floodplain will affect the base floodplain, impacts resulting from these actions should also be identified.**

   Potential impacts associated with the Recommended Plan are summarized in Chapter 4 *Existing and Future Conditions/Affected Environment, Environmental Consequences, and Mitigation Measures*. The proposed ecosystem restoration actions would increase beneficial floodplain values by reconnecting diked ponds currently separated from tidal flows with San Francisco Bay, allowing the establishment of valuable marsh habitats that have been lost to the region through human development. The implementation of flood risk management actions would protect existing developed areas and therefore not negatively impact natural floodplain areas.

5. **If the action is likely to induce development in the base floodplain, determine if a practicable non-floodplain alternative for the development exists.**

   The Shoreline Phase I Project does not include activity that would directly result in new residential or non-residential development. Within the study area, population growth and urban development are driven by local, regional, and national economic conditions. The City of San José's current General Plan does not assume that the project will occur and thus does not reflect how the project benefits that are related to better flood risk management could affect regional development patterns. It is possible that the City will update its General Plan to reflect the improved flood risk management in the area. However, even if a General Plan update were to occur, new development would be limited by proximity to the San José–Santa Clara Regional Wastewater Facility (Wastewater Facility), proximity to the bay, the City's Urban Growth and Urban Services Area boundaries, the City's stated desire to protect the baylands from development, and land availability (areas to the south of SR 237 are already developed, so new development would be mostly infill).

   Environmental analyses have been completed for the Recommended Plan pursuant to the NEPA and the California Environmental Quality Act (CEQA). These analyses disclose the environmental effects associated with their implementation and describe mitigation measures adopted to eliminate or reduce the severity of environmental effects.

   The Recommended Plan is consistent with existing land use and project plans in the study area that were approved and initiated before the proposed levee improvements had been modeled and studied. Development in these areas is proceeding in accordance with the applicable plans.

6. **As part of the planning process under the P&G, determine viable methods to minimize any adverse impacts of the action including any likely induced development for which there is no practicable alternative and methods to restore and preserve the natural and beneficial floodplain values. This should include reevaluation of the "no action" alternative.**

   Measures are identified and would be implemented as part of the project to minimize the project's potentially adverse environmental impacts. The project is not expected to induce development because its purpose is to reduce flood risk for an urbanized area that is already developed (i.e., community of Alviso in northern San José and a water treatment plant).

7. **If the final determination is made that no practicable alternative exists to locating the action in the floodplain, advise the general public in the affected area of the findings.**

   The Draft Integrated Document was released for public review between December 19, 2014, and February 2, 2015. Comments received are responded to in Appendix I1 *Public Comments and Responses on Draft Integrated Document*.

8. **Recommend the plan most responsive to the planning objectives established by the study and consistent with the requirements of the Executive Order.**

   The objective of the project is to reduce the probability and consequences of flooding in the study area. The project is responsive to the Executive Order 11988 objective of:

   > … avoidance, to the extent possible, of long- and short-term adverse impacts associated with the occupancy and modification of the base floodplain and the avoidance of direct and indirect support of development in the base floodplain wherever there is a practicable alternative.

   This is because the proposed features focus on reducing the threat of flooding to the existing urban area, while altering a very small footprint within the floodplain. These features would reduce the hazard and risk associated with floods thereby minimizing both the probability and the consequences of flooding within the urban area, and would preserve the natural and beneficial values of the base floodplain.

The proposed project also includes nonstructural measures (such as emergency warning systems, evacuation procedures, and potential future relocation of structures in response to rising sea level) to be included in the floodplain management plan that will be developed with the non-Federal sponsor and local interests such as the City of San José. The City of San José currently has an emergency management plan covering a broader area that includes the study area; this plan includes a floodplain management plan that addresses flooding due to rain, tidal flooding, overtopping of levees or failure of those levees protecting developed areas in Alviso, or overtopping of creeks anywhere in the City; or localized flooding due to storm drain capacity problems. The City of San José participates in the National Flood Insurance Program, and takes remedial actions to obtain low flood insurance rates for property owners. In 1999 the City was awarded a certificate of Class 8 rating.

8.3.2 Executive Order 12898

On February 11, 1994, President Bill Clinton issued Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. This order requires Federal agencies to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies, and activities on minority and low-income populations. As the Federal sponsor of the Proposed Project, the USACE must consider how the project might affect minority and low-income populations.

The Council on Environmental Quality's (CEQ) *Environmental Justice: Guidance under the National Environmental Policy Act* (1997) provides guidance for implementing Executive Order 12898.

For the purpose of this study, low-income and minority populations are defined as follows:

- A *low-income* population is any persons having a household or median income below the poverty thresholds defined by the U.S. Department of Health and Human Services.
- A *minority* is a person belonging to one of the following five groups: Black, Hispanic, Asian, American Indian or Alaskan Native, or Native Hawaiian or other Pacific Islander.

Environmental justice is discussed in Appendix B12 *Environmental Justice Appendix* of this document.

8.4 Federal Executive Orders

Pursuant to Section 103 of the Water Resources Planning Act (Public Law 89-80) and Executive Order 11747, President Ronald Reagan approved the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* to guide planning for projects such as the Shoreline Phase I Project. These guidelines list specific Executive Orders that should be considered when evaluating the potential effects of a recommended plan. These orders, other orders that apply to the Project (but that are not listed in the P&G), and the orders' applicability are listed in Table 8.4-1 *Executive Orders Considered in This Integrated Document*.

Table 8.4-1. Executive Orders Considered in This Integrated Document

Order Number	Order Name	Order Focus
11514	Protection and Enhancement of Environmental Quality	Directs the Federal government to provide leadership in protecting and enhancing the quality of the Nation's environment to sustain and enrich human life. Directs Federal agencies to initiate measures needed to direct their policies, plans, and programs so as to meet national environmental goals. Amended by later orders. The objectives of the proposed action are focused on environmental protection. The Recommended Plan is in compliance with this E.O.
11593	Protection and Enhancement of the Cultural Environment	Directs the Federal government to provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the Nation. The USACE is in ongoing coordination with SHPO and the tribes to ensure compliance with this E.O.
11988	Floodplain Management	Directs Federal agencies to provide leadership and take action to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities, (2) providing Federally undertaken, financed, or assisted construction and improvements, and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities. Purpose of E.O. is to discourage Federally induced development of floodplains. Commitment of lands to restoration precludes such development. The Recommended Plan is in compliance with this E.O.
11990	Protection of Wetlands	Directs Federal agencies to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities, (2) providing Federally undertaken, financed, or assisted construction and improvements, and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities. The Recommended Plan objectives include tidal wetland restoration. The objectives of the Recommended Plan are focused on environmental restoration and in compliance with this E.O.
12898	Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	Directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions. The Recommended Plan does not present any environmental impacts that are high, adverse and disproportionate to low income, or minority populations. Sufficient scoping and public participation ensured potential impacts were understood by the public. No comments were presented as possible environmental impacts that may be disproportionate to low income or minority populations. The Recommended Plan is in compliance with this E.O.
13007	Indian Sacred Sites	Directs Federal agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners. It directs agencies to avoid adversely affecting the physical integrity of such sacred sites and to maintain the confidentiality of information pertaining to such locations. The Recommended Plan does not intend to affect sacred sites and is in compliance with this E.O.
13045	Environmental Health and Safety Risks to Children	Focuses Federal attention on actions that affect human health and safety conditions that may disproportionately affect children. The Recommended Plan is not expected to have environmental or safety risks that may disproportionately affect children and is in compliance with this E.O.

Table 8.4-1. Executive Orders Considered in This Integrated Document

Order Number	Order Name	Order Focus
13423	Strengthening Federal Environmental, Energy, and Transportation Management	Directs Federal agencies to conduct environmental, transportation, and energy-related activities under the law in support of their respective missions in an environmentally, economically, and fiscally sound, integrated, continuously improving, efficient, and sustainable manner. The objectives of the Recommended Plan are in compliance with this E.O.
13122	Invasive Species	An invasive species management plan will be developed during the design phase of the project. Best Practices for managing invasive species as part of the construction specifications would be addressed. This project is in compliance with this E.O.

8.5 State and Regional Requirements

8.5.1 California Environmental Quality Act

The CEQA of 1973 (Public Resources Code [PRC] Section 21000 et seq.) establishes requirements similar to those of NEPA for considering environmental impacts and alternatives and for preparing an EIR prior to implementing applicable projects. The CEQA Guidelines (PRC Section 15000 et seq.) provide further guidance on the application of the CEQA.

The CEQA requires that significant environmental impacts be mitigated to a level of insignificance or to the maximum extent feasible. If full mitigation is not feasible, the State lead agency must make a finding of overriding considerations before approving the project. The CEQA requires full consideration of impacts to biological resources, including effects on Endangered, Threatened, or Rare plant or wildlife species, effects on the habitat of such species, effects on wetlands, and conflicts with policies or ordinances protecting biological resources.

In addition to providing an overarching environmental review requirement, the CEQA also directs agencies to make additional considerations for special-status species and historic and unique archaeological resources.

8.5.1.1 Special-Status Species under the CEQA

Although Rare, Threatened, and Endangered species are protected by specific Federal and State statutes, the CEQA Guidelines Section 15380(d) provides that a species not listed on Federal or State lists of protected species may be considered Rare or Endangered if the species can be shown to meet certain specified criteria. These criteria have been modeled after the definition in the FESA and the section of the California Fish and Game Code that addresses Rare or Endangered plants and animals. The CEQA Guidelines Section 15380(d) allows a public agency to undertake a review to determine whether a significant effect on species that have not yet been listed by either the USFWS or the California Department of Fish and Wildlife (formerly the California Department of Fish and Game) (i.e., Candidate species) would occur.

Thus, the CEQA provides an agency with the ability to protect a species from a project’s potential impacts until the respective government agencies have had an opportunity to designate the species as protected, if warranted. Examples of species that may be considered under the CEQA Guidelines Section 15380 include some vascular plants. The California Rare Plant Rank (CRPR) system identifies vascular plants that are Rare, Threatened, or Endangered but have no designated status or protection under Federal or State endangered species legislation.

The CRPR designations are:

- 1A, presumed extinct in California
- 1B, Rare or Endangered in California and elsewhere
- 2, plants Rare, Threatened, or Endangered in California but more common elsewhere
- 3, plants about which we need more information (a review list)
- 4, plants of limited distribution (a watch list)

The ranks are further clarified by threat codes, which are as follows:

- .1 – Seriously Endangered in California
- .2 – Fairly Endangered in California
- .3 – Not very Endangered in California

Note that all List 1A plants (presumed extinct in California) and some List 3 plants (need more information) lacking any threat information receive no threat code extension.

In general, CRPR Rank 1A, 1B, and 2 plants are considered to meet the CEQA Guidelines Section 15380 criteria. Effects on these species would therefore be considered significant.

8.5.1.2 Historic and Unique Archaeological Resources under the CEQA

The CEQA offers directives regarding impacts on historical resources and unique archaeological resources. The CEQA states generally that if implementing a project would result in significant environmental impacts, public agencies should determine whether such impacts can be substantially lessened or avoided through feasible mitigation measures or feasible alternatives. This general mandate applies equally to significant environmental effects related to certain cultural resources.

Only significant cultural resources (i.e., historical and archaeological resources) need to be addressed. The CEQA Guidelines define a “historical resource” as, among other things, “a resource listed or eligible for listing on the California Register of Historical Resources (California Register).” A historical resource may be eligible for inclusion in the California Register, as determined by the State Historical Resources Commission or the lead agency, if the resource meets any of the following four criteria:

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

In addition, a resource is presumed to constitute a “historical resource” if it is included on a “local register of historical resources” unless “the preponderance of evidence demonstrates that it is not historically or culturally significant” [CEQA Guidelines Section 15064.5(a)(2)].

In addition, the CEQA Guidelines require consideration of unique archaeological sites (Section 15064.5; also see PRC Section 21083.2). A “unique archaeological resource” is defined as follows [Section 21083.2(g)]:

> … an archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:
>
> 1. Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.
> 2. Has a special and particular quality such as being the oldest of its type or the best available example of its type.
> 3. Is directly associated with a scientifically recognized important prehistoric or historic event or person.

If an archaeological site does not meet the criteria for listing in the California Register but does meet the definition of a unique archaeological resource as defined in the PRC Section 21083.2, it is entitled to special protection or attention under the CEQA. Treatment options under the CEQA include activities that preserve such resources in place in an undisturbed state. Other acceptable methods of mitigation under Section 21083.2 include excavation and curation, or study in place without excavation and curation (if the study finds that the artifacts would not meet one or more of the criteria for defining a “unique archaeological resource”).

Section 15064.5(e) of the State CEQA Guidelines and Health and Safety Code Section 7050.5 require that excavation activities be stopped whenever human remains are uncovered and that the county coroner be called in to assess the remains. If the county coroner determines that the remains are those of Native Americans, the Native American Heritage Commission (NAHC) must be contacted within 24 hours. At that time, Section 15064.5(d) of the CEQA Guidelines directs the lead agency to consult with the appropriate Native Americans as identified by the NAHC and directs the lead agency (or applicant), under certain circumstances, to develop an agreement with Native Americans for the treatment and disposition of the remains.

8.5.2 Other State Requirements

Table 8.5-1 *Applicable State Laws and Regulations That Apply to the Shoreline Phase I Study* summarizes the other state laws and regulations that apply to the Shoreline Phase I Study.

Table 8.5-1. Applicable State Laws and Regulations That Apply to the Shoreline Phase I Study

Regulation	Summary of Requirement	How Addressed for the Shoreline Phase I Study
Porter-Cologne Water Quality Control Act (California Water Code Division 7)	Under this act, the SWRCB has overall authority for State water rights and water quality policy. The act also established nine Regional Water Quality Control Boards to oversee water quality on a day-to-day basis at the local and regional levels. The Regional Boards prepare and update Basin Plans (water quality control plans) and regulate all pollutant or nuisance discharges that may affect either surface water or groundwater.	The Shoreline Phase I Study Area is in the San Francisco Bay region. The San Francisco Bay Region Basin Plan establishes beneficial uses for surface and groundwater resources and sets regulatory water quality objectives that are designed to protect those beneficial uses. Beneficial uses and water quality are discussed in Section 4.5 *Surface Water and Sediment Quality*. The Recommended Plan is in compliance.
California Endangered Species Act of 1984 (CESA; Fish and Game Code Section 2050 et seq.)	Regulates the listing and take of endangered and threatened species through a permit process that is administered by the CDFW. The CESA is similar to the Federal ESA but pertains only to species State-listed as Endangered and Threatened. For projects sponsored by state or local agencies and being reviewed under the CEQA, the CESA directs the State and/or local agencies to consult with the CDFW on projects or actions that could affect listed species, directs the CDFW to determine whether jeopardy to listed species would occur, and allows the CDFW to identify “reasonable and prudent alternatives” to the project consistent with conserving the species. Agencies can approve a project that affects a listed species if the agency determines that there are “overriding considerations”; however, the agencies are prohibited from approving projects that would cause the extinction of a listed species.	The study area study area supports several species that are listed pursuant to the CESA. See Section 4.6 *Aquatic Biological Resources* and Section 4.7 *Terrestrial Biological Resources* for more information about CESA-listed species. The Recommended Plan is in compliance.
Fully Protected Species (Fish and Game Code Sections 3511, 4700, 5050, and 5515)	The Fish and Game Code identifies 37 fully protected species. The code prohibits take or possession at any time of fully protected species. Fully protected species may not be taken or possessed at any time, and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research and relocation of the bird species for the protection of livestock. Administered by the CDFW.	The study area study area supports several fully protected species. See Section 4.7 *Terrestrial Biological Resources* for more information about potential project effects on fully protected species. The Recommended Plan is in compliance.
Birds of Prey (Raptors; 8.3.58.4.3 Fish and Game Code Section 3503.5)	Makes it unlawful to take, possess, or destroy any birds in the orders *Falconiformes* or *Strigiformes* (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by the code or any regulation adopted pursuant thereto. Administered by the CDFW.	Several species of raptors use the study area. See Section 4.7 *Terrestrial Biological Resources* for more information about raptors. The Recommended Plan is in compliance.
Streambed Alteration Agreements (Fish and Game Code Section 1600)	Defines the responsibilities of the CDFW and the requirement for public and private applicants to obtain an agreement to “divert, obstruct, or change the natural flow or bed, channel, or bank of any river, stream, or lake designated by the CDFW in which there is at any time an existing fish or wildlife resource or from which those resources derive benefit, or will use material from the streambeds designated by the department.”	Project construction could temporarily affect streams subject to agreements under Section 1600, including Coyote Creek, Alviso Slough, and Artesian Slough. CDFW would issue an agreement for the selected plan if that plan would require alteration of Coyote Creek, Alviso Slough, and/or Artesian Slough. The Recommended Plan is in compliance.

8.5.3 Regional Water Quality Control Board Concurrence Letter

Regional Water Quality Control Board Concurrence letter was received on July 14, 2015 (see Appendix B9 *Pertinent Correspondence).*

8.6 Local and Regional Plans, Goals, and Policies

Government agencies have established plans, goals and policies related to specific resources and/or land use in the study area. This section describes the plans, goals, and policies related to:

- The Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California
- Don Edwards San Francisco Bay National Wildlife Refuge Comprehensive Conservation Plan
- New Chicago Marsh Water Management Plan
- San Francisco Estuary Project Comprehensive Conservation and Management Plan
- Santa Clara County General Plan
- City of San José General Plan
- Alviso Master Plan
- Wastewater Facility Plant Master Plan

8.6.1 Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California

The USFWS approved the Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California in August 2013. This plan focuses on five Endangered species: California Ridgway's rail; salt marsh harvest mouse (*Reithrodontomys raviventris*) (SMHM); Suisun thistle (*Cirsium hydrophilum* var. *hydrophilum*); soft bird's beak (*Cordylanthus mollis* ssp. *mollis*); and California sea-blite (*Suaeda californica*) (USFWS 2013). The biology of these species is at the core of the recovery plan, but the goal of this effort is the comprehensive restoration and management of tidal marsh ecosystems. The recovery plan is an expansion and revision of the 1984 *California Clapper Rail and Salt Marsh Harvest Mouse Recovery Plan* and addresses Endangered and Threatened species of tidal marshes in California from Humboldt Bay to Morro Bay. The three species covered by the recovery plan and found in the study area are discussed in Section 4.7 *Terrestrial Biological Resources*.

The ultimate goal of this recovery plan is to recover all listed species so they can be delisted. The recovery plan identifies five distinct recovery units. The Shoreline Phase I Study Area is located in the Central/South San Francisco Bay recovery unit, which encompasses suitable or restorable tidelands from Point San Pablo on the Contra Costa coast and Point San Pedro, Marin County, to the extreme southern extent of San Francisco Bay. Limited populations of California sea-blite and SMHM are present within this recovery unit. This recovery unit also supports the majority of California Ridgway's rail populations. The two other species addressed in the recovery plan, Suisun thistle and soft bird's beak, are not present in the Central/South San Francisco Bay recovery unit or in the Shoreline Phase I Study Area.

Although the plan sets out ambitious restoration goals, it is largely a voluntary program. Much of the targeted land is owned by Cities, Counties, park districts, and nonprofit groups. No money has been dedicated to implement the plan at this time.

The Recommended Plan is not expected to negatively impact these species, and the effects are discussed in Section 4.7 *Terrestrial Biological Resources*. The ecotone would provide more gradual transition habitat and buffer for listed species in compliance with the recovery plan. The other action alternatives would incorporate a bench instead of an ecotone. The bench would not meet the ecotone and buffer criteria but along with the extensive new marshes would be a large improvement over current conditions for these species. In addition, numerous remnant islands created along the existing dike alignments would provide substantially improved refugial habitat relative to current conditions.

8.6.2 Don Edwards San Francisco Bay National Wildlife Refuge Comprehensive Conservation Plan (CCP) and New Chicago Marsh Water Management Plan

As described in Section 4.3 *Land Use and Planning*, the Federal government owns and the USFWS manages all of the ponds within the Shoreline Phase I Study Area as part of the Refuge with the exception of Pond A18 (which is owned by the City of San José). The USFWS manages the Refuge consistent with its Comprehensive Conservation Plan (CCP) (USFWS 2012). The CCP was completed in 2012 and recognizes that the Shoreline Phase I Study is in progress.

The CCP addresses hunting, recreation, education, and a volunteer program as well as habitat enhancement and species protection. The CCP includes the following five overarching Refuge goals:

- **Goal 1:** Protect and contribute to the recovery of Endangered, Threatened, and other special-status species on the Refuge by conservation and management of the habitats on which these species depend.
- **Goal 2:** Conserve, restore, enhance, create, and acquire habitats to support the diversity and abundance of migratory birds and other native flora and fauna that depend on Refuge lands.
- **Goal 3:** Provide the local community and other visitors with compatible wildlife-oriented outdoor recreation opportunities to enjoy, understand, and appreciate the resources of the Refuge.
- **Goal 4:** Through diverse environmental education, interpretation, and outreach opportunities, increase public awareness of the Refuge's purpose and the ecosystem of the San Francisco Bay estuary and promote environmental stewardship and conservation.
- **Goal 5:** Instill community stewardship through volunteerism to support the Refuge's diverse purposes.

The CCP includes detailed objectives and strategies to achieve these goals.

The New Chicago Marsh Water Management Plan, originally adopted in the early 1990s and updated in 2008, guides how the USFWS manages the area that is included in the New Chicago Marsh (NCM) footprint. The 390-acre marsh was restored to muted tidal marsh in 1994. The USFWS currently manages water levels under the New Chicago Marsh Water Management Plan consistent with two goals: (1) to enhance marsh habitat for SMHM and (2) to increase wildlife diversity in the marsh, achieve nuisance mosquito reduction, and maintain water quality (USFWS 2008a).

The Recommended Plan objectives include flood risk management, ecosystem restoration, and recreation. This is consistent with this Plan as it will provide environmental restoration to approximately 2,900 acres of tidal wetland habitat.

8.6.3 San Francisco Estuary Project Comprehensive Conservation and Management Plan

The San Francisco Estuary Project (SFEP) is a Federal-State-local partnership established in 1987 under CWA Section 320, National Estuary Program. This project is a cooperative effort to promote effective management of the San Francisco Bay/Sacramento–San Joaquin Delta (Bay Delta) Estuary and to restore and maintain its water quality and natural resources while also maintaining the region's economic vitality. The SFEP Comprehensive Conservation and Management Plan (2007) is a collaboratively produced, consensus-based agreement about protecting and restoring the estuary. It serves as a road map for restoring the estuary's chemical, physical, and biological health. The plan was mandated under a reauthorization of the

CWA in 1987, and Congress has directed that it be implemented. However, many of the actions suggested in the Comprehensive Conservation and Management Plan will require regulatory or policy initiatives for implementation. Meanwhile, securing the necessary funding for acquisition, restoration, and other projects is an ongoing challenge.

The 2007 Comprehensive Conservation and Management Plan updates a 1993 plan and was based on input from the broad stakeholder community. The 2007 plan includes new and revised actions while retaining many of the original plan's actions. Based on successes since 1993 and new and continuing challenges, participants updating the Comprehensive Conservation and Management Plan focused on actions considered most relevant at this time. Some actions from the 1993 edition were not revised because of time and resource constraints. The 2007 plan contains the following goals relevant to biological resources within the Shoreline Phase I Study Area.

Aquatic Resources Goals

- Stem and reverse the decline in the health and abundance of estuarine biota (indigenous and desirable nonindigenous biota), thereby restoring healthy natural reproduction.
- Restore healthy estuarine habitat to the Bay Delta, taking into consideration all beneficial uses of Bay Delta resources.
- Ensure the survival and recovery of listed (and Candidate) Threatened and Endangered species, as well as other species in decline.
- Manage the fish and wildlife resources of the estuary to achieve the goals stated above.

Wildlife Goals

- Stem and reverse the decline of estuarine plants and animals and the habitats on which they depend.
- Ensure the survival and recovery of listed and Candidate Threatened and Endangered species, as well as special-status species.
- Optimally manage and monitor the wildlife resources of the estuary.

Wetlands Management Goals

- Protect and manage existing wetlands.
- Restore and enhance the ecological productivity and habitat values of wetlands.
- Expedite a significant increase in the quantity and quality of wetlands.
- Educate the public about the values of wetland resources.

The Recommended Plan objectives include flood risk management, ecosystem restoration, and recreation. This is consistent with this Plan as it will provide environmental restoration to approximately 2,900 acres of tidal wetland habitat.

8.6.4 Santa Clara County General Plan

The Santa Clara County General Plan (1994) identifies strategies and policies to preserve and enhance scenic resources within its boundaries. Three general strategies include (1) manage growth and plan for open space, (2) minimize development impacts on significant scenic resources, and (3) maintain and enhance the values of scenic urban settings. Specific policies relevant to the Shoreline Phase I Study that support these strategies are identified below.

- **C-RC 49:** Cultural heritage resources within Santa Clara County should be preserved, restored wherever possible, and commemorated as appropriate for their scientific, cultural, historic, and place values.
  - Strategy #2: Prevent or Minimize Adverse Impacts on Heritage Resources
- **C-RC 52:** Prevention of unnecessary losses to heritage resources should be ensured as much as possible through adequate ordinances, regulations, and standard review procedures. Mitigation efforts, such as relocation of the resource, should be employed where feasible when projects will have significant adverse impact upon heritage resources.
  - Strategy #3: Restore, Enhance and Commemorate Resources
- **C-RC 54:** Heritage resources should be restored, enhanced, and commemorated as appropriate to the value and significance of the resource.
- **C-RC 57:** The scenic and aesthetic qualities of both the natural and built environments should be preserved and enhanced for their importance to the overall quality of life for Santa Clara County.
- **C-RC 58:** The general approach to scenic resource preservation on a countywide basis should include the following strategies: (a) conserving scenic natural resources through long-range, inter-jurisdictional growth management and open space planning; (b) minimizing development impacts on highly significant scenic resources; and (c) maintaining and enhancing scenic urban settings, such as parks and open space, civic places, and major public commons areas.
- **C-RC 59:** Scenic values of the natural resources of Santa Clara County should be maintained and enhanced through countywide growth management and open space planning.

The Recommended Plan objectives include flood risk management, ecosystem restoration, and recreation. This is consistent with this Plan as it will provide environmental restoration to approximately 2,900 acres of tidal wetland habitat.

8.6.5 City of San José General Plan

The City of San José's current General Plan, called Envision San José 2040 General Plan (City of San José 2011), outlines the City's role in the advancement of an innovation-based economy, its development and environmental policies, and its land-use planning practices. The General Plan identifies several planning areas, including one for the Alviso area. The Shoreline Phase I Study Area is entirely within the Alviso planning area.

The General Plan includes 12 major strategies that are addressed through goals, policies, and actions. The major strategies address the following:

1. Community-based planning
2. Form-based plan
3. Focused growth
4. Innovation and regional employment
5. Urban villages
6. Streetscapes for people
7. Measurable sustainability and environmental stewardship
8. Fiscally strong city
9. Destination downtown
10. Life amidst abundant natural resources
11. Design for a healthful community
12. Phasing and periodic review

Plan goals, policies, and actions address many of the resources discussed previously in this document. General categories that the goals, policies, and actions address and that the Shoreline Phase I Project activity considers include the following:

- **Land use and employment:** includes items that address cultural attractions (including open space such as that associated with the study area; Goal IE-5)
- **Measurable environmental sustainability:** includes items that address construction-related air emissions (Goal MS-13) and water quality (Goal MS-20)
- **Environmental resources:** includes items that address riparian corridors (such as Coyote Creek; Goal ER-2), the bay and baylands (Goal ER-3), special-status plants and animals (Goal ER-4), migratory birds (Goal ER-5), urban-natural interface (Goal ER-6), wildlife movement (Goal ER-7), water resources (Goal ER-9), and archaeology and paleontology (Goal ER-10)
- **Environmental considerations and hazards:** includes items that address noise and vibration (Goals EC-1 and EC-2) and flooding hazards (Goal EC-5)
- **Parks, open space, and recreation:** includes items that address sustainable parks and recreation (Goal PR-6) and interconnected systems (Goal PR-7)

- **Land use:** includes items that address growth areas (Goal LU-2), historic landmarks and districts (Goal LU-13), historic structures of lesser significance (Goal LU-14), public awareness of historic resources (Goal LU-15), compatibility between historic preservation and sustainability (Goal LU-16), and urban growth boundary (Goal LU-19)
- **Transportation:** includes items that address walking and bicycling (Goal TR-2)
- **Trail network:** includes items that address trails as transportation (Goal TN-2) and accessible, safe, and well-functioning trails (Goal TN-3)
- **Plan implementation:** includes items that address plan implementation by other agencies (Goal IP-16)

The Recommended Plan objectives include flood risk management, ecosystem restoration, and recreation. This is consistent with this Plan as it will provide environmental restoration to approximately 2,900 acres of tidal wetland habitat.

8.6.6 Alviso Master Plan

As described in Section 4.3 *Land Use and Planning*, the Envision San José 2040 General Plan incorporates the 1998 Alviso Master Plan.

Alviso is a unique district of San José that retains much of its original character and historical roots. Working closely with the Alviso community, the City prepared the Alviso Master Plan to address how the City can retain the small-town atmosphere while preserving historic resources, enhancing infrastructure and services, and providing modest development opportunities. The Alviso Master Plan provides for mixed-use development within the historical Alviso Village area, modest expansion of the established residential neighborhood, and significant amounts of new industrial and commercial development along the plan area's southern and eastern edges. This plan area notably includes several of the City's recycling and landfill facilities and the Wastewater Facility. The Envision San José 2040 General Plan amended the 1998 plan by adding employment growth capacity.

The Recommended Plan objectives include flood risk management, ecosystem restoration, and recreation. This is consistent with this Plan as it will provide environmental restoration to approximately 2,900 acres of tidal wetland habitat.

8.6.7 San José–Santa Clara Regional Wastewater Facility Plant Master Plan

The City of San José adopted a Plant Master Plan for the Wastewater Facility in 2013. The intent of the plan is to guide future operation and development of the Wastewater Facility. The Plant Master Plan addresses future wastewater operations and other future compatible uses of the City-owned property.

The master plan focuses on two major components: plant process improvements and future land uses. The plant process improvements section of the plan provides guidance for replacing aging facilities and infrastructure and identifies process changes and long-range capital projects that will enable the Wastewater Facility to meet future and regulatory requirements and service demand. The planned changes will shrink the facility's processing area footprint and reduce odor. These elements will enable new or different compatible uses on other parts of the Wastewater Facility property.

The Plant Master Plan's land-use plan provides a conceptual plan for how some areas that were formerly part of the facility's processing areas can be redeveloped and used for other purposes. The plan shows areas for active and passive recreation, habitat restoration and easements, burrowing owl habitat, and commercial, light industrial, research and development, and office uses. The Plant Master Plan maintains a smaller core processing facility and does not propose any future development on the adjacent Nine Par Landfill (closed) or Zanker Road Landfill (active and surrounded by Wastewater Facility property).

As the City developed the plan, it coordinated with the USACE, the State Coastal Conservancy, and the Santa Clara Valley Water District to ensure that the Shoreline Phase I Study considered and is compatible with the Plant Master Plan. The City will continue to coordinate with the Shoreline Phase I Project proponents as it continues implementing the Plant Master Plan.

The Recommended Plan objectives include flood risk management, ecosystem restoration, and recreation. This is consistent with this Plan as it will provide environmental restoration to approximately 2,900 acres of tidal wetland habitat.

8.7 Areas of Controversy and Unresolved Issues

The planning of the Shoreline Study and choice of Recommended Plan relied extensively on existing scientific and local knowledge of the Study Area (such as information gathered through the SBSP Restoration Project implementation process) from the primary defining of the problems and opportunities to the evaluation of alternatives and estimation of restoration performance. While the Recommended Plan is based on a wealth of knowledge, concerns and controversies were documented through the planning process. The monitoring and adaptive management plan provides an approach to address controversies and risk (unresolved issues) and provides a method to inform ongoing project adjustments with the intent to improve project performance.

8.7.1 Areas of Controversy

Loss of Pond Habitat. The loss of pond habitats due to the creation of tidal marsh was extensively debated during the 5 year programmatic planning effort of the South Bay Salt Pond Restoration Project (SBSP Restoration Project; 2003–2008). The SBSP Restoration Project environmental documentation stated that the preferred alternative included up to 90 percent of the project area be restored to tidal marsh in order to make up for the overwhelming loss of the historic tidal wetland resources. However, the project documentation also stated that several strategies would be incorporated into the project to address impacts to the pond-specialist species.

The first major strategy is to enhance a carefully selected group of existing ponds to improve their productivity, creating what are called "enhanced managed ponds." These are ponds that have lower salinity levels, better ability to manage water levels and flows with new water-control structures, and islands for roosting and nesting.

The second strategy for the SBSP Restoration Project to prevent significant impacts to pond species is the adaptive management process. Conversion of ponds to tidal wetlands will happen over time, in phases, with monitoring and applied studies being incorporated into the process.

Based on these results, if undesired impacts appear, then corrective action would be taken or, possibly, the conversion of ponds to tidal wetlands would stop. Since the Shoreline Phase I Study is closely coordinated with the SBSP Restoration Project planning effort, a similar approach was adopted to address the impacts of converting pond habitats to tidal wetlands. The ecosystem restoration actions would be implemented in phases with monitoring and close integration with the adaptive management program of the SBSP Restoration Project.

Other Areas of Controversy. Throughout the process of developing the final Integrated Document, the USACE and non-Federal sponsors worked together and with other stakeholders to resolve other issues raised during the public participation process, including:

- Cost-sharing responsibility for elements of the Recommended Plan;
- Management compatibility for areas that are owned and managed by different parties, such as SCVWD and USFWS management of adjacent areas owned by each;
- Work windows intended to protect special-status species yet allow restoration to proceed;
- Design details, such as levee dimensions, ecotone size, and the Artesian tide gate configuration;
- Ecosystem restoration phasing and coordination with ongoing implementation of the SBSP Restoration Project;
- Long-term operation and maintenance details, such as levee maintenance and ecosystem management programs that are compatible; and
- Third-party requirements to maintain access to and/or through the study area, such as PG&E access to its facilities in the study area.

8.7.2 Unresolved Issues

Long-term conditions in the Proposed Project area are dependent factors that are out of the control of the project proponents. For example, climate change could result in SLC that could influence the success of ecosystem restoration. Seismic activity could cause sudden, short term effects that might affect long-term conditions in the Refuge and surrounding areas. The monitoring and adaptive management plan includes management triggers and a detailed protocol for implementing management changes as a means to support long-term management flexibility. However, the extent to which the adaptive management will be able to address large scale or extensive changes associated with unknown factors such as sea level change and seismic activity is uncertain.

As noted throughout the Integrated Document, there is some uncertainty as to how various environmental resources would respond to long-term changes brought about by the Shoreline Phase I Project and the SBSP Restoration Project. As implementation of the project progresses, adaptive management would guide the selection of the final mix of habitats. Since project construction would occur over more than 14 years, later phases would reflect lessons learned from earlier actions. Adaptive management may also result in corrective measures being implemented for earlier phases.

The EIR for the Plant Master Plan for the Wastewater Facility includes a levee alignment between Pond A18 and plant property that is not the same alignment discussed in the Integrated Document. However, in the final adopted version of Plant Master Plan, the City did not adopt a specific levee alignment. Rather, the Plan Master Plan outlines a vision of flood protection and restoration to be implemented in partnership with other agencies. The project proponents of the Shoreline Phase I Project will continue to work with the City of San José and the regulatory agencies to coordinate the two plans and develop a final alignment that serves both while minimizing adverse effects.

The Recommended Plan would result in impacts to air quality, the noise environment, aesthetic resources, the historic landscape, vegetation, and disturbances to and displacement of fish and wildlife resources to other nearby habitat. The Integrated Document includes measures to reduce potential adverse impacts. However, even with the application of these measures, some adverse impacts remain unavoidable. The adverse unavoidable impacts are:

- Incompatibility with the New Chicago Marsh Water Management Plan (Section 4.3 *Land Use and Planning*) – Alternative 5 only
- Loss and/or disruption of marsh habitat in the NCM (Section 4.7 *Terrestrial Biological Resources*):
  - Levee bisecting the NCM effect on wildlife movement and habitat connectivity – Alternative 4 only
  - Levee alignment leaving all/part of the NCM subject to tidal flooding effect on population and habitat trends – project and cumulative impact for Alternatives 4 and 5
- Incompatible with biological components of New Chicago Marsh Water Management Plan – Alternatives 4 and 5
- Violate air quality standard for NO_x (nitrogen oxides) and ROG (reactive organic gases) (Section 4.10 *Air Quality/Greenhouse Gases*) – all action alternatives
- Short-term negative effect on visual character (Section 4.12 *Aesthetics*) – Alternatives 4 and 5

- Long-term negative effect on visual character from Alviso (Section 4.12 *Aesthetics*) – project and cumulative impact for Alternatives 4 and 5
- Cumulative loss of pond habitat used by pond-specialist bird species (Section 4.7 *Terrestrial Biological Resources*) – all action alternatives
- Cumulative temporary increase in noise levels (Section 4.13 *Noise*) – all action alternatives.

9.0 Findings and Recommended Plan

This chapter describes the findings of the Shoreline Phase I Study, and then provides details regarding the U.S. Army Corps of Engineers (USACE) Recommended Plan, including procedures and cost sharing required for implementation. A schedule and a list of further analyses are also included.

9.1 Shoreline Phase I Study Findings

This feasibility report has identified a feasible and policy-compliant plan within the Federal interest for USACE implementation. The Recommended Plan is a Locally Preferred Plan (LPP), Alternative 3. The Recommended Plan would provide flood risk management (FRM) for the community of Alviso and the San José–Santa Clara Regional Wastewater Facility (Wastewater Facility) by constructing a 15.2-foot NAVD 88 levee along existing pond dikes located on U.S. Fish and Wildlife Service (USFWS) lands and a flood gate across Union Pacific Railroad (UPRR) tracks west of Artesian Slough (Ponds A12/13), crossing Artesian Slough with a tide gate, and continuing levee construction along an existing dike footprint bordering the southern edge of Pond A18 located on Wastewater Facility lands. The partial placement of the levee on USFWS lands is necessary because the USFWS Don Edwards San Francisco Bay National Wildlife Refuge (Refuge) is adjacent to the community of Alviso, and this particular alignment is the most cost-effective alignment of the options analyzed.

The Recommended Plan would restore approximately 2,900 acres of formerly used salt production ponds to tidal salt marsh and transitional habitat (ecotone). The restoration would include in-pond features to prepare the ponds for conversion to tidal marsh, construction of a 30:1 ecotone feature (between the proposed USACE FRM levee and tidal marsh), and phased pond dike breaching guided by monitoring and adaptive management.

The Recommended Plan also includes recreation features: two pedestrian bridges, one crossing the UPRR tracks and the other crossing Artesian Slough, with viewing platforms and benches.

The National Economic Development/National Environmental Restoration (NED/NER) Plan is Alternative 2. It includes the same levee alignment as Alternative 3 but with a levee elevation of 12.5 feet NAVD 88. The NED/NER Plan would restore the same set of ponds as the Recommended Plan and would result in approximately 2,900 acres of restored tidal marsh; however, it does not include the 30:1 ecotone. The NED/NER plan also includes two pedestrian bridges, viewing platforms, and benches.

The Recommended Plan is a Locally Preferred Plan (LPP) that was requested by the non-Federal sponsor, and Federal cost sharing would be capped at 65 percent of the NED/NER Plan (Alternative 2) for FRM and ecosystem restoration features and 50 percent for recreation features. On August 24, 2015, the Assistant Secretary of the Army for Civil Works (ASA [CW]) approved a policy exception to allow the Federal government to recommend the LPP rather than the NED/NER Plan.

9.2 Plan Description

9.2.1 Features

The principal features of the Recommended Plan (i.e., LPP) are (1) construction of approximately 3.8 miles of levee to provide a more reliable form of tidal FRM to the community and (2) restoration of a total of about 2,900 acres, which includes approximately 2,800 acres of tidal marsh habitat and approximately 60 acres of transitional habitat (dependent on water inundation levels) between the FRM levee and the San Francisco Bay [Figure 9.2-1 *Recommended Plan (Alternative 3) Features*].

The Recommended Plan includes an **earthen levee** at 15.2 feet NAVD 88 with an average width at the crown of the levee of 16 feet and 107.2 feet at the base of the levee. Beyond the physical footprint of the levee itself, on the landside (opposite the ponds), there would be a 15-foot-wide permanent easement (for operation and maintenance) and an additional 15-foot-wide temporary easement for the construction period along the full length of the levee. The levee segments along Ponds A12, A13, and A16 would be constructed on USFWS lands, while the segment along Pond A18 would be on Wastewater Facility lands. All segments would be maintained by the Santa Clara Valley Water District (SCVWD) as a non-Federal sponsor. Due to the nature of the flood risk and the location of the community of Alviso adjacent to the USFWS Refuge, a levee system addressing flood risk in Alviso must be located at least partially on USFWS lands.

The Recommended Plan includes two **pedestrian bridges**. One bridge would be constructed across Artesian Slough to connect the Alviso and Wastewater Facility levee segments. This connection would better accommodate pedestrian use of existing and planned trails in the refuge and would provide connectivity to trails east of the Wastewater Facility, including the Coyote Creek Trail (a segment of the Bay Trail). The Refuge trail network would also use the second new bridge, which would be constructed over the Union Pacific Railroad tracks near the northeast corner of Pond A12 and southwest corner of Pond A16. The railroad bridge would provide continuous pedestrian access in the Refuge, provide connectivity to the Alviso Marina, and, eventually, provide connectivity to the Bay Trail network as sections of the Bay Trail are constructed by others.

Viewing platforms, interpretive signs, and **benches** (for seating) would be installed in areas of the Refuge. These features would enhance the recreation experience of people using existing and planned trails in the project area. **Trail connections** to existing trail systems in and outside of the Refuge would continue to accommodate recreational trail use in the study area.

A railroad floodgate would be installed (approximately a 150-foot span) where the active railroad line crosses the FRM levee adjacent to Pond A12. Concrete barriers would be installed on either side of the railroad right-of-way and would tie into the earthen levees. The metal floodgate would be connected to the barrier and would remain open during normal conditions and closed during flood conditions.

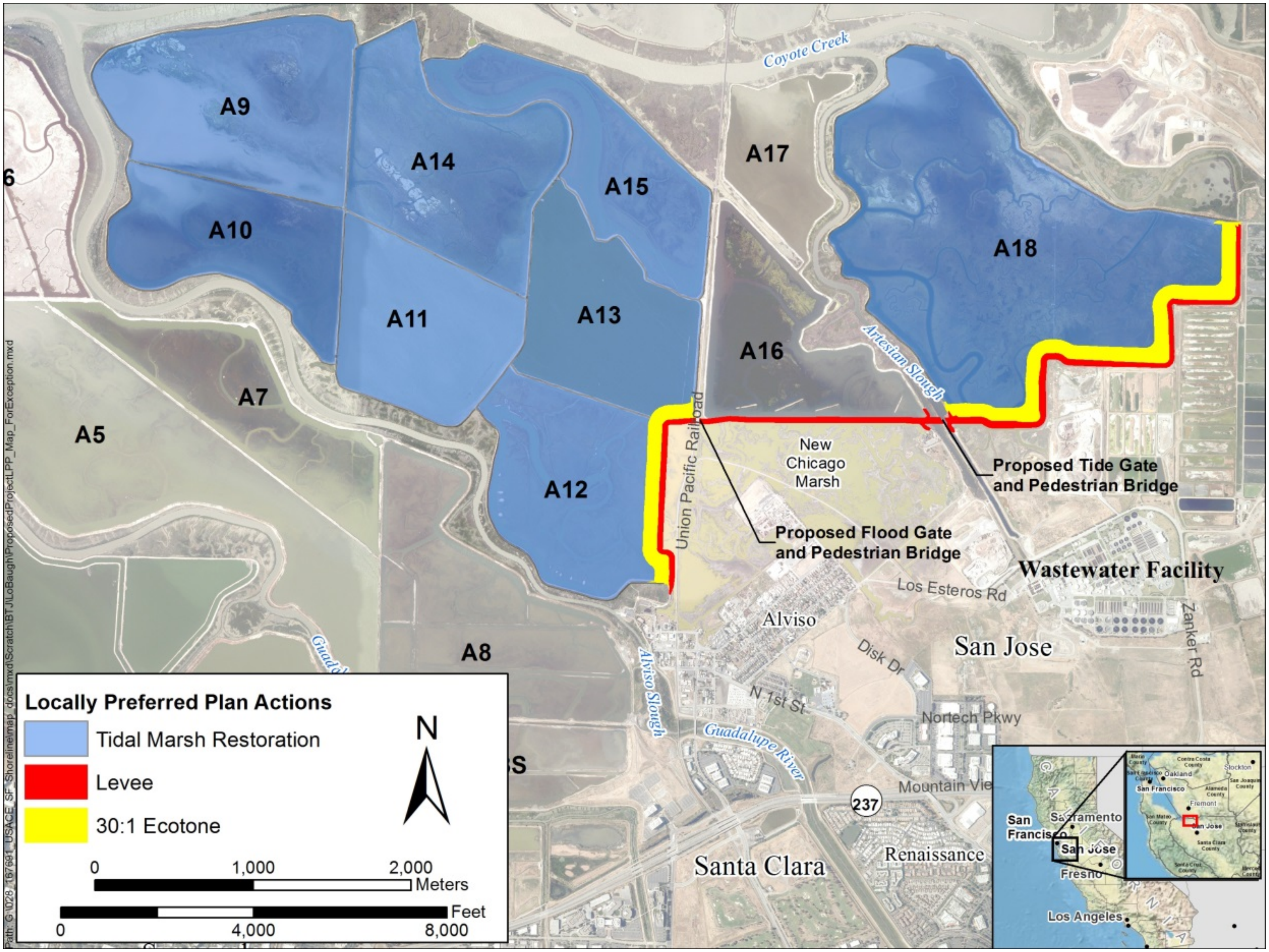

Figure 9.2-1. Recommended Plan (Alternative 3) Features

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A **tide gate closure system** would be constructed at least 300 feet bayward of the existing Wastewater Facility outfall for treated water at Artesian Slough. The proposed levee and tide gate are not anticipated to interfere with the Wastewater Facility general operations or operation/discharge during storm events (further discussion in Chapter 3 *Alternative Plan Formulation, Evaluation, Comparison, and Selection*).

The plan would restore approximately 2,880 acres of **tidal marsh** from existing pond habitat. This includes approximately 856 acres of Pond A18 plus approximately 2,045 acres of Ponds A9–A15. Basic in-pond preparation prior to breaching would include internal pond dike breaches, pilot channels from streams or sloughs into ponds, and ditch blocks. After in-pond preparation is complete, the outboard levee would be breached to allow tidal exchange with the adjacent sloughs and San Francisco Bay. Over time, natural processes would bring in sediment from the bay to raise the elevation of the pond bottoms, creating a continuum of subtidal and tidal habitats. Figures reflecting the final combination of in-pond preparation features, as well as proposed construction phasing by groups of ponds, are provided in Section 3.8.2 *Ecosystem Restoration Details*.

The plan would create an **ecotone** (30:1) transitional habitat feature in Ponds A12, A13, and A18 would be constructed bayward to the proposed FRM levee along the southeastern border of the pond. This habitat would gently slope downward (30:1) from the toe of the FRM levee into the tidal marsh. The ecotone would create about 60 acres of transitional habitat. Together with the restored tidal marsh, the plan would create about 2,900 acres of new habitat.

Monitoring and Adaptive Management would be an integral component of proposed tidal marsh restoration and allow lessons learned from other restoration actions implemented along San Francisco Bay (for example, by the USFWS on Refuge lands or by the South Bay Salt Pond Restoration Project [SBSP Restoration Project]) to be incorporated as management plans are updated and the designs of future actions are developed and implemented. This implementation approach acknowledges that risks and uncertainty exist and provides a framework for adjusting management decisions as the cause-and-effect linkages between management actions and the physical and biological response of the system become apparent. A key aspect of the adaptive management approach would be to avoid adverse environmental impacts by triggering specific preplanned intervention measures if monitoring of nearby restoration actions reveals that the ecosystem is evolving (or is responding to prior interventions) along an undesirable trajectory.

9.2.2 Real Estate

The non-Federal sponsors for the study and future project are the SCVWD and the State Coastal Conservancy. The USFWS and the City of San José are major landowners within the study area.

The Recommended Plan would require acquisition of approximately 3,100 acres for FRM and ecosystem restoration activities. This total includes an estimated 900 acres for Pond A18, which is currently owned by the City of San José. The project would require using approximately 2,135 acres of USFWS-managed lands for ecosystem restoration in Ponds A9 through A15, and approximately 54 acres for the levee alignment. The non-Federal sponsors will be required to acquire these lands and other identified real estate as part of the project. Details on specific real estate acquisition can be found in the Real Estate Plan, Appendix H *Real Estate Plan*.

In addition, the project would potentially impact utilities and facilities, which would require relocations. Affected utilities include an electrical line, the railroad tracks associated with the flood gate (the railroad tracks would be removed and replaced in the same location to facilitate construction of the floodgate), and power lines. The owners of these utilities are the City of San José, Union Pacific Railroad, and Pacific Gas & Electric, respectively. The Real Estate Plan presented in Appendix H *Real Estate Plan* provides more detail. Real estate costs are provided in the Real Estate Plan.

9.2.3 Operations, Maintenance, Repair, Replacement, and Rehabilitation

Once construction of the project is complete, the project would be turned over to the non-Federal sponsors. Operations, maintenance, repair, replacement, and rehabilitation (OMRR&R) would be the responsibility of the SCVWD for FRM features and the State Coastal Conservancy for ecosystem restoration features and would be accomplished in accordance with the OMRR&R manual. For recreation features, the SCVWD would be responsible for OMRR&R of the Artesian Slough pedestrian bridge and viewing platforms associated with Pond A18, while the Conservancy would be responsible for the UPRR pedestrian bridge and features (benches and viewing platforms) associated with Ponds A9–A15.

Periodic maintenance of the new FRM levee would be required to maintain the levee to design elevation. Erosion and excessive vegetative growth on levee side slopes could require maintenance. Maintenance requirements will be discussed in detail in the OMRR&R manual. In general, the project would be inspected and maintained periodically as well as during and after floods by the non-Federal sponsors. The USACE would also inspect the project features and recommend corrective action to ensure that the project functions as designed.

Vegetated areas on transition zones, established either through natural processes after pond breaching or through restoration plantings as an adaptive management activity, are expected to be self-sufficient, requiring little to no maintenance. A minimal amount of routine maintenance of such items as gates, locks, signs, fencing, and other items that protect the restoration areas would be required. In addition, periodic checklist type inspections on an annual or biannual basis would be required to monitor the site for severe adverse effects.

Additional activities covered by OMRR&R could include graffiti removal, levee inspection and repairs, trash and debris removal, and sign installations or repairs.

Subsequent to the completion of the design of the project features and prior to construction, a draft OMRR&R manual would be prepared in coordination with the non-Federal sponsors and affected agencies. A final OMRR&R manual would be prepared after the completion of construction.

9.3 Plan Accomplishments and Impacts, in Comparison with the NED/NER Plan

Project performance statistics for the 15.2-foot NAVD 88 levee included in the Recommended Plan (in comparison to the 12.5-foot levee included in the NED/NER Plan), including mean annual exceedance probability, long term risk, and the conditional non-exceedance probability were presented in Table 3.10-1 *Project Performance Statistics at 2067 – 12.5-foot NAVD 88 and 15.2-foot NAVD 88 LPP Levees*. The residual tidal flood risk associated with the Recommended Plan (in comparison to the NED/NER Plan) was presented in Table 3.10-2 *Summary of Results for 12.5-foot NAVD 88 and 15.2-foot NAVD 88 Levees*.

The project would manage flood risk for a population at risk of approximately 6,000 residents and people working in the area. A structure inventory conducted as part of the economic analysis for this study identified 1,140 structures (1,034 residential, 54 commercial, 42 industrial, and 9 public) in the 0.2-percent Annual Chance of Exceedance (ACE) floodplain under the USACE High sea level change (SLC) scenario that defines the study area's boundaries for the flood risk assessment.

Investment costs, annual costs, and annual benefits with cost allocation for the proposed project are displayed in Table 9.3-1 *Comparison of Total Annual Benefits and Costs for NED/NER Plan and LPP*, which addresses the NED and numeric aspects of the Environmental Quality (EQ) account in the Principles and Guideline's (P&G) "accounts" for reporting benefits and impacts. Investment costs include the cost to construct the features and associated Preconstruction Engineering and Design (PED) and construction management costs. The intent of the system of accounts is to provide decision makers with plan ranking based on advantages and disadvantages of each plan. Both the NED and the LPP levee options are strongly economically justified. However, the LPP provides less residual tidal flood risk to the community with the increased levee height and allows the local community to meet both FEMA certification requirements and the SCVWD's standard for the funding of FRM projects at the end of the 50-year period of analysis.

The average annual habitat units displayed in Table 9.3-1 *Comparison of Total Annual Benefits and Costs for NED/NER Plan and LPP* show a slight decline for the LPP relative to the NED/NER plan. This is because the CHAP model used to evaluate ecosystem outputs rates habitats more highly when they have more wildlife diversity. The ecotone, which is the distinctive ecosystem restoration feature of the LPP, would provide important refugial habitat for several marsh wildlife species including two listed species. However, in doing so it would provide less habitat for a number of fish species which utilize lower and mid-elevation portions of tidal marshes. The net result is a slightly lower CHAP output with the ecotone than without it. Note that these fish species would already gain a great deal of new habitat value from the NER measures and only small additional habitat value from deleting the ecotone from the project.

Table 9.3-1 Comparison of Total Annual Benefits and Costs for NED/NER Plan and LPP (October 2014 Price Levels)[1,2]

	NED/NER Plan			Locally-Preferred Plan		
NED ACCOUNT - FLOOD RISK MANAGEMENT						
Investment Costs						
FRM First Costs	$74,718,000			$90,186,000		
Interest During Construction	$3,738,180			$4,512,052		
Total	**$78,456,180**			**$94,698,052**		
Annual Cost						
Interest and Amortization	$3,269,838			$3,946,755		
Annual Maintenance Cost	$538,000			$538,000		
Total Annual Cost (Rounded)	**$3,808,000**			**$4,485,000**		
USACE SLC Scenario	**Low**	**Intermediate**	**High**	**Low**	**Intermediate**	**High**
Annual Benefits	$18,914,000	$23,551,000	$40,443,000	$18,932,000	$23,573,000	$42,137,000
Net Annual FRM Benefits	$15,106,000	$19,743,000	$36,635,000	$14,447,000	$19,088,000	$37,652,000
Benefit to Cost Ratio	4.97	6.18	10.62	4.22	5.26	9.40
EQ ACCOUNT (NER PLAN - ALL PONDS)						
Investment Costs						
ER First Costs	$28,624,000			$74,790,000		
Interest During Construction	$4,688,951			$12,251,490		
Total	**$33,312,951**			**$87,041,490**		
Average Annual Cost (Rounded)	**$1,388,000**			**$3,628,000**		
Average Annual Habitat Units	**48,508**			**48,308**		
Cost per Habitat Unit	**$29**			**$75**		
NED ACCOUNT - RECREATION						
Investment Costs						
Recreation First Costs	$6,212,000			$6,212,000		
Interest During Construction	$95,516			$95,516		
Total	**$6,307,516**			**$6,307,516**		
Average Annual Cost	**$262,900**			**$262,900**		
Annual Recreation Benefits	**$290,600**			**$290,600**		
Net Annual Recreation Benefits	**$27,700**			**$27,700**		
Recreation B/C Ratio	**1.11**			**1.11**		

1 Some numbers have been rounded and may be slightly different than those displayed in the appendices.
[2] This comparison uses October 2014 Price Levels in order to be consistent with price levels used for the benefit analysis.

This finding contradicts current scientific understanding of the value of upper marsh transitional habitats in tidal marshes. As noted by an Independent External Peer Review panel: “The CHAP model outputs were generally unable to demonstrate that additional costs associated with accelerating salt pond restoration or adding 30:1 ecotone transitional habitat to the Bay side of the new FRM levees would result in additional environmental outputs. As such, ecotone construction was not included in the NER plan. The ecotone with the 30:1 side slopes is preferable to the levee bench refugia measure based on habitat objectives associated with the

SBSP Restoration Project) and the current understanding of benefits provided by broad transitional tidal habitats."

Table 9.3-2 *Environmental Quality and Other Social Effect Accounts Comparison of NED/NER Plan and LPP* displays a comparison of the NED/NER Plan and LPP using qualitative aspects of the EQ and Other Social Effects (OSE) accounts to display the positive and negative effect of each plan.

Table 9.3-3 *Significant Resource-Specific Project Accomplishments* summarizes the significant resource-specific accomplishments as a result of ecosystem restoration.

Table 9.3-2. Environmental Quality and Other Social Effect Accounts Comparison of NED/NER Plan and LPP

<table>
<tr><th>Characteristic</th><th>NED/NER Plan</th><th>LPP</th></tr>
<tr><td colspan="3">Environmental Quality Account</td></tr>
<tr><td>Water Quality</td><td colspan="2">Negative short-term impacts from temporary increase in salinity in sloughs and potential remobilization of mercury in ponds and sloughs; positive long-term effects for ponds as system equilibrates with the restoration of tidal marsh habitat; levees would provide flood protection, thereby preventing potential wastewater contamination
There is little to no relationship between sediment concentrations of total or methyl mercury and mercury in biota. A complex set of biogeochemical processes mediate the methylation and uptake of methyl mercury into biological tissues. Since levels in biota cannot be predicted or modeled from concentrations in water or sediment, regulatory agencies generally require assessment of mercury in biological samples, such as fish. The non-Federal sponsors will monitor mercury levels in local aquatic species to determine if there are any effects on biota.</td></tr>
<tr><td>Air Quality/Greenhouse Gases</td><td>Minor negative construction-related impacts</td><td>Moderate negative construction-related impacts</td></tr>
<tr><td>Aquatic Habitat Value</td><td colspan="2">Minor negative construction-related impacts; positive long-term effects with restoration of tidal marsh habitat</td></tr>
<tr><td>Marsh Habitat Value</td><td>Substantial positive long-term effects; establishment of marsh communities in ponds takes longer to develop than for LPP</td><td>Substantial positive mid- and long-term effects; ecotone provides for early evolution of marsh communities in ponds</td></tr>
<tr><td>Upland Habitat Value</td><td colspan="2">Minor negative temporary construction-related impacts</td></tr>
<tr><td>Threatened and Endangered Species</td><td>Substantial positive effects over the long term</td><td>Substantial positive mid- and long-term effects</td></tr>
<tr><td>Cultural Resources</td><td colspan="2">Potential disturbance to unknown sites</td></tr>
<tr><td>Noise</td><td colspan="2">Minor negative temporary construction-related impacts</td></tr>
<tr><td>Aesthetics</td><td colspan="2">Minor negative temporary construction-related impacts</td></tr>
<tr><td colspan="3">Other Social Effects Account</td></tr>
<tr><td>Public Health and Safety</td><td>Would reduce potential public health and safety risks associated with flooding</td><td>Similar effects to NED/NER Plan, but greater risk reduction</td></tr>
<tr><td>Public Facilities and Services</td><td colspan="2">Long-term benefit to water pollution control plant facility by providing increased flood protection (greater for LPP than for NED/NER Plan). Potential reduced need for emergency response related to flood incidents, potential short-term rail service interruption effects during construction, potential short-term utility service interruption effects during construction</td></tr>
<tr><td>Recreation and Public Access –Trail System</td><td colspan="2">Short-term nuisance effects (noise, dust, access) during construction; increase in recreation features such as pedestrian bridges, benches, and viewing platforms.</td></tr>
<tr><td>Traffic and Transportation</td><td colspan="2">Short-term adverse effects on intersection function and freeway operation during construction</td></tr>
<tr><td>Displacement of People and Businesses</td><td colspan="2">No impact in the short term; depending on magnitude of sea level rise, some people and businesses could be displaced in the long term (greater potential under the NED/NER Plan vs LPP)</td></tr>
</table>

Table 9.3-3. Significant Resource-Specific Project Accomplishments

Resource	Location	Potential Effect	Sources of Significance		
			Institutional[1] Recognition	Public Recognition	Technical Recognition
Plants					
Pt. Reyes bird's-beak (*Chloropyron maritimum* ssp. *palustre*)	Historical records in the Shoreline Phase I Study Area (1905). Species is presumed to be extirpated from the Santa Clara County but was found in La Riviere Marsh in Alameda County in 2010.	Tidal marsh habitat restoration could benefit this species by providing habitat that could support re-establishment in the study area.	CRPR 1B.2 (Rare, Threatened, or Endangered in California and elsewhere, fairly endangered in California)	N/A	N/A
Invertebrates					
Tidal marsh invertebrate communities	Found in vegetated portions of tidal salt and brackish marshes.	Increase of up to about 2,880 acres of tidal marsh habitat would benefit these species by providing additional habitat and improving ecological function of the area as a whole. There would be minor losses of tidal marsh habitat on outboard sides of levees during and following levee breaches, but the amount of new habitat created would far exceed the amount lost.	N/A	N/A	Perform a variety of important ecological services (discussed by Maffei [2000g]).
Fish					
Steelhead – California Central Coast DPS (*Oncorhynchus mykiss*)	Known to be present in several South Bay area creeks (including Coyote, Stevens, and San Francisquito Creeks, and the Guadalupe River) and associated marshes and small channels in the study area. CCC steelhead are not known to be present in Ponds A9–A15 or A18 but are present in Alviso Slough during upstream migration of adults to spawning areas in the Guadalupe River watershed and downstream migration of adults and smolts heading toward the ocean. Steelhead could potentially move into Artesian Slough adjacent to Pond A18 as well, although, because they do not spawn in Artesian Slough, such presence is expected to be infrequent and limited to a small number	Substantial, positive, long-term benefits to fish species through reconnection to tidal habitats and an increase in available aquatic habitat through pond conversion. Possible short-term effects during construction (disturbance).	Federal ESA (listed as Threatened)	In 1988, salmon and steelhead were estimated to provide annual net benefits worth $101 million to the Sacramento-San Joaquin River Systems and $3.4 million to other California rivers (Lufkin, ed., 1991).	Guadalupe River and Coyote Creek support identified critical habitat.

Table 9.3-3. Significant Resource-Specific Project Accomplishments

Resource	Location	Potential Effect	Sources of Significance		
			Institutional[1] Recognition	Public Recognition	Technical Recognition
	of individuals.				
Central Valley fall-run and late fall-run Chinook salmon (*Oncorhynchus tshawytscha*)	Suitable spawning habitat is not present in the study area, but this species moves through the area to spawn upstream. During certain times of the year, Coyote Creek, Artesian Slough, and Alviso Slough may contain Chinook salmon.		California Species of Special Concern; Magnuson-Stevens Fishery Conservation and Management Act, FMP species (Pacific Coast Salmon FMP, Estuarine Composite EFH)	As the most abundant of the Central Valley salmon runs, this run contributes substantially to commercial and recreational fisheries in the ocean and is a popular sportfishery in the freshwater streams where it spawns (CDFW 2013). In 1988, salmon and steelhead were estimated to provide annual net benefits worth $101 million to the Sacramento-San Joaquin River Systems and $3.4 million to other California rivers (Lufkin, ed., 1991).	N/A
Green sturgeon – Southern DPS of North American Green Sturgeon (*Acipenser medirostris*)	Green sturgeon has been caught infrequently by anglers in the South Bay. Although the distribution of this species in the study area is poorly known, it is likely that green sturgeon are present infrequently, and in low numbers, in Alviso Slough and in the portions of the open bay adjacent to the study area.		Federal ESA (listed as Threatened)	N/A	South Bay is in the area considered critical habitat for this species.
Longfin smelt San Francisco Bay-Delta DPS (*Spirinchus thaleichthys*)	Seasonally documented (winter assemblage) in the tidal sloughs of the Alviso pond complex.		Federal ESA (Candidate); California ESA (listed as Threatened)	N/A	N/A
Striped bass (*Morone saxatilis*)	Forages in the South Bay.		N/A	N/A	Striped bass are the most important sport

Table 9.3-3. Significant Resource-Specific Project Accomplishments

Resource	Location	Potential Effect	Sources of Significance		
			Institutional[1] Recognition	Public Recognition	Technical Recognition
					fish in the San Francisco Estuary, bringing in approximately $45 million per year into the local economies of the Estuary (Sommer 2000).
Northern anchovy (*Engraulis mordax*)	Abundant from South to Central Bay; adults and juveniles present in South and South-Central Bay		Magnuson-Stevens Fishery Conservation and Management Act FMP species (Coastal Pelagic FMP)	N/A	N/A
Pacific sardine (*Sardinops sagax*)	Adults and juveniles present in South and South-Central Bay				
Leopard shark (*Trikakis semifasciata*)	Present from South Bay to Central Bay; adults and juveniles present		Magnuson-Stevens Fishery Conservation and Management Act FMP species (Pacific Groundfish FMP (Estuarine Composite EFH)	N/A	N/A
Soupfin shark (*Galeorhinus galeus*)	Present in South-Central and Central Bay and rare in South Bay; adults and juveniles present in Central Bay and rare in South Bay; less known about life stages in South-Central Bay				
Spiny dogfish (*Squalus acanthias*)	Present from South Bay to Central Bay; adults and juveniles in South and Central Bay; less known about life stages in South-Central Bay				
Big skate (*Raja binoculata*)	Present from South Bay to Central Bay; adults and juveniles present in Central Bay; less known about other life stages present in South and South-Central Bay				
California skate (*Raja inornata*)	Present in South Bay (probably rare)				
Lingcod (*Ophiodon elongatus*)	Present from South to Central Bay but rare in South-Central Bay; adults and juveniles				
Brown rockfish (*Sebastes auriculatus*)	Present from South to Central Bay; juveniles present in South and South-Central Bay; adults and juveniles present in Central Bay				

Table 9.3-3. Significant Resource-Specific Project Accomplishments

Resource	Location	Potential Effect	Sources of Significance		
			Institutional[1] Recognition	Public Recognition	Technical Recognition
English sole (*Parophrys vetulus*)	Abundant from South to Central Bay; adults and juveniles present				
Pacific sanddab (*Citharichthys sordidus*)	Present from South to Central Bay; adults, juvenile, larvae, and eggs present in Central Bay; less known about life stages in South Bay				
Sand sole (*Psettichthys melanostictus*)	Present in South and Central Bay but rare in South-Central Bay; adults, juveniles, and larvae present				
Starry flounder (*Platichthys stellatus*)	Present from South to South-Central Bay and abundant in Central Bay; adults and juveniles present in South Bay and adults juveniles, larvae, and eggs present in Central Bay				
Cabezon (*Scorpaenichthys marmoratus*)	Rare to few from South to Central Bay; juveniles present in South and South-Central Bay; adults and juveniles present in Central Bay				
Bocaccio (*Sebastes paucispinis*)	Rare in Central Bay; less known about presence and life stages elsewhere in bay				
Calico rockfish (*Sebastes dalli*)	Rare in South Bay, life stages unknown				
Rex sole (*Glyptocephalus zachirus*)	Rare in South Bay, life stages unknown				
Birds					
Alameda song sparrow (*Melospiza melodia pusillula*)	Uncommon resident, breeding and foraging in tidal salt marsh.	Long-term benefits due to restoration of tidal marsh habitat, which would increase available habitat for these species, improve overall ecological function, and improve overall habitat quality. Possible short-term effects during construction (disturbance). California Ridgway's rail and California black rail would also benefit	California Species of Special Concern	N/A	Subspecies is endemic to San Francisco Bay Area.
California black rail (*Laterallus jamaicensis coturniculus*)	Nonbreeding individuals winter in small numbers in tidal marsh within the study area, but the species is not currently known to breed in the South Bay. Fourteen individuals captured adjacent to Pond A15 in 2012 during breeding season, but breeding condition not confirmed.		California ESA (listed as Threatened), Fully Protected under California Fish and Game Code	N/A	N/A

Table 9.3-3. Significant Resource-Specific Project Accomplishments

Resource	Location	Potential Effect	Sources of Significance		
			Institutional[1] Recognition	Public Recognition	Technical Recognition
California Ridgway's rail (*Rallus longirostris obsoletus*)	Uses tidal marsh habitats along Coyote Creek and Alviso Slough.	from the construction of transitional habitat, a habitat type that is currently scarce in the study area.	Federal ESA (listed as Endangered); California ESA (listed as Endangered); Fully Protected under California Fish and Game Code	N/A	Species is endemic to salt marshes of San Francisco Bay.
Northern harrier (*Circus cyaneus*)	Breeds in small numbers in marsh habitats in the study area; forages in a variety of habitats.		California Species of Special Concern (nesting)	N/A	N/A
Saltmarsh common yellowthroat[a] (*Geothlypis trichas sinuosa*)	Common resident, breeding in freshwater and brackish marshes (and possibly to a limited extent in salt marshes), and foraging in all marsh types during the nonbreeding season.		California Species of Special Concern	N/A	N/A
Western snowy plover (*Charadrius alexandrinus nivosus*)	Breeds and forages at sites in and near the study area, including Ponds A8, A16, A17 and A23 outside the study area and Pond A13 in the study area. Additional birds are present in the study area during winter.	Would benefit from the creation of transitional habitat, a habitat type that is currently scarce in the study area. Possible short-term effects during construction (disturbance).	Federal ESA (listed as Threatened); California Species of Special Concern (nesting)	N/A	N/A
Mammals					
Salt marsh harvest mouse (*Reithrodontomys raviventris raviventris*)	Breeding populations present in pickleweed marshes within the study area. Also is present in brackish marshes.	Long-term benefits due to restoration of tidal marsh habitat, which would increase available habitat for these species and improve overall ecological function of the study area. Possible short-term effects during construction (disturbance).	Federal ESA (listed as Endangered); California ESA (listed as Endangered); Fully Protected under California Fish and Game Code	N/A	Species is endemic to salt marshes of San Francisco Bay.
Salt marsh wandering shrew (*Sorex vagrans halicoetes*)	Breeding populations may be present in salt marshes throughout the study area, although numbers have declined, and current status is unknown. The CNDDB lists several occurrences in or near the study area.		California Species of Special Concern	N/A	N/A

Table 9.3-3. Significant Resource-Specific Project Accomplishments

Resource	Location	Potential Effect	Sources of Significance		
			Institutional[1] Recognition	Public Recognition	Technical Recognition
Habitats					
Essential Fish Habitat; Fisheries Management Plan species	The Shoreline Phase I Study Area includes EFH from three FMPs, the Coastal Pelagic, West Coast Groundfish, and Pacific Coast Salmon FMPs (see individual species listed above under **Fish**).	Substantial, positive, long-term benefits to ecological function of bay habitats used by FMP species. The benefits would be realized by reconnecting the former salt pond areas to tidal habitats and an increasing the amount of available aquatic habitat through pond conversion. Possible short-term effects during construction (disturbance).	Magnuson-Stevens Fishery Conservation and Management Act FMPs: Coastal Pelagic, West Coast Groundfish, and Pacific Coast Salmon	N/A	N/A
Tidal wetlands (salt marsh, brackish marsh, muted tidal/diked marsh, freshwater marsh)	Total of about 1,188 acres of tidal wetlands in the study area (detailed in the following four rows).	Ecosystem restoration could result in a maximum of about 2,880 acres of restored tidal wetlands. Restoration would provide substantial improvements in the ecological function of the area. The 2,880 acres would amount to a 142-percent increase in the amount of tidal wetlands in the study area.	Migratory Bird Treaty Act (San Francisco Bay Joint Venture); CALFED Bay-Delta Program; San Francisco Bay Area Wetlands Ecosystem Goals Project and Baylands Ecosystem Habitat Goals Report; McAteer-Petris Act (established the Bay Conservation and Development Commission); Don Edwards Comprehensive Conservation Plan; Western Hemisphere Shorebird Reserve Network (site of hemispheric importance; American Bird Conservancy (Globally Important Bird Area); wetland of International	NGO Partners to the San Francisco Bay Joint Venture include the Bay Area Audubon Council, The Bay Area Open Space Council, The Bay Institute, the Bay Planning Coalition, the Citizens Committee to Complete the Refuge, Ducks Unlimited, the National Fish and Wildlife Foundation, the Point Reyes Bird Observatory Conservation Science, Save the Bay, and the Sierra Club. Public agencies partnering with the San Francisco Bay Joint Venture include the Bay Conservation and Development	Tidal wetlands support high densities of San Francisco Bay endemic wildlife species, including the State and Federally endangered salt marsh harvest mouse (habitats with pickleweed) and California Ridgway's rail (habitats with cordgrass, pickleweed, and marsh gumplant). Other species supported include songbirds, ducks, herons, and egrets. Harbor seals use these habitats as haul-out and pupping sites.
• Tidal salt marsh	About 322 acres on outboard sides of levees in the study area.				
• Brackish marsh	About 432 acres, in low-to-mid intertidal reaches of sloughs and creeks draining into the Bay where the vegetation is subject to tidal inundation diluted by freshwater flows from upstream.				
• Muted tidal/diked marsh	About 340 acres, including New Chicago Marsh.				
• Freshwater marsh	About 93 acres, found in upper reaches of Coyote Creek, Artesian Slough, and Alviso Slough.				

Table 9.3-3. Significant Resource-Specific Project Accomplishments

Resource	Location	Potential Effect	Sources of Significance		
			Institutional[1] Recognition	Public Recognition	Technical Recognition
			Importance (consistent with the Ramsar Convention criteria for inclusion on the List of Wetlands of International Importance Comprehensive Conservation and Management Plan (The San Francisco Estuary Project); Invasive Spartina Project: Spartina Control Program; Santa Clara County General Plan; San José 2040 General Plan; Alviso Master Plan.	Commission, the California Coastal Conservancy, the California Department of Fish and Wildlife, the National Marine Fisheries Service, the Natural Resources Conservation Service, the San Francisco Bay Regional Water Quality Control Board, the San Francisco Estuary Project, the USACE, the U.S. Environmental Protection Agency, the USFWS, and the Wildlife Conservation Board.	

[1] ESA - Endangered Species Act
FMP - Fisheries Management Plan
Sources: Lufkin (ed.) 1991; Maffei 2000g; Sommer 2000; CDFW 2013

9.4 Plan Cost and Cost Sharing

The cost for the Recommended Plan was estimated on the basis of October 2015 price levels and amounts to $173,900,000. Table 9.4-1 *Estimated Costs of Recommended Plan* breaks down the cost of the Recommended Plan by primary project feature, which includes construction, Preconstruction Engineering and Design, and Construction Management Costs. Estimated average annual costs assume a 3.375-percent interest rate, a 50-year period of analysis, and construction of the FRM portion ending in 2021. Cost-shared monitoring and adaptive management will extend no longer than 10 years after the end of construction, although the non-Federal sponsor (and potentially the USFWS) may continue such activities after the cost-sharing period is over.

Table 9.4-1. Estimated Costs of Recommended Plan (October 2015 Price Levels)

MCACES Account	Description	Total First Cost
Lands, Easements, Relocations, Right-of-Way, and Disposal Sites		
01	Real Estate	$13,493,000
02	Utility Relocations	$587,000
Construction, Flood Risk Management (FRM)		
11	FRM	$67,299,000
16	Bank Stabilization	$1,535,000
Construction, Ecosystem Restoration		
06	Ecotone Transitional Habitat	$35,944,000
06	Pond Restoration	$5,765,000
06	Monitoring	$984,000
06	Adaptive Management	$6,276,000
Construction, Recreation		
14	Recreation	$4,848,000
Other Costs		
30	Preconstruction Engineering and Design	$24,842,000
31	Construction Management	$12,327,000
	Estimated Total Project First Cost	$173,900,000

MCACES = Micro Computer Assisted Cost Estimating Software

9.4.1 Cost Allocation of the NED/NER Plan and Recommended Plan

For multipurpose projects, costs must be allocated between project purposes—in this case, FRM (NED), ecosystem restoration (NER), and recreation. For both the NED/NER Plan and the Recommended Plan, all of the levee construction costs have been allocated to the FRM purpose, and all of the pond restoration costs have been allocated to the ecosystem restoration purpose.

For a single-purpose FRM project, there would be some environmental impacts. However, these impacts would be similar for all levee scales. Further, since the ecosystem restoration component of the multipurpose project provides a significant net gain in ecological outputs, a combined plan would not require mitigation, and a determination was made that it is not necessary to allocate any ecosystem restoration–related costs to the FRM component of the project.

If the ecosystem restoration components of the NED/NER or LPP were implemented without the FRM levee components of these plans, the ecosystem restoration components would require flood risk mitigation, as these features would result in induced flood risk. The cost of such mitigation would be very significant and restoration would not occur without first implementing the FRM component. Accordingly, ecosystem restoration plans were formulated and evaluated incrementally as a second-added purpose once the optimal levee alignments and the NED and LPP FRM plans were identified. Therefore, it has also been determined that no flood risk mitigation related costs should be allocated to the ecosystem restoration components of the NED/NER or LPP.

9.4.2 Cost Apportionment

The cost sharing was first determined for the NED/NER Plan, since it determines the limit for the USACE cost share (Table 9.4-2 *Summary of Cost-Sharing Responsibilities*). The FRM cost for the NED/NER Plan was apportioned 65 percent maximum Federal (USACE) and 35 percent minimum non-Federal. The ecosystem restoration costs for all ponds under the NED/NER Plan were apportioned 58 percent Federal (USACE) and 42 percent non-Federal; the non-Federal sponsor has waived the right to reimbursement of LERRDs above the typical 35-percent cost share for ecosystem restoration. The recreation costs for a pedestrian bridge over Artesian Slough and over the Union Pacific Railroad tracks were apportioned 50 percent Federal (USACE) and 50 percent non-Federal.

After determining the USACE cost sharing, the additional cost of the LPP for FRM features (increased levee height and associated planning, engineering, design, and construction management) and the additional restoration features (30:1 ecotone adjacent to Ponds A12/A13 and Pond A18 and associated planning, engineering, design, and construction management) was assigned to the non-Federal sponsor.

Table 9.4-2. Summary of Cost-Sharing Responsibilities[a]

Cost-Sharing Responsibility	Federal	Non-Federal	Total
NED/NER Plan Cost Sharing			
Flood Risk Management (FRM)			
Project Features/Construction	$56,937,000		$56,937,000
Lands, Easements, Rights-of-Way, Relocations, and Disposal Sites (LERRDs) [b]		$2,012,000	$2,012,000
Preconstruction Engineering and Design	$11,470,000		$11,470,000
Construction Management	$5,738,000		$5,738,000
Monitoring	$0		$0
Adaptive Management	$0		$0
Subtotal	$74,145,000	$2,012,000	$76,157,000
Additional Cash Contribution	–$24,643,000	$24,643,000	
Total (FRM)	$49,502,000	$26,655,000	$76,157,000
Percentage of Total (FRM) [c]	65%	35%	
Ecosystem Restoration			
Project Features/Construction	$5,765,000		$5,765,000
LERRDs		$11,967,000	$11,967,000
Preconstruction Engineering and Design	$2,624,000		$2,625,000
Construction Management	$1,213,000		$1,213,000
Monitoring	$984,000		$984,000
Adaptive Management	$6,276,000		$6,276,000
Subtotal	$16,862,000	$11,967,000	$28,829,000
Cash Contribution	$0	$0	
Total (Ecosystem Restoration)	$16,862,000	$11,967,000	$28,829,000
Percentage of Total (Ecosystem Restoration) [d]	58%	42%	
Recreation			
Project Features/Construction	$4,848,000		$4,848,000
Preconstruction Engineering and Design	$977,000		$977,000
Construction Management	$489,000		$489,000
Subtotal	$6,314,000		$6,314,000
Cash Contribution	–$3,157,000	$3,157,000	
Total (Recreation)	$3,157,000	$3,157,000	$6,314,000
Percentage of Total (Recreation)	50%	50%	
Subtotal (NED/NER Plan Cost Sharing)	$69,521,000	$41,779,000	$111,300,000
Additional LPP Costs			
Flood Risk Management (FRM)			
Project Features/Construction		$11,897,000	$11,897,000
LERRDs		$104,000	$104,000

Table 9.4-2. Summary of Cost-Sharing Responsibilities[a]

Cost-Sharing Responsibility	Federal	Non-Federal	Total
Preconstruction Engineering and Design		$2,475,000	$2,475,000
Construction Management (FRM)		$1,237,000	$1,237,000
Monitoring		$0	$0
Adaptive Management		$0	$0
Subtotal (FRM)		$15,713,000	$15,713,000
Ecosystem Restoration			
Project Features/Construction		$35,944,000	$35,944,000
LERRDs		$-3,000	$-3,000
Preconstruction Engineering and Design		$7,296,000	$7,296,000
Construction Management		$3,650,000	$3,650,000
Monitoring		$0	$0
Adaptive Management		$0	$0
Subtotal (Ecosystem Restoration)		$46,887,000	$46,887,000
Subtotal (Additional LPP Costs)	$0	$62,600,000	$62,600,000
GRAND TOTAL– PROJECT COSTS	$69,521,000	$104,379,000	$173,900,000

[a] Based on October 2015 (Fiscal Year 2016) price levels, a 3.375% interest rate, and a 50-year period of analysis. This cost-sharing scenario would require a project authorization that directs the USACE to implement ecosystem restoration on USFWS lands.

[b] Non-Federal interests must provide all LERRDs and a minimum cash contribution of 5% of the total project cost.

[c] Based on the tidal nature of the flood risk, the cost sharing for flood risk management features is per the Coastal Storm Damage Reduction mission (65% maximum Federal, 35% non-Federal).

[d] Cost sharing for ecosystem restoration is typically 65% Federal, 35% non-Federal, with the non-Federal sponsor receiving reimbursement for LERRDs in excess of 35%. However, the non-Federal sponsor has agreed to waive the right to reimbursement for LERRDs costs in excess of 35% of ecosystem restoration project costs.

9.5 Plan Implementation

This section describes the remaining steps for implementation of the Recommended Plan.

9.5.1 Report Completion and Approval

The draft Integrated Document (combined EIS/EIR/FR) was circulated for public and agency review for 66 days between December 19, 2014, and February 23, 2015. In addition to seeking written comment, the agencies held a public meeting on January 14, 2015, where the public was able to provide comments on and express views about the study results. Comments were considered and have been incorporated into the Final Integrated Document, as appropriate. Comments received during the public and agency review period and their responses are presented in Appendix I1 *Public Comments and Responses on Draft Integrated Document*. This final Integrated Document has been provided to any public agency that provided comments on the draft report. The SCVWD has certified that the final Integrated Document was prepared in compliance with the CEQA.

USACE Headquarters also received comments from affected Federal and State agencies and completed its own independent review of the final report. After review of the final Integrated Document, including consideration of public comments, USACE Headquarters will prepare the Chief of Engineers' Report. This report will be submitted to the ASA (CW), who will coordinate with the Office of Management and Budget and submit the report to Congress.

USACE Implementation of actions on USFWS-owned lands would require approval of the ASA (CW).

Separate Records of Decision (RODs) will be prepared by USACE and the USFWS under NEPA and its implementing regulations. The USACE ROD will be signed by the ASA(CW) and the USFWS ROD will be signed by the USFWS Pacific Southwest Regional Director.

If USACE construction of the entire project is authorized then USACE would proceed to the Preconstruction Engineering and Design phase described in Section 9.5.2 (Preconstruction Engineering and Design). Under this scenario, the USFWS would still need a ROD because it would be authorizing construction of the project on its land.

In addition to the recipients listed in the mailing list, copies of the final integrated report will be sent to all parties who provided substantive comments to the draft Integrated Report.

9.5.2 Preconstruction Engineering and Design

During the PED phase, several additional studies would be conducted as part of developing detailed designs for the project. These studies include:

- Additional geotechnical explorations and analysis of the foundation soils;
- Topographic and ground surveys for project design;
- Preconstruction biological field surveys to avoid direct impacts to nesting birds and other sensitive species;

- Water quality analysis of construction activities and methods;
- Detailed hydraulic analysis to validate the design levee height identified as meeting State of California requirements for 1-percent ACE flood with assurance;
- State Historic Preservation Office (SHPO) consultation and tribal coordination are ongoing (consultation letters in Appendix B9, Pertinent Correspondence). The results of the consultation may allow the SHPO to concur with the USACE in correspondence; however, notwithstanding the previous USFWS Memorandum of Agreement from 2012 on the SBSP Restoration Project, it is possible that SHPO views the USACE undertaking as requiring its own agreement document;
- For real estate, continue coordination and finalize real estate acquisition.

9.5.3 Project Authorization and Appropriation for Construction

These are two separate actions by Congress. Authorization is the approval of the project by Congress. Appropriation refers to providing funding for the project. Both authorization and appropriations are needed before construction can begin.

9.5.4 Project Cost-Sharing Agreements

A Design Agreement must be executed between USACE and the non-Federal sponsors in order to cost share the development of detailed plans and specifications. The Federal government and the non-Federal sponsors would execute a Project Partnership Agreement before construction would begin. This agreement would define responsibilities of the non-Federal sponsor for project construction as well as operation, maintenance, repair, replacement, and rehabilitation and other assurances. A Project Partnership Agreement would not be signed until Congress has appropriated funds in the Construction General (CG) account.

9.5.5 Division of Responsibilities

9.5.5.1 Federal Responsibilities

The USACE would be the Federal implementing agency for FRM, ecosystem restoration, and recreation features within the study area. Implementation by the USACE of features on USFWS lands would be contingent on meeting the requirements of the Implementation Guidance provided in WRRDA 2014, Section 1025. For the features to be implemented by USACE, the Federal government would provide 65 percent of the First Cost of implementing the FRM and ecosystem restoration features included in the NED/NER Plan including preconstruction Planning, Engineering and Design (PED), construction and construction management, monitoring, and adaptive management. The Federal government would also provide 50 percent of the cost of implementing recreation features. In addition to its financial responsibility, the Federal Government would:

- Design and prepare plans and specifications for construction of the Recommended Plan; and
- Administer and manage contracts for construction and supervision of the project after authorization, funding and execution of a project partnership agreement with the State Coastal Conservancy and the SCVWD.

9.5.5.2 Non-Federal Responsibilities

Specific items of local cooperation are identified in Chapter 10 *Conclusions and Recommendations*. The SCVWD and the State Coastal Conservancy, as the non-Federal sponsors, will provide funds from a variety of sources. In Santa Clara County, voters recently approved the Safe Clean Water Measure which provides up to $15 million for the design and partial construction of the Shoreline Phase I Study recommendations in EIA11. The non Federal sponsors may request work in kind during the PED or construction phase of the project.

9.5.5.3 Financial Capability of Non-Federal Sponsors

The total estimated non-Federal first cost of the Recommended Plan is $104,379,000 (October 2015 price levels), which includes $13,493,000 for LERRDs (Table 9.4-3 *Summary of Cost Sharing Responsibilities*). The non-Federal sponsors are aware of the financial obligations of the non-Federal first cost of the Recommended Plan and have the financial capability to satisfy this obligation. The State Coastal Conservancy is funded by voter-approved State bond initiatives, and its cost-share would be expected to use these State funds. In addition, the State Coastal Conservancy and the SCVWD are eligible for a variety of State funding grant programs such as the California Department of Water Resources' Integrated Regional Watershed Management Program Grant program which provides significant fund for water supply, flood protection, and environmental enhancement projects. The non-Federal sponsors have provided a self-certification of financial capability for the future Design Project and are in compliance with the applicable guidance (CECW-PC memo dated Jun 12, 2007, paragraph 2.b.).

9.5.6 Schedule

Depending on the dates of Congressional authorization and appropriation, construction activities could start in 2018. Following is a schedule showing the approval and construction phases of the project.

Division Commander's Notice	August 2015
Chief of Engineers Report	December 2015
Feasibility Report Transmittal to Congress	June 2016
USACE and Sponsor Sign Design Agreement	To be determined 2016
Preconstruction Engineering and Design	2016–2017
Levee Construction	2018–2021
Habitat Restoration	2018–2031

9.6 Local Actions for Flood Risk Management

A number of nonstructural FRM measures are also recommended for local implementation concurrent with the Recommended Plan. These measures are expected to be included in the floodplain management plan that will be developed during and after project implementation. The non-Federal Sponsor will work with the non-Federal Interest, City of San José, who has land use authority and jurisdiction to prepare a floodplain management plan that is consistent with USACE guidance. The City of San José currently has an emergency management plan covering a broader area that includes the study area. This plan includes a floodplain management plan that addresses flooding due to rain, tidal flooding, overtopping of levees or failure of those levees protecting developed areas in Alviso, overtopping of creeks anywhere in the City, and localized flooding due to storm drain capacity problems. The City of San José participates in the National Flood Insurance Program, and takes remedial actions to obtain low flood insurance rates for property owners. In 1999 the City was awarded a certificate of Class 8 rating.

The nonstructural measures recommended to be included in the future floodplain management plan associated with this project include relocating or reinforcing critical utility infrastructure, providing emergency education and outreach in potentially affected communities, establishing evacuation and flood response plans, and managing disease vectors (e.g., mosquitoes) in case of flooding. The study recommends the use of dry and wet flood proofing to upgrade existing infrastructure and structures and elevating structures and transportation infrastructure. In the event of sea level risk greater than anticipated under the USACE High SLC scenario (consistent with the State's planning requirements), the study also recommends that the floodplain management plan consider future relocation of structures and residents at risk.

9.7 Risk

9.7.1 Risks and Uncertainty

Uncertainty can arise due to natural variation that is outside of human control, or it can arise due to human limitations in forecasting future events. In general, the ability of the plan to provide the expected accomplishments depends on the validity of pertinent assumptions, base data, and analytical techniques used in this study; the successful completion of future studies, designs, and construction; and appropriate operation, maintenance, repair, replacement, and rehabilitation after construction.

Other risks include natural environmental risks such as extreme flooding, wildfire, and herbivore damage to the restored lands. It is possible that an extremely large flood event could damage young restoration plantings before they are sufficiently mature to withstand extended flooding. Likewise it is also possible for wildfire to destroy plantings, both young and mature.

Monitoring and adaptive management would address some areas of risk and uncertainty associated with the implementation of the selected plan (specifically, achieving the desired ecosystem restoration objectives) and would address potential adjustments to respond to situations that could affect plan performance or costs. Other areas of risk and uncertainty (e.g., related to FRM, sedimentation, public access, and future SLC) that result in future actions to implement necessary changes would be addressed through operation and maintenance of the completed project or a post-authorization-change process. Each of these areas was discussed while describing project alternatives in Section 3.11 *Risks and Uncertainty*.

9.7.2 Residual Flood Risk

Because the elevations of all of the assessed FRM levee options target an ACE event at the end of the period of analysis, all would provide an extremely high level of tidal flood risk reduction for the entire fifty-year period of analysis from 2017 to 2067[1]. If SLC occurs more slowly than assumed under the USACE Low SLC scenario, the residual tidal flood risk would be even lower, and if it rises more quickly than under the USACE High SLC scenario (consistent with State planning requirements) the residual tidal flood risk would be higher.

The LPP (which includes a FRM levee at 1-percent ACE [under FEMA criteria]) with the highest levee height of 15.2 feet NAVD 88 is associated with the least residual risk of tidal flood damage in the study area at the end of the fifty-year period of analysis. There would still be some riverine residual flood risk in the study area, with the largest residual flood risk coming from the Guadalupe River (see Plate 55 of Annex 1 to Appendix D1 *Coastal Engineering and Riverine Hydraulics Summary*).

Another potential source of residual flooding is the existing storm drain network. Residual flood risk from stormwater drainage is expected to remain as nuisance flooding, with no appreciable damages or changes to the expected annual damage.

Although no levee can be said to eliminate all risk of failure below the top of levee elevation, if well maintained the likelihood of structural failure is estimated to be very low. The consequences of a failure would be significant in terms of property damage and the risk to

[1] The technical analysis throughout this Integrated Document was developed assuming a base year of 2017. The Implementation Schedule, discussed in Chapters 3 and 9, concludes that given funding and construction timelines the project would be constructed beginning in 2018 and providing benefits in the year 2021. Therefore the Base Year is 2021, and the period of analysis is 2021 to 2071 although the technical analysis reflects results over the period 2017 through 2067.

human health and safety. Residual flood risk from all sources can be reduced with effective floodplain management such as building codes, flood warning systems, and evacuation plans.

9.8 Consistency with Other USACE Initiatives

9.8.1 USACE Actions – Change for Applying Lessons Learned during Hurricanes Katrina and Rita

On August 24, 2006, the USACE Chief of Engineers signed and released the "Twelve Actions for Change," a set of actions that the USACE has focused on to transform its priorities, processes, and planning. The feasibility study and USACE Recommended Plan are consistent with each of the Chief of Engineers "Twelve Actions for Change" issued August 24, 2006.

9.8.2 USACE Environmental Operating Principles

The USACE has reaffirmed its commitment to the environment by formalizing a set of Environmental Operating Principles (EOPs) applicable to all its decision-making and programs (discussed in Section 2.7.1 *USACE Environmental Operating Principles*).

These principles foster unity of purpose on environmental issues, reflect a new tone and direction for dialogue on environmental matters, and ensure that employees consider conservation, environmental preservation, and restoration in all USACE activities. By implementing these principles, the USACE will continue its efforts to develop the scientific, economic, and sociological measures to judge the effects of its projects on the environment and to seek better ways of achieving environmentally sustainable solutions.

The Feasibility Report and Recommended Plan are consistent with each of the USACE EOPs, as demonstrated in Table 9.8-1 *Project Implementation Features Associated with Environmental Operating Principles*.

Table 9.8-1. Project Implementation Features Associated with Environmental Operating Principles

Environmental Operating Principle	Feasibility Study	Implementation
1. Foster sustainability as a way of life throughout the organization.		The ecosystem restoration will use natural processes to create tidal marsh habitat, which will reduce operation and maintenance requirements compared to the existing landscape.
2. Proactively consider environmental consequences of all Corps activities and act accordingly.	The Integrated Document (feasibility report and EIS/EIR) discloses the environmental consequences of a wide range of potential actions and recommends a plan that avoids, minimizes, or mitigates for negative impacts	Project implementation includes a robust monitoring and adaptive management program that will allow the project to adjust to unforeseen negative impacts to the environment.
3. Create mutually supporting economic and environmentally sustainable solutions.		Implementation of the FRM features will allow the tidal marsh restoration to occur. The tidal marsh and other future habitat features will improve the reliability of structural flood protection features and also help address flood risk.
4. Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments.	The Integrated Document describes how the proposed actions are in compliance with relevant laws affecting natural resources and the human environment.	
5. Consider the environment in employing a risk management and systems approach throughout life cycles of projects and programs.		Project implementation includes a robust monitoring and adaptive management program to address uncertainty in future conditions and project performance, as well as unforeseen negative impacts.
6. Leverage scientific, economic and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner.	Development of the Integrated Document was conducted by economists, biologists, engineers, planners, realty specialists, and legal staff from the USACE, the non-Federal sponsor, and landowning agencies. Local scientists and other experts were actively engaged, as well as the public, through a collaborative process that employed scientific advisory committees and stakeholder forums.	
7. Employ an open, transparent process that respects views of individuals and groups interested in Corps activities.	A series of public meetings were held throughout the planning process. In addition, the non-Federal sponsors regularly engaged local governments to communicate study progress and receive their input.	The non-Federal sponsor will continue outreach efforts with the public and local governments during and after project implementation.

9.8.3 USACE Campaign Plan

The mission of the USACE is to provide vital public engineering services in peace and war to strengthen the Nation's security, energize the economy, and reduce risks from disasters. In order to meet this mission, the agency has developed the USACE Campaign Plan as a component of the corporate strategic management process to establish priorities, focus on the transformation initiatives, measure and guide progress and adapt to the needs of the future.

The goals and supporting objectives of the Campaign Plan are:

- Ready for all Contingencies
  - Ready responsive and reliable
  - The USACE supports combat, stability and disaster operations
  - Human resources and family support to promote readiness
  - Institutionalize USACE capabilities in interagency policy and doctrine
- Transform Civil Works (Engineering Sustainable Water Resources Solutions)
  - Deliver enduring and essential water resources solutions.
  - Collaborates with partners and stakeholders to find holistic and sustainable solutions.
  - Improve water resources policies and stream line regulatory processes.
  - Enable Gulf Coast recovery
- Building Effective, Innovative, Sustainable Solutions
  - Use innovative tools to efficiently and effectively deliver high quality facilities
  - Improve reliability and resiliency of critical infrastructure and reduce risks related to water resources and other DOD infrastructure
  - Use risk-informed asset management
  - Innovative approaches to delivering quality infrastructure
- Recruiting and Retaining Strong Teams
  - Build and cultivate a competent, disciplined and resilient team
  - Strengthen critical core technical competencies
  - Communicate strategically with stakeholders and the public
  - Use standardized processes.

The Shoreline Phase I Study has been responsive to these goals and objectives by:

Deliver enduring and essential water resources solutions:

- Designing a project which avoids or minimizes environmental impacts while maximizing future safety and economic benefits to the community
- The Recommended Plan allows for continued floodplain flooding while focusing the flood risk reduction on the established urban area.

Improve water resources policies and stream line regulatory processes:

- LPP policy exception request was granted by ASA (CW) on August 24, 2015 to recommend the plan that meets FEMA accreditation requirements and State criteria for urban areas.

Collaborate with partners and stakeholders to find holistic and sustainable solutions.

- The Project team organized and participated in stakeholder meetings and public workshops throughout the process and worked with local groups to achieve a balance of project goals and public concerns.

Build and cultivate a competent, disciplined and resilient team

- The study successfully employed the use of District Quality Control Agency Technical Review, Risk Analysis, and Independent External Peer Review to assist in the review of the development of a technically sound recommendation of Federal Interest.

9.9 Future Phases of the San Francisco Bay Shoreline Study

As mentioned in Chapter 1 *Study Information*, this study would only partially addresses the water resources problems and opportunities in only a portion of the geographic area authorized for the South San Francisco Bay Shoreline Study, and is therefore, referred to as “Phase I” and labeled as an “Interim Feasibility Report”. Scoping, local coordination, and funding for future phases of the Shoreline Study effort are in process by the non-Federal entities, in coordination with the USACE, San Francisco District. The future phases would investigate FRM, ecosystem restoration, and recreation problems and opportunities along the shoreline of other counties adjacent to San Francisco Bay, and other former salt ponds within Alviso, Ravenswood, or Eden Landing Pond complexes acquired by the state and Federal government in 2003. This indicates that the Shoreline Phase I Study is addressing a specific area within the authority, rather than the entire area authorized for study. Additional studies to address other areas within the authorized South San Francisco Bay Shoreline footprint would be initiated if funding is provided by Congress.

10.0 Conclusions and Recommendations

This chapter describes the conclusions reached by this study and the Items of Cooperation for the Recommended Plan, which is a Flood Risk Management, Ecosystem Restoration, and Recreation Project that will be specifically authorized for implementation by the U.S. Army Corps of Engineers (USACE) and the non-Federal sponsors, Santa Clara Valley Water District and the California State Coastal Conservancy. The Recommended Plan is a locally preferred plan (LPP), which requires the non-Federal sponsor to pay 100 percent of the costs in excess of the National Economic Development/National Ecosystem Restoration Plan (NED/NER Plan).

10.1 Conclusions

The major conclusions of studies conducted to date are:

- Adoption of the Recommended Plan would be economically feasible;
- The non-Federal sponsor would fully support the Recommended Plan;
- The Financial Analysis completed for the South San Francisco Bay Shoreline Study Phase I Study indicated that the non-Federal sponsor would be financially capable of participating in the Recommended Plan;
- The non-Federal sponsor fully understands the cost-sharing requirements for project construction and the responsibility for operations, maintenance, rehabilitation, relocation, and repair (OMRR&R) for the project;
- The Recommended Plan would meet the Federal and non-Federal sponsor's flood risk management (FRM) objectives, ecosystem restoration, and recreation objectives;
- Passage of Section 1025 of the Water Resources Reform and Development Act (WRRDA) of 2014 enables the Secretary of the Army to recommend that the USACE implement the flood risk management, ecosystem restoration, and recreation activities on USFWS-managed lands as part of the Recommended Plan; and
- Although the FRM elements of the Recommended Plan can be successfully implemented if ecosystem restoration is not implemented, ecosystem restoration can be implemented only after the FRM elements of the Recommended Plan are implemented.

10.2 Recommendations

I recommend that the USACE project identified by the South San Francisco Bay Shoreline Phase I Study be authorized for implementation, as a Federal project, with such modifications thereof as at the discretion of the Commander, U.S. Army Corps of Engineers, San Francisco District, may be advisable. The estimated first cost (October 2015 price level) of the Recommended Plan is $174,000,000 with an estimated Federal cost of $70,261,500, and the estimated non-Federal cost of $103,738,500. The estimated annual OMRR&R cost is $538,000 (October 2015 price levels).

Federal implementation of the Recommended Plan would entail USACE construction of flood risk management measures and ecosystem restoration measures on lands that are under the jurisdiction of another Federal Agency, the United States Fish and Wildlife Service (USFWS). Authority for USACE to conduct these activities on USFWS-managed lands was authorized by the Assistant Secretary of the Army, Civil Works (ASA(CW)), pursuant to Section 1025 of the Water Resources Reform and Development Act of 2014 (WRRDA 2014). Pursuant thereto, the USFWS, the Santa Clara Valley Water District, and the California State Coastal Conservancy will enter into a Memorandum of Understanding (MOU). Pursuant to the MOU, the USFWS will grant access to USACE for pre-construction engineering and design activities, and construction and operation for the Project. USFWS will grant a right-of-way easement without term limitations to the non-Federal sponsors and waive its rights to compensation, to allow the non-Federal sponsors to carry out their responsibilities under Section 103(i) of the Water Resources Development Act of 1986 (WRDA 1986), 33 U.S.C. § 2213(i); USACE regulations and policies.

Federal implementation of the Recommended Plan would be subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including but not limited to:

1. Provide a minimum of 35 percent, but not to exceed 50 percent, of total FRM costs for the NED Plan, plus additional costs associated with the Recommended Plan, as further specified below:

    a. Provide 35 percent of NED Plan design costs allocated by the Federal Government to FRM, plus 100 percent of the additional design costs associated with the LPP, in accordance with the terms of a design agreement entered into prior to commencement of design work for the FRM features;

    b. Provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs allocated by the Federal Government to FRM;

    c. Provide, during construction, a contribution of funds equal to 5 percent of total FRM costs;

    d. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Federal

Government to be required or to be necessary for the construction, operation, and maintenance of the FRM features;

e. Provide, during construction, any additional funds necessary to make its total contribution for FRM equal to at least 35 percent of total FRM costs for the NED Plan, plus 100 percent of the additional FRM costs associated with the LPP;

2. Provide a minimum of 35 percent[1] of total ecosystem restoration costs for the NER Plan and 100 percent of the additional costs associated with the LPP as further specified below:

   a. Provide 35 percent of NER Plan design costs allocated by the Federal Government to ecosystem restoration, plus 100 percent of the additional design costs associated with the LPP, in accordance with the terms of a design agreement entered into prior to commencement of design work for the ecosystem restoration features;

   b. Provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs allocated by the Federal Government to ecosystem restoration;

   c. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Federal Government to be required or to be necessary for the construction, operation, and maintenance of the ecosystem restoration features, but no reimbursement shall be provided to the non-Federal sponsor, for any value of lands, easements, rights-of-way, relocations or improvements required on lands, easements, rights-of-way to enable the disposal of dredged or excavated material that exceeds 35 percent of the total ecosystem restoration costs;

   d. Provide, during construction, any additional funds necessary to make its total contribution for ecosystem restoration equal to a minimum of 35 percent of total ecosystem restoration costs for the NER Plan, plus 100 percent of the additional ecosystem restoration costs associated with the LPP;

3. Provide 50 percent of total recreation costs as further specified below:

   a. Provide 50 percent of design costs allocated by the Federal Government to recreation in accordance with the terms of a design agreement entered into prior to commencement of design work for the recreation features;

   b. Provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs allocated by the Federal Government to recreation;

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[1] The non-Federal sponsors have agreed to waive their right to reimbursement of LERRDs in excess of the typical 35-percent non-Federal cost share for ecosystem restoration. The certified cost estimate includes ecosystem restoration LERRDs valued at 39 percent of the NER cost.

c. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Federal Government to be required or to be necessary for the construction, operation, and maintenance of the recreation features;

d. Provide, during construction, any additional funds necessary to make its total contribution for recreation equal to 50 percent of total recreation costs;

e. Provide, during construction, 100 percent of the total recreation costs that exceed an amount equal to 10 percent of the sum of the Federal share of total flood damage reduction costs and the Federal share of total ecosystem restoration costs;

4. Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefor, to meet any of the non-Federal obligations for the project unless the Federal agency providing the Federal portion of such funds verifies in writing that expenditure of such funds for such purpose is authorized;
5. Not less than once each year, inform affected interests of the extent of protection afforded by the FRM features;
6. Agree to participate in and comply with applicable Federal floodplain management and flood insurance programs;
7. Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 USC 701b-12), which requires a non-Federal interest to prepare a floodplain management plan within 1 year after the date of signing a project cooperation agreement, and to implement such plan not later than 1 year after completion of construction of the FRM features;
8. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the FRM features;
9. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the level of protection the FRM features afford, reduce the outputs produced by the ecosystem restoration features, hinder operation and maintenance of the project, or interfere with the project's proper function;
10. Shall not use the ecosystem restoration features or lands, easements, and rights-of-way required for such features as a wetlands bank or mitigation credit for any other project;
11. Keep the recreation features, and access roads, parking areas, and other associated public use facilities, open and available to all on equal terms;

12. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 USC 4601–4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;
13. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;
14. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsors own or control for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;
15. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;
16. Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 CFR Section 33.20;
17. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 USC 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 USC 3141–3148 and 40 USC 3701–3708 (revising, codifying, and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 USC 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 USC 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 USC 276c et seq.);
18. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 USC 9601–9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal

Government determines to be required for construction, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal sponsors with prior specific written direction, in which case the non-Federal sponsors shall perform such investigations in accordance with such written direction;

19. Assume, as between the Federal Government and the non-Federal sponsors, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under the CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project;

20. Agree, as between the Federal Government and the non-Federal sponsors, that the non-Federal sponsors shall be considered the operators of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under the CERCLA; and

21. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 USC 1962d-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public Law 99-662, as amended [33 USC 2213(j)], which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the non-Federal sponsors, the State, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

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12.0 Glossary and Index

12.1 Glossary

adaptive management: A structured, iterative process of robust decision-making in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring.

accretion: The act of adding material, such as from the deposition and accumulation of waterborne particles.

acute toxicity: For purposes of this project, a median of less than 90-percent survival, or less tan 70-percent survival more than 10-percent of the time, of test organisms in a 96-hour static or continuous flow test. See also *chronic toxicity*.

adsorption: The adherence of gas, liquid, or dissolved material on the surface of a solid.

algae: Simple rootless plants that grow in bodies of water (e.g., *estuaries*) at rates dependent on sunlight, temperature and the amounts of plant nutrients (e.g., nitrogen and phosphorus) available in water.

alluvial: Relating to the deposits made by flowing water; washed away from one place and deposited in another; as, alluvial soil, mud, accumulations, deposits.

Alquist Priolo Act: The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. This State law was a direct result of the 1971 San Fernando Earthquake, which was associated with extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures. The Alquist-Priolo Earthquake Fault Zoning Act's main purpose is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. The Act only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards. The Seismic hazards Mapping Act, passed in 1990, addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides.

amphibian: A cold-blooded, smooth-skinned vertebrate animal of the class Amphibia, such as a frog or salamander, that typically hatches as an aquatic larva with gills. The larva then transforms into an adult having air-breathing lungs.

amphipods: A small freshwater or marine crustacean with a thin body and without a carapace.

anadromous: Fish and invertebrates, such as shrimp, migrating from saline to fresh water to spawn.

anaerobic: Not containing oxygen or not requiring oxygen.

aquifer: Underground rock or soil layer yielding groundwater for wells and springs, etc.

astronomic tides: The periodic rise and fall of a body of water resulting from gravitational interactions between the Sun, Moon, and Earth.

attenuation: Reduction.

base flood: A flood having a 1-percent chance of being equaled or exceeded in any given year.

base flood elevations: Predicted water surface elevations landward of shoreline and river barrier crests as a result of a base flood.

base year: Also known as *Year 0*; the year project construction will begin.

batch pond: higher-salinity managed ponds where salinity levels are allowed to rise to support specific wildlife populations.

bathymetry: Of or relating to measurements of depths of water bodies, such as oceans, estuaries or lakes.

baylands: Shallow water habitats around San Francisco Bay. They include lands that are touched by tides and lands that would be tidal in the absence of man-made structures.

benthic organisms: Those organisms living at or near the bottom of a body of water.

berm: A mound or bank of earth, used especially as a barrier.

bioaccumulation: The increase in concentration of a chemical in organisms that reside in environments contaminated with low concentrations of various organic compounds. Also used to describe the progressive increase in the amount of a chemical in an organism resulting from rates of absorption of a substance in excess of its metabolism and excretion.

bioavailability: The degree and rate at which a substance (as a drug) is absorbed into a living system or is made available at the site of physiological activity.

biotic: Pertaining to life or living things, or caused by living organisms.

bivalve: A mollusk having a shell consisting of two lateral plates or valves joined together by an elastic ligament at the hinge, which is usually strengthened by prominences called teeth. The shell is closed by the contraction of two transverse muscles attached to the inner surface, as in the clam, or by one, as in the oyster.

borrow ditch: An excavated ditch adjacent to the pond levees where material was excavated in order to create and maintain the pond levees.

brackish water: Water containing a mixture of seawater and fresh water; contains dissolved materials in amounts that exceeded normally acceptable standards for municipal, domestic, and irrigation uses.

brackish: A mixture of fresh and saltwater typically found in estuarine areas; of intermediate salinity.

breach: An opening (especially a gap in a levee).

brines: Water containing large amounts of salt or salts, especially sodium chloride.

California clapper rail: See *Ridgway's rail*.

candidate species (*Federal definition*): A species for which the U.S. Fish and Wildlife Service has on file sufficient information to support a proposal to list the species as endangered or Threatened, but for which proposed rules have not yet been issued.

candidate species (*State definition*): A native species of subspecies of a bird, a mammal, fish, amphibian, reptile, or plant that the California Fish and Game Commission has formally noticed as being under review by the California Department of Fish and Game for addition to either the list of endangered species or the list of Threatened species, or a species for which the Commission has published a notice of proposed regulation to add the species to either list.

catadromous: Fish and invertebrates, such as a shrimp, migrating from fresh to saline water to spawn.

chronic toxicity: A detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure or the health of an organism, population, or community. See also *acute toxicity*.

congeners: Elements belonging to the sample group on the periodic table (e.g., sodium and potassium); compounds produced by identical synthesis reactions and procedures.

cooperating agency: a Federal, state, or local agency that accepts obligation to contribute staff to the NEPA evaluation. Cooperating agencies participate in the NEPA process (including scoping), develop analyses for which they have particular expertise, and fund their own participation in the EIS process.

cumulative effects or impacts (Federal definition): the impact on environment, human, and community resources that results from the incremental impact of the Proposed Project when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or persons undertakes such actions.

cumulative effects or impacts (State definition): two or more individual effects on environmental resources, that when considered together, are considerable or compound or increase other environmental impacts.

datum: A base elevation used as a reference from which to recon heights or depths.

deep-water habitat: Aquatic habitats, such as in lakes, rivers and oceans, where surface water is permanent and deeper than 6.6 feet (2 meters) most of the year.

delta: a nearly flat plan of alluvial deposits between diverging branches of the mouth of a river.

detritus: Organic waste material from decomposing dead plants or animals.

diatoms: A major group of eukaryotic algae, and one of the most common types of phytoplankton.

dissolved oxygen: The concentration of oxygen dissolved in water, expressed in mg/L or as percent saturation, where saturation is the maximum amount of oxygen that can theoretically be dissolved in water at a given altitude and temperature.

ditch block: a constructed blockage in a flow path, such as a borrow ditch, designed to defect the flow of water into an alternate flow path, such as a historic marsh channel.

diurnal: Having a daily cycle.

diversity: An ecological measure of the variety of organisms present in a habitat.

ecology: The study of the interactions between living things and their environment.

ecosystem: A basic functional until of nature comprising both organism and their nonliving environment, intimately linked by a variety of biological, chemical, and physical processes.

ecotone: A transition zone between two ecosystems; also called *transitional habitat*.

emergent vegetation: Plants typically rooted in shallow water that have most vegetative growth above the water surface.

endangered (*Federal definition*): Any species which is in danger of extinction throughout all or a significant portion of its range.

endangered (*State definition*): A native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, completion, or disease.

endemic: Restricted or peculiar to a locality or region.

epifauna: Aquatic animals living on the surface of the seabed or a riverbed, or attached to submerged objects or aquatic animals or plants. Compare with *infauna*.

essential fish habitat: Waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

estuarine: Of, relating to, or found in an *estuary*.

estuary: The wide part of a river where it nears the sea; where fresh and salt water mix in a semi-enclosed body of water.

eutrophication: Having waters rich in material and organic nutrients that promote a proliferation of plant life, especially algae, which reduces the dissolved oxygen content and often causes the extinction of other organisms.

exotic species: Any introduced plant or animal species that is not native to the area and that may be considered a nuisance (e.g., Norway rat, *Spartina*, etc.). See also invasive species.

extirpated: Locally extinct (permanently absent).

fauna: Animals, especially the animals of a particular region or period, considered as a group.

floodplain: An area adjacent to the lake, stream, ocean or other body of water lying outside the ordinary banks of the water body and periodically filled by flood flows. Often referred to as the area likely to be filled by the 1-percent annual chance of exceedance flood (base flood).

flood risk management: The application of policies, programs, expertise and specific measures towards reducing overall flood risk.

flora: Plants considered as a group, especially the plants of a particular country, region, or time.

fluvial: Produced by or found in a river or flowing water.

fluvial flooding: Results when river, stream or creek discharges overtop their banks and results in the inundation of adjacent lands.

global climate change: A significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It may be a change in average weather conditions, or in the distribution of weather around the average conditions (i.e., more or fewer extreme weather events).

geomorphic: Pertaining to the shape or surface of the earth, including small-scale changes in land surface resulting from restoration projects.

geotechnical: A science that deals with the application of geology to engineering.

groundwater: Water that penetrates the earth's surface from precipitation and from infiltration from streams; water present below ground from ponds and lakes; water that flows or ponds underground.

habitat: The range of environmental factors at a particular location supporting specific plant and animal communities.

halophyte: Salt-tolerant vegetation.

halophytic: Having the characteristics of a hylophyte (salt-tolerant) plant.

hazardous air pollutant: The classification, under Federal law, for a pollutant that increases the public's risk of developing cancer. See also *toxic air contaminant.*

hemiparasitic: Partially dependent on another host plant in order to survive.

hydraulic: Of or involving a fluid, especially water, under pressure.

hydrodynamics: Deals with the motion of fluids.

hydrology: The scientific study of the properties, distribution, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.

hypersaline: marked by increased salt in a saline solution. Applies to highly saline *brines*, typically several times as salty as seawater.

igneous: Said of a rock or mineral that solidified from molten or partially molten material, i.e., from a magma.

inboard: In, toward, or near the inside (especially the areas inside of pond levees or salt ponds).

infauna: Aquatic animals that live in the substrate of the body of water, especially in a soft sea bottom.

Integrated Document: Combined feasibility study, NEPA Environmental Impact Statement, and CEQA Environmental Impact Report.

intermittent stream: A stream filled with water for only a portion of the year.

interstitial: Pertaining to the interstices, or small spaces between adjacent objects.

intertidal habitat: The tidal area between the mean lower low water (*MLLW*) and mean higher high water (*MHHW*) which is alternately exposed and covered by water twice daily.

intertidal mudflats: The habitat zone that is generally found between MLLW and approximately one foot above local mean sea level and that lacks vascular plants.

inundation: Covered by a flood.

invasive species: A species that is (1) nonnative (*exotic*) to the ecosystem under consideration and (2) whose introduction causes or is likely to cause economic or environmental ham or harm to human health.

invertebrate: A animal without a backbone.

jurisdictional wetlands: Wetlands which meet the criteria of "waters of the United States" and are thereby under the jurisdiction of the USACE and the USEPA. The definition developed by the USACE considers a wetlands those areas which "… are inundated or saturated by surface or groundwater at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Under this definition, all three of the following conditions must be present**:** (a) a dominance of wetland plants; (b) hydric soils (soils with low oxygen concentrations in the upper layers during the growing season); and (c) wetlands hydrology.

larvicide: Control agent that targets the larval portion of the life cycle, as used in the control of mosquitoes.

lateral spreading: The horizontal displacement of soil during strong, earthquake-induced ground motion.

lead agency: The agency carrying out the Federal or state action; these agencies are responsible for ensuring that the potential project effects are considered pursuant to the NEPA (for Federal projects) and the CEQA (for State projects). In the case of the Shoreline Phase I Project, there are two NEPA lead agencies acting as co-leads**:** the USACE and the USFWS. The State (CEQA) lead agency is the SCVWD.

levee: A barrier constructed to contain the flow of water, protect against flooding, or to keep out the sea.

liquefaction: see *soil liquefaction*.

lower tidal marsh: Habitat that occurs above mudflats along stream and slough channels and typically is found between mean tide level and mean high water (3.3-5.5 feet National Annual Vertical Datum 88). Within the range of daily tidal fluctuations; ground surface and low-growing plants are exposed at low tides and completely inundated at higher tides and during periods of high stream discharge.

mammal: Any of various warm-blooded vertebrate animals of the class *Mammalia*, including humans, characterized by a covering of hair on the skin and, in the female, milk-producing mammary glands for nourishing the young.

managed ponds: Diked wetland, generally shallow open water habitats.

marsh: A common term applied to describe treeless *wetlands* characterized by shallow water and abundant emergent, floating, and submerged wetland *flora*. Typically found in shallow basins, on lake margins, along low gradient rivers, and in calm tidal areas. Marshes may be fresh, brackish or saline, depending on their water source(s).

marsh panne: Marsh pannes are topographic depressions on mature tidal marsh plains. They are most common in areas most distant from any tidal source and exit on drainage divides between channel networks, and on the backsides of natural levees. Marsh panes range in age from less than 50 years to more than 1,500 years.

mean sea level: The arithmetic mean of hourly heights observed over the National Tidal Datum Epoch.

metamorphic rock: Any rock derived from pre-existing rocks by mineralogical, chemical, and/or structural changes, essentially in the soil state, in response to marked changes in temperature, pressure, shearing stress, and chemical environment, generally at depth in the earth's crust.

methylation: Conversation of sediment-bound mercury may through both biotic and abiotic processes to its more bioavailable methylated form. Methyl mercury has known neurological toxicity effects that tend to increase at each level up the food chain in aquatic environments. Thus, the availability of such contaminants, even in the seemingly insignificant parts of per trillion range, often are ecologically important.

MHHW: Mean Higher High Water, the average height of the higher of the two daily high tides.

MHW: Mean High Water, the average height of all the high tides.

middle tidal marsh: Habitat that occurs between mean high water and mean high higher water (5.5–6.0 feet National Annual Vertical Datum 88); inundated only during higher high tides.

migratory: Moving regularly or occasionally from one region or climate to another; as, migratory birds.

MLLW: Mean Lower Low Water, the average height of the lower of the two daily low tides.

MLW: Mean Low Water, the average height of all low water heights.

morphology: That branch of biology which deals with the structure of animals and plants.

MTL: Mean Tide Level.

mudflat: Flat un-vegetated wetlands subject to periodic flooding and minor wave action. The area, which lies between tidal marshes and the edge of San Francisco Bay at low tide, provides habitat for invertebrates, fish, and shorebirds.

muted tidal marsh: A tidal marsh that receives less than full tidal flow because of a physical impediment. Muting can result from the presence of natural formations such as a sand bar or of human-made structures such as tide gates, culverts, or other water control structures that reduce the range of the tides but still allow frequent inundation. Muted tidal marshes exhibit many of the same features of fully tidal marshes, along they frequently lack the same range of plant diversity. Also referring to as damped tidal marsh (see also microtidal marsh).

native species: Species which have lived in a particular region or area of an extended period of time.

neap tides: The tides resulting when the sun and moon are at right angles to each other, characterized by a reduced tidal range.

nonattainment areas: Areas that do not meet the national ambient air quality standards established in 1970 by the Clean Air Act.

nonnative: See *exotic species*.

obligates: Obligate wetland plant species. Wetland indicator species are designated according to their frequency of occurrence in wetlands. Obligate and facultative wetland indicator species are hydrophytes that occur "in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present" (Environmental Laboratory 1987).

outboard: On, toward, or near the outside (especially the areas outside of pond levees or salt ponds).

pelagic: Referring to the open sea at all depths.

peripheral halophytes: Plants adapted to living in a saline environment. Peripheral halophytes occur along the banks and tops of levees separating tidal areas from salt ponds, and occasionally along levees separating salt ponds from each other.

permeability: The degree to which something (e.g., an earthen structure) can be penetrated by a liquid.

pH: Measure of the acidity or alkalinity (basicity) of water (pH 7 is neutral, increasing values indicate alkalinity and decreasing value indicate acidity).

phytoplankton: Small (often microscopic) aquatic plants suspended in water.

planform: The shape or form of an object as seen from above.

point source: A source of pollution that can be attributed to a specific physical location; and identifiable, end of pipe "point." The vast majority of point source discharges of plant nutrients are from wastewater treatment plants, although some come from industries.

point-source discharge: A discharge of a pollutant from an identifiable point, such as a pipe, ditch, channel, sewer, tunnel, or container.

pond complex: A group of salt ponds being treating as a unit for planning purpose.

Proposed Project: the action that the Federal and State agencies are considering in this EIS/EIR. Normally called *proposed action* under the NEPA and *tentatively selected plan* under USACE ER-1105-2-100.

proposed species of concern (*Federal definition*): A group of organisms for which a general notice has been published in a local newspaper and a proposed rule for listening has been published in the Federal Register. A species that may or may not be listed in the future (formerly "C2 candidate species" or "species under consideration for listing for which there is insufficient information to support listing.")

Rare (*State definition*): A species, subspecies, or variety is Rare when, although not presently threatened with extinction, it is in such small numbers throughout its range that it may become endangered if its present environment worsens.

refugia: An area in which organisms can survive through a period of unfavorable conditions (especially high elevation habitat for use during high tide or flood conditions).

residence time: The average length of time a water particle spends in a given water body or region of interest.

Responsible Agency: A State or local public agency that proposes to carry out or approve a project for which a State lead agency is preparing an Environmental Impact Report**.**

restoration: The return of an ecosystem to a closed approximation of tits condition prior to disturbance.

Ridgway's rail: The newly titled California Ridgway's rail (previously referred to as the California clapper rail) includes three subspecies: the Bay Area's California Ridgway's rail; the light-footed Ridgway's rail in Los Angeles and San Diego; and the Yuma Ridgway's rail in Arizona, Nevada, and eastern California. All three of them remain on the Endangered species list. It is part of a larger split; two rail species will now be five: king rails in the eastern U.S. and the Caribbean; clapper rails in the eastern U.S. and Cuba; mangrove rails in South America; Aztec rails in the Mexican highlands; and the West Coast Ridgway's rails.

riparian: Of, relating to, or situated on the banks of a body of water, stream, river, marsh, or shoreline.

riparian area: An area of land directly influenced by water; an ecosystem that is transitional between land and water ecosystems. Riparian areas usually have visible vegetative or physical characteristics reflecting the influence of water.

ruderal: Disturbed habitat usually of poor quality.

saline: Of, relating to, or containing saline; salty.

salinity: A measure of the salt concentration of water; higher salinity means more dissolved salts.

salt marsh: A coastal habitat consisting of salt-resistant plants residing in an organic-rich sediment.

salt pannes: Salt panes are shallow, generally unvegetated areas that form shallow ponds on the salt marsh. They become hypersaline in late summer. Salt panes often contain fish populations and provide valuable habitat for shorebirds when flooded.

salt ponds: Commercial facilities that extract salt from bay water by evaporation. Algae are the main vegetation, brine shrimp and birds the primary inhabitants.

sea level rise: an increase in the height of mean sea level compared to a given time

seasonal wetlands: Shallow depressions that typically contain standing water during the rainy season but become drier, or dry out, in summer and fall. They include diked (formerly tidal) salt and brackish marshes, farmed wetlands, abandoned salt ponds, inland freshwater marshes and vernal pools.

sediment budget: An accounting of all sediment delivery, export, and storage.

sedimentation: The deposition or accumulation of sediment.

semidiurnal: Occurring twice each day.

sensitive species (*Federal definition*): Those plant and animal species identified by a regional forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density, or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

Shoreline Phase I study area: the Alviso pond complex and an inland area roughly bounded by Coyote Creek on the north, I-880 on the east, and State Route (SR) 237 on the south.

slough: A narrow, winding waterway edged with marshy and muddy ground. These water bodies are distinguished by low flow or stagnant waters.

soil liquefaction: The sudden and total loss of soil strength during earthquake-induced ground motion. Occurs in loose, saturated, clean sand where ground shaking increases effective pore pressure resulting in the displacement of individual sand grains and groundwater. The soil transforms into a fluid-like state, allowing displacement of water and the potential mobilization of sand if not confined.

***Spartina* (*alterniflora*):** Smooth cordgrass, an *invasive spec*ies.

special-status species: Collective term for Endangered species, Threatened species, Species of Concern, and Species of Special Concern.

species of concern (*Federal definition*): An informal term that refers to those species which the USFWS believes might be in need of concentrated conversation actions. (Formerly known as Category 1 or 2 Candidate).

species of special concern (*State definition*): Native species of subspecies that have become vulnerable to extinction because of declining population levels, limited ranges, or rarity. The goal is to prevent these animals and plants from becoming endangered by addressing the issues of concern early enough to secure long-term viability for these species.

spring tides: The tides resulting when the gravitational forces exerted on the earth by the sun and moon are acting in the same direction.

stillwater flood elevation: Projected elevation that floodwaters would assume in the absence of waves resulting from wind or seismic effects.

streambed: a channel occupied (or formerly occupied) by a stream.

submerged plants: Plants growing with their root, stems, and leaves completely under the surface of the water.

submerged: Below water.

subsidence: The motion of a surface (usually, the Earth's surface) as it shifts downward relative to a datum such as sea level.

subtidal habitat: Areas below mean lower low water (MLLW) that are covered by water most of the time.

taxa: Any group or rank in a biological classification into which related organisms are classified.

tectonic: Pertaining to the forces involved in, or the resulting structures of geology dealing with the broad architecture of the outer part of the earth, that is, the major structural or deformation features and their relations, origin, and historical evolution.

Threatened (*Federal definition*): Any species which is likely to become an endangered species within the foreseeable future throughout all or significant portion of its range.

Threatened (*State definition*): A native species or subspecies of a bid, mammal, fish, amphibian, reptile, or plant that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts.

tidal: Characterized by or affected by periodically rising and falling or flowing and ebbing waters, usually coastal.

tidal excursion: The horizontal distance a water particle travels during a single flood or ebb tide.

tidal dispersion: The transportation of a particle or water parcel travels during a single flood or ebb tide.

tidal marsh: Wetlands with fresh water, brackish water, or salt water along tidal shores.

tidal mud flat: The unvegetated shoreline area exposed to air during low tide.

tidal prism: The volume of water that flows into and out of a marsh.

topography: The general configuration of a land surface, including its relief and the position of its natural and man-made features.

total maximum daily load program: A quantitative assessment, provided for in the Clean Water Act, of a problem that affects water quality. Establishes the amount of a pollutant present in a water body and specifies an allowable load of the pollutant from individual sources to ensure compliance with water quality standards.

toxic air contaminant: The classification, under California law, for a pollutant that increases the public's risk of developing cancer. See also *hazardous air pollutant*.

toxic: The property of being poisonous, of causing death or severe temporary or permanent damage to an organism.

toxicity: The degree to which a substance is *toxic*.

transitional habitat: A transition area between two distinct habitats (especially tidal wetland and upland habitats). Sometimes referred to as *ecotone*.

tsunami: A seismically induced flood caused by the transfer of energy from an earthquake epicenter to coastal areas by ocean waves.

turbidity: The relative clarity of water, which depends in part on the material in suspension in the water.

upland: Ground elevated above the lowlands along rivers or shorelines.

upper tidal marsh: Habitat that occurs from mean high higher water and up to several feet (>6.0 feet National Annual Vertical Datum 88) to the maximum elevation of tidal effects. This habitat is inundated only during higher high tides.

vascular plant: Green plant having a vascular system**:** ferns, gymnosperms, angiosperms.

vector: An insect or other organism that transmits a pathogenic fungus, virus, bacterium, etc.

watershed: An area of land where all of the groundwater and surface water drains to the same water body (typically a river or creek).

zooplankton: Floating and free-swimming invertebrates that are suspended in the water column.

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