

DRAFT INTEGRATED GENERAL REEVALUATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT

SAN FRANCISCO BAY TO STOCKTON, CALIFORNIA NAVIGATION STUDY

APPENDIX G: Environmental



FEBRUARY 2019



SAN FRANCISCO BAY TO STOCKTON NAVIGATION IMPROVEMENT PROJECT
Draft General ReEvaluation Report and Environmental Impact
Statement/Environmental Impact Report
404(b)(1) Evaluation

SECTION 404(b)(1) EVALUATION

I. Project Description

a. Location. The San Francisco Bay to Stockton project area is located in the San Francisco Bay Delta. The navigation channel includes the Pinole Shoal Channel, Bulls Head Reach, and the surrounding waters of Central Bay, San Pablo Bay, Carquinez Strait, and Suisan Bay.

b. General Description. The U.S. Army Corps of Engineers (Corps) is proposing to deepen the current Federal navigation channel. The proposed plan includes the following: deepening the existing maintained channel depth of -35 feet MLLW to -38 feet MLLW, along with creating a sediment trap at Bulls Head Reach, which would be maintained at -42 feet MLLW. The dredged material would be placed on one or two beneficial reuse sites; Montezuma Wetlands and Cullinan Ranch.

A small rock outcrop is present immediately north of the downstream portion of the Suisun Bay Channel. The top of the outcrop is currently at a depth of 39.7 feet MLLW. While coordinating with the San Francisco Bay Bar Pilots for this project, the Bar Pilots expressed safety concerns as the outcrop poses a threat to safe navigation. Even though this rock formation is not in the federal channel, it is located in the shipping lane and will need to be addressed as part of this project to provide safe navigation. The rock formation will be lowered so that there is a minimum of 3-ft of additional clearance below the 2-ft of overdepth tolerance. As part of the project, the outcrop would be lowered by approximately 3.3 feet, to a depth of 43 feet MLLW.

The reuse sites are currently permitted, therefore, this 404(b)(1) Evaluation does not include the disposal sites.

c. Authority and Purpose. See **Chapter 1** of the integrated draft GRR/EIS.

d. General Description of Dredged Material

(1) General Characteristics of Material: Please see **Section 2.2** of the integrated GRR/EIS and Appendix E – Geotechnical Analysis for additional detail on the sediment characteristics. Generally, the following material is expected within the project limits: Sand with infiltrated silt and/or clay in the West Richmond Channel, sand with varying amounts of silt and clay in Pinole Shoal, and a range of fine sands to sand or silt and clay with sand in the Bulls Head Reach. The rock outcrop would be expected to dissipate onto the bottom of the channel area.

(2) Quantity of Material: The total dredging volume of material would be approximately 1,443,900 cubic yards in the Pinole Shoal Channel, and approximately 159,300 cubic yards in the Suisun Bay Channel. Please see **Chapter 4 in the Civil Design Appendix** of the integrated GRR/EIS for additional detail.

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(3) Source of Material: Dredged material would come from the Federal navigation channel shown in the reference map in the **Executive Summary** of the integrated GRR/EIS.

e. Description of the Proposed Discharge Site(s)

(1) Location. It is anticipated that all of the material to be excavated from the channel would be placed in a currently permitted beneficial reuse site, either Cullinan Ranch or Montezuma Wetlands. Please see **Section 2.4.5 Dredged Material Placement** in the integrated GRR/EIS.

(2) Size. The excavated material would be placed in the currently permitted beneficial reuse site. The Cullinan Ranch Wetland Restoration Site accepts over 2.8 million cubic yards of dredged material, with potential for 9 million cubic yards. Montezuma Wetland Restoration Site is approximately 2,400 acres and is able to accept the volume of deepening material that will be disposed.

(3) Type of Site. Beneficial reuse site.

(4) Type(s) of Habitat. See **Section 2.4.5** for a description of the Beneficial Use Sites.

(5) Timing and Duration of Discharge. The exact timing of dredging operations is not known, although dredging activities are expected to occur within the approved work windows for critically endangered species throughout the Bay.

f. Description of Disposal Method. The dredged material would be placed on scows using a clamshell dredge. Scows will be towed to the beneficial use site and offloaded as a slurry and pumped to the placement location.

II. Factual Determinations

a. Physical Substrate Determinations

(1) Substrate Elevation and Slope: Deepening would occur between the existing channel toes, widening the channel is not part of the project. However, the channel side slopes require a 3-foot horizontal to 1-foot vertical (3:1) side slope to ensure slope stability. Therefore, dredging would occur on the side slopes of the channel to ensure the side slopes maintain stability following construction. (**Appendix A – Engineering and Appendix B – Water Resources**).

(2) Sediment Type. The material to be dredged is composed most of a sandy, silty/clay.

(3) Dredged Material Movement: N/A. The dredged material will be placed on beneficial reuse sites.

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(4) Physical Effects on Benthos: Dredging would displace benthos within the channel, however, recolonization would be expected upon construction completion. This site is currently dredged for maintenance at -35 feet MLLW once a year (-36 feet including overdraft). Some benthic organisms that are not mobile may be covered by the placement at the beneficial reuse sites. Recolonization soon after project completion is expected to replace those organisms that do not survive project construction. It is anticipated that no long-term adverse impacts would occur.

(5) Other Effects: N/A

(6) Actions Taken to Minimize Impacts: All dredging will occur within the approved environmental work windows, as described in the main report. The dredged material for the deepening project would be placed upon existing beneficial reuse sites to offset environmental impacts.

b. Water Circulation. Fluctuation and Salinity Determinations

The increase in depth will result in an increase in cubic yards of maintenance dredging. The dredged material from maintenance dredging will continue to be placed within the In-Bay disposal sites, SF-10 and SF-16. This is discussed further within the draft GRR/EIS and the Maintenance Dredging of the Federal Navigation Channels in San Francisco Bay Fiscal Years 2015 – 2024 Long Term Maintenance Strategy Environmental Assessment (April 2016).

- (1) Water column: During dredging operations, turbidity would increase temporarily in the water column adjacent to the project. The increased turbidity would be short-term; therefore no long-term or significant impacts are expected to occur to salinity, water chemistry, clarity, color, odor, taste, dissolved gas levels, nutrients or eutrophication.
- (2) Current Patterns and Circulation: The net movement of water in the project footprint is from east to west. All of the streams and rivers begin on the east face of the Sierra Nevadas and flow west to the Sacramento River Basin and the San Joaquin River Basin. The Sacramento River flows north to south and the San Joaquin flows from east to the west. The flow in Suisun Bay Channel and Pinole Shoal Channel is east to west. The project would have no significant effect on existing current patterns, current flow, velocity, stratification, or the hydrologic regime in the area.
- (3) Normal Water Level Fluctuations: Mean tidal range near the midway point of the project area is 4.4 feet (<https://tidesandcurrents.noaa.gov/stationhome.html?id=9415143>). Typical spring tide ranges are 5-8 feet in San Francisco Bay, and the range in the project area is expected to be at the upper end of these values (AECOM 2016).
- (4) Salinity Gradients: Salinity in the project area is highly variable and largely dependent on tides and freshwater outflow. Data collected near Bulls Head Reach available from the California Data Exchange Center indicates that salinity in that location can vary from less than 1 (i.e., fresh water) to 27 practical salinity units (PSU). However, data collected

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near the most seaward portion of Pinole Shoal ranges from approximately 17 PSU to the salinity of oceanic water (Hutton et al. 2016).

Modeling indicates that the low salinity zone (LSZ) will shift approximately 0.3 km east on average after project implementation. Impacts to X2 directly affect fish and wildlife through changes to the spatial distribution of salinity in the delta, and therefore, available LSZ habitat. This project is expected to have minimal impacts to fish and wildlife due to the shift in LSZ and X2 (see Biological Assessment for predicted effects to delta smelt). Impacts also may have minor effects on water supply reliability during periods of the year when the position of X2 is managed by regulating (i.e., increasing) Delta outflow to push the X2 farther west. These impacts were evaluated against effects criteria and determined to be insignificant.

- (5) Actions That Will Be Taken to Minimize Impacts: BMPs and other benthic protection measures have been coordinated with the resource agencies to minimize impacts.

c. Suspended Particulate/Turbidity Determinations

- (1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site: There may be a temporary increase in turbidity levels in the project area. Turbidity would be short-term and localized and no significant adverse impacts are expected. State water quality standards for turbidity outside an allowable mixing zone would not be exceeded.
- (2) Effects (degree and duration) on Chemical and Physical Properties of the Water Column: The sea floor, at this location, is characterized by a sandy substrate. There would be little, if any, adverse effects to chemical and physical properties of the water as a result of dredging.
 - (a) Light Penetration: Some decrease in light penetration may occur in the immediate vicinity of the dredged area. This effect would be temporary, limited to the immediate area of construction, and would have no adverse impact on the environment.
 - (b) Dissolved Oxygen: Dissolved oxygen levels would not be altered by this project due to the high energy wave environment and associated adequate reaeration rates.
 - (b) Toxic Metals and Organics: No toxic metals or organics are expected to be released by the project.
 - (d) Pathogens: No pathogens are expected to be released by the project.
 - (e) Aesthetics: The aesthetic quality of the water in the immediate area of the project would be reduced during construction due to increased turbidity. This

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would be a short-term and localized condition. Material placed in the beneficial reuse area would likely provide improved wetland aesthetics.

(f) Others as Appropriate: None.

(3) Effects on Biota

(a) Primary Production, Photosynthesis: Primary productivity in the benthic area would be disturbed temporarily during dredging, but should quickly return to ambient conditions.

(b) Suspension/Filter Feeders: An increase in turbidity could adversely impact burrowing invertebrate filter feeders within and adjacent to the immediate construction area. It is not expected that a short-term, temporary increase in turbidity would have any long-term negative impact on these highly fecund organisms.

(c) Sight Feeders: No significant impacts on these organisms are expected as the majority of sight feeders are highly motile and can move outside the project area.

(4) Actions taken to Minimize Impacts: BMPs and other benthic protection measures would be coordinated with the resource agencies to minimize impacts.

d. Contaminant Determinations: The Pinole Shoal and Suisan Bay Channels sediment has been tested as it is currently dredged for maintenance once a year. Samples in the project foot print collected in 1997 at depths below -35 ft show that the material is likely suitable for upland cover or deep ocean disposal. Additional sampling and testing will occur during the Preconstruction, Engineering, and Design (PED) phase of this project to confirm.

e. Aquatic Ecosystem and Organism Determinations: The material that would be placed in the beneficial reuse site would help to increase the wetland quality in the area. Additional testing of the sediment during the PED phase will confirm quality of the sediment for beneficial reuse.

(1) Effects on Plankton: No adverse impacts on autotrophic or heterotrophic organisms are anticipated.

(2) Effects on Benthos: The dredging would disturb benthic organisms during the construction. Recolonization is expected to occur within a year after construction activities cease. No adverse long-term impacts to non-motile or motile benthic invertebrates are anticipated.

(3) Effects on Nekton: No adverse impacts to nektonic species are anticipated.

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- (4) Effects on Aquatic Food Web: No adverse long-term impact to any trophic group in the food web is anticipated.
- (5) Effects on Special Aquatic Sites: There are no hardground or coral reef communities located in the immediate area that would be impacted by disposal activities. **Chapter 4** of the integrated GRR/EIS offers a more detailed discussion on impacts.
- (6) Threatened and Endangered Species: Appropriate measures to avoid, minimize, and mitigate for impacts to listed species are being fully coordinated with NMFS and USFWS. Beneficial reuse of the dredge material will minimize effects to delta smelt by contributing to the Cullinan Ranch and Montezuma Wetland sites to improve habitat for delta smelt.
- (7) Other Wildlife: No adverse impacts to small foraging mammals, reptiles, or wading birds, or wildlife in general are expected. Beneficial reuse of the dredge material is expected to improve the habitat for several species.
- (8) Actions to Minimize Impacts: Minimization efforts by the Corps include working within the listed species construction windows, using a clamshell dredge, and beneficially reusing the disposal material. Other BMPs along with terms and conditions associated with ESA Biological Opinions would be followed.

f. Proposed Disposal Site Determinations

- (1) Mixing Zone Determination: No adverse impacts related to depth, current velocity, direction and variability, degree of turbulence, stratification, or ambient concentrations of constituents are expected from implementation of the project.
- (2) Determination of Compliance with Applicable Water Quality Standards: All applicable water quality standards would be met upon placing the material at the beneficial reuse sites.
- (3) Potential Effects on Human Use Characteristic
 - (a) Municipal and Private Water Supply: The project will result in minor and insignificant changes to salinity at the nearest Delta water utility intake pump stations as detailed in Section 4.6 of Chapter 4 of the EIS/EIR.
 - (b) Recreational and Commercial Fisheries: Fishing in the immediate construction area would be prohibited during construction. Otherwise, recreational and commercial fisheries would not be impacted by the implementation of the project.

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- (c) Water Related Recreation: No long term impact. Water related recreation in the immediate vicinity of construction would be prohibited during construction activities. This would be a short-term impact.
- (d) Aesthetics: The existing environmental setting would not be adversely impacted. Construction activities would cause a temporary increase in noise and air pollution caused by equipment as well as some temporary increase in turbidity. These impacts are not expected to adversely affect the aesthetic resources over the long term and once construction ends, conditions would return to pre-project levels.
- (e) Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves: No such designated sites are located within the project area.

g. Determination of Cumulative Effects on the Aquatic Ecosystem: There would be no cumulative effects that result in a major impairment in water quality of the existing aquatic ecosystem resulting from the deepening, dredging, or placement of material.

h. Determination of Secondary Effects on the Aquatic Ecosystem: There would be no secondary impacts on the aquatic ecosystem as a result of the deeper channel, dredging, or material placement.

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge

a. Adaptation of the Section 404(b)(1) Guidelines to this Evaluation: No significant adaptations of the guidelines were made relative to this evaluation.

b. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem: No practicable alternative exists which meets the study objectives. Further, no less environmentally damaging practical alternatives to the proposed actions exist because the material will be used to benefit the environment by adding to the creation of wetland areas. The no action alternative would allow the present condition of the channel to need maintenance dredging at increased frequency compared to the preferred alternative.

The maintenance requirements of the completed project are not expected to substantially differ from the existing 35-foot project. The estimated future O&M volumes include approximately 351,000 CY biannually for Pinole Shoal, and 55,000 CY annually for Bull's Head Reach (including the sediment trap). Maintenance material dredged from the existing channel would be placed in the existing SF-10 and SF16 while material removed from the deepening project would be placed onto the beneficial reuse sites. The LTMS study completed in April, 2015 Action is to continue maintenance dredging the federal navigation channels in the San Francisco Bay. Specifically, the Main Ship, Pinole Shoal, Outer Richmond, and Suisun Bay Channels will be dredged annually using a hopper dredge. In instances where a hopper dredge is not available, a

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mechanical dredge may be used for these channels. Richmond Inner, Oakland Inner and Outer Harbor, and Redwood City will be dredged annually using a mechanical dredge. Petaluma River Channel, Napa River Channel, San Rafael Creek, San Leandro Marina, and San Bruno Shoal will be maintained every 4 to 10 years during the 10-year planning period. Dredged material will be placed at the respective project's federal standard, or at a site secondary site, as discussed under the Proposed Action in the EA (April 2015). Consequently, this Section 404 (b)(1) Evaluation focuses on the impacts associated with the discharge of dredged or fill material that would occur during construction of the 38-foot project.

c. Compliance with Applicable State Water Quality Standards: After consideration of disposal site dilution and dispersion, the discharge of dredged materials would not cause or contribute to, violations of any applicable State water quality standards.

d. Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 Of the Clean Water Act: The discharge operation would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

e. Compliance with Endangered Species Act of 1973: The disposal of dredged material would not jeopardize the continued existence of any species listed as threatened or endangered or result in the likelihood of destruction or adverse modification of any critical habitat as specified by the Endangered Species Act of 1973, as amended. Deepening the channel may result in displacement of the state endangered longfin smelt and the federally endangered delta smelt. However, placing the dredged material onto the beneficial reuse sites will offset impacts by restoring tidal marsh habitat for these species, and also increasing the input of nutrients and food into adjacent open water habitat.

f. Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972: No marine sanctuaries are located within the project area.

g. Evaluation of Extent of Degradation of the Waters of the United States: The deepening and/or the placement of dredged material would not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic species and other wildlife would not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values would not occur.

h. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem: The placement of material onto beneficial reuse sites minimizes the environmental impact as much as possible.

i. On the basis of the guidelines, the proposed dredging and disposal sites are specified as complying with the requirements of these guidelines.

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Appendix G – Attachment 2
Coastal Zone Management Act Evaluation

San Francisco Bay to Stockton Navigation Improvement Project

Coastal Zone Management Act Evaluation

Introduction

The USACE planning project, titled the San Francisco Bay to Stockton Navigation Improvement Project is considering deepening of the shipping channel, which includes the John F. Baldwin Ship Channel from the Golden Gate to Avon.

The planning process and environmental effects of each alternative are discussed in the GRR/EIS, in Chapters 3 (alternatives) and 4 (environmental effects). The Tentatively Selected Plan (proposed action) is to deepen 10.3 miles of Pinole Shoal Channel (STA 0+00 to STA 547+00), in San Pablo Bay, and the 2.9 miles in the portion of Suisun Bay Channel at the eastern extremity of the Carquinez Strait, Bulls Head Reach (STA 0+00 to STA 62+00 and STA 88+00 to STA 160+00). The affected channels are in the Commission's Bay and Suisun Marsh jurisdictions of the Coastal Zone.

Regulatory Background

The following is excerpted from the San Francisco Bay Plan (Bay Plan), the main document outlining the Commission's coastal zone policies.

"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 Commission was one of the first agencies to participate in the federal program. In February 1977, the U.S. Department of Commerce approved the Commission's coastal management program for the San Francisco Bay segment of the California coastal zone. The Commission's coastal management program is based on the provisions and policies of the McAteer-Petris Act, the Suisun Marsh Preservation Act of 1977, the San Francisco Bay Plan, the Suisun Marsh Protection Plan, and the Commission's administrative regulations.

"Under the Coastal Zone Management Act, federal agencies are generally required to carry out their activities and programs in a manner "consistent" with the Commission'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 Commission then has the opportunity to review the consistency determinations and certifications and to either concur with them or object to them. The Commission's decisions on federal consistency matters are governed by the provisions of the Coastal Zone Management Act and the Department of Commerce regulations. Four different and distinct consistency requirements exist, each applying to a different kind of situation.

"1. A federal activity that directly affects land or water uses within the coastal zone must be consistent to the maximum extent practicable with the coastal management program.

"2. A federal development project located within the coastal zone must be consistent to the maximum extent practicable with the coastal management program.

“3. A project that affects land or water uses located within the coastal zone and that requires a federal permit, license, or other authorization must comply with and be conducted in a manner that is fully consistent with the coastal management program.

“4. A state or local project that affects land or water uses within the coastal zone and that is supported by federal financial assistance must comply with and be conducted in a manner that is fully consistent with the coastal management program.”

The proposed action is a federal activity directly affecting water uses within the coastal zone and must be consistent to the maximum extent practicable with the coastal management program. This evaluation considers each of the policy categories in the Bay Plan and the Suisun Marsh Protection Plan to determine whether the policy is applicable to the proposed action and, if applicable, whether the proposed action is consistent with the Commission’s policy.

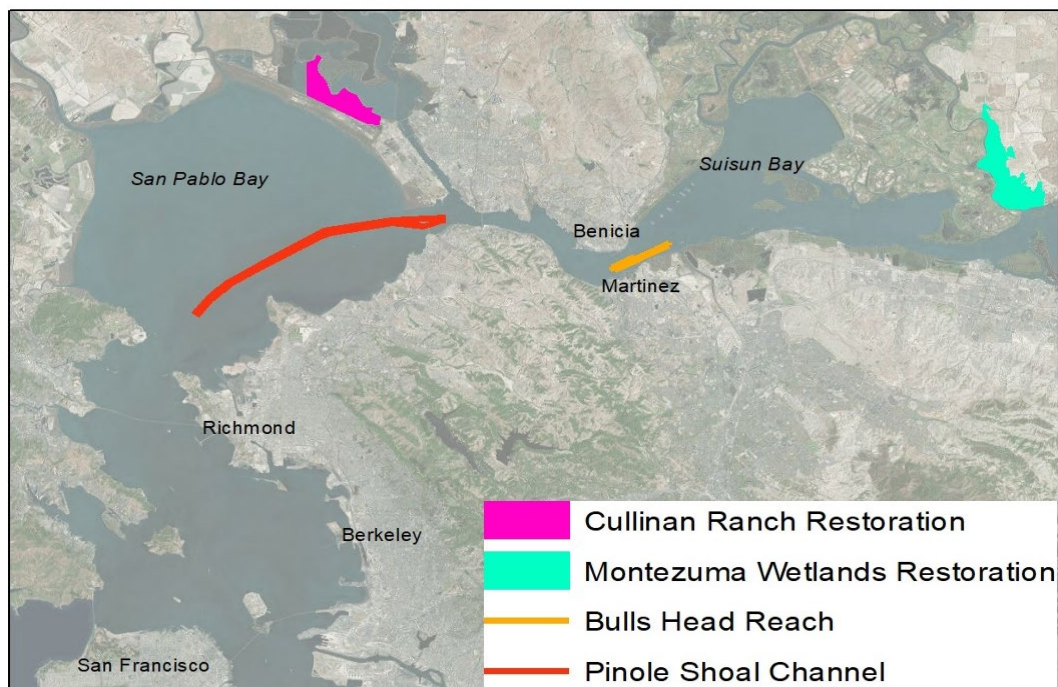


Figure 1. Proposed Action Features (channels to be deepened and restoration sites for dredged material placement).

CZMA Evaluation

Proposed Action Overview

The Tentatively Selected Plan/Proposed Action is to deepen and widen only the existing side slopes within the federally maintained shipping channels in San Pablo Bay and the Bull’s Head Reach portion of Suisun Bay. The economic analysis performed by USACE has determined that the cost of deepening these channels is offset by benefits to the national economy (see

Appendix D, Economics). Deepening the channel will allow ships to transit the channels more heavily loaded, and is intended to provide the economic benefits of increased shipping volume and minimized ship traffic.

Specific elements of the proposed action are as follows:

- Deepen the existing Pinole Shoal Channel and the Bulls Head Reach of the Suisun Bay Channel from -35 feet to -38 feet mean lower-low water (MLLW). Approximately 13.2 miles of channel will be deepened allowing shipping (Panamax) vessels to transit the channels carrying heavier loads.
- Dredge a 2,600 foot sediment trap at Bulls Head Reach with a depth of -42 feet MLLW, plus 2 feet of overdepth. The sediment trap will alleviate the need for emergency maintenance dredging to assure the authorized depth for Panamax type vessels in the channels.
- Level the rock outcropping located to the west of Pinole Shoal from a peak of -39.7 feet MLLW to -43 feet MLLW.
- Use dredged material at previously permitted beneficial reuse sites.

The project depth of -38 ft MLLW was selected as the alternative with the greatest net National Economic Development benefits that is environmentally acceptable. The TSP/proposed action includes using the dredged sediment from deepening the navigation channels to restore tidal marsh habitat at Cullinan Ranch Tidal Restoration Project and Montezuma Wetlands Restoration Project (both existing and permitted sites). Rock fragments from leveling the rock outcropping would be sidecast (deposited in the adjacent open water area of the Bay). The table below provides quantities and characteristics of the dredged material and where it will be placed.

Summary of Consistency with San Francisco Bay Plan

Fill

The proposed action is consistent with the Bay Plan's policies regarding fill of the Bay. Deepening of the existing deep draft channels would add volume to the open water area of the Bay because the dredged sediments would not be placed in the Bay. Dredged sediment would be used to restore tidal marsh sites in the Bay and Delta, and the rock fragments from leveling the rock outcropping, estimated to total 40 CY, would be sidecast.

Dredging

The proposed action is consistent with the Commission's dredging policies. The second major proposal listed in the Bay Plan is to deepen shipping channels from the Golden Gate to the Delta if they limit marine terminal activity and are economically and environmentally acceptable.

In its discussion of dredging, the Bay Plan finds that "dredging is often necessary to provide and maintain safe navigation channels and turning basins with adequate underkeel clearance." The proposed deepening of the Pinole Shoal and Bulls Head Reach channels is meant to allow safe

passage of existing Panamax vessels by providing the required underkeel clearance when they are more fully loaded. The deeper channels allow for the ships to be more heavily loaded, which is expected to result in a reduction in the number of vessel transits through the channels (see Appendix D, Economics).

The Commission's policies, consistent with the Long Term Maintenance Strategy (LTMS), include the goal of limiting in-Bay disposal volume at one million cubic yards per year. The proposed action is to either place the dredged material from deepening at Montezuma Wetlands, Cullinan Ranch Tidal Marsh Restoration or a similar, economically feasible, beneficial reuse site.

Water Quality

The proposed action is consistent with the Commission's water quality policies. Deepening will temporarily increase turbidity. Concentration of resuspended sediment typically reduces to near background levels within several hundred feet of dredging (Palermo et al 1990). The turbidity plume from dredging the navigation channels is expected to dissipate before reaching the closest eelgrass or shellfish beds.

The increased turbidity can lead to increased nutrient levels in the water column and temporarily change other water quality parameters such as dissolved oxygen (DO) and pH. Results of sediment sampling of Pinole Shoal and Bulls Head Reach (at depths equal to or greater than the proposed depth) have not shown levels of pollutants high enough to cause significant changes to water quality in the Bay, or prohibit the use of the dredged material for beneficial reuse as either wetland foundation or wetland cover material (ECM 2014; Lee 2000; Kohn et al. 1991; Kohn et al. 1993; Kohn et al. 1994; Word and Kohn 1990). Confirmatory testing on the dredged sediment will be completed during Preconstruction, Engineering, and Design (PED).

Extensive modeling was completed to evaluate the effect of the proposed action on salinity intrusion into the Delta (Appendix B, Attachment 1 Salinity Modeling Report). USACE performed hydrodynamic modeling that considered both hydrologic (climatic) conditions and water project operations to predict the effect of the proposed action on salinity and has determined that salinity intrusion will not increase significantly as a result of the proposed action. USACE recognizes that significant increase of salt intrusion into the Delta would not only affect fish and wildlife in the Commission's jurisdiction, it would also cause problems for freshwater intakes and diversions for water supply. The proposed action provides economic benefits while minimizing the effect on salinity intrusion.

Detailed Evaluation of Consistency with Bay Plan and Suisun Marsh Protection Plan

A detailed evaluation was completed based on the complete list of categories of policies in the Bay Plan and Suisun Marsh Protection Plan. A few categories of non-applicable policies have been combined under one heading.

Consistency Evaluation with San Francisco Bay Plan

The Bay as a Resource:

Fish, Other Aquatic Organisms and Wildlife

The Commission's policies for protecting and conserving fish, other aquatic organisms and wildlife include conserving, restoring and increasing tidal marsh, tidal flats, and subtidal habitats. The proposed action is not a habitat restoration project. The proposed action is to deepen existing navigation channels in the Bay. Dredged materials from deepening will be placed at existing/permitted sites to benefit tidal marsh restoration.

The proposed action could, depending on dredging technique of the successful contractor bid, result in "taking" of some fish, other aquatic organism or wildlife species listed as endangered or threatened (T&E species). Due to the existing depths of the channels to be deepened, there are no T&E plant species that will be affected. Dredging will be conducted during environmental work windows, as well as using clamshell dredges, as established in the LTMS to minimize the potential for adverse effects on T&E fish species. The proposed project is in coordination with the USFWS and NMFS. The proposed action is consistent with this policy.

Water Quality

Deepening the navigation channels will temporarily increase turbidity. Concentration of resuspended sediment typically reduce to near background levels within several hundred feet of dredging (Palermo et al 1990). The turbidity plume from dredging the navigation channels is expected to dissipate before reaching the closest eelgrass or shellfish beds. **Figures 2 and 3** show the locations of shellfish and eelgrass beds relative to the Pinole Shoal Channel.

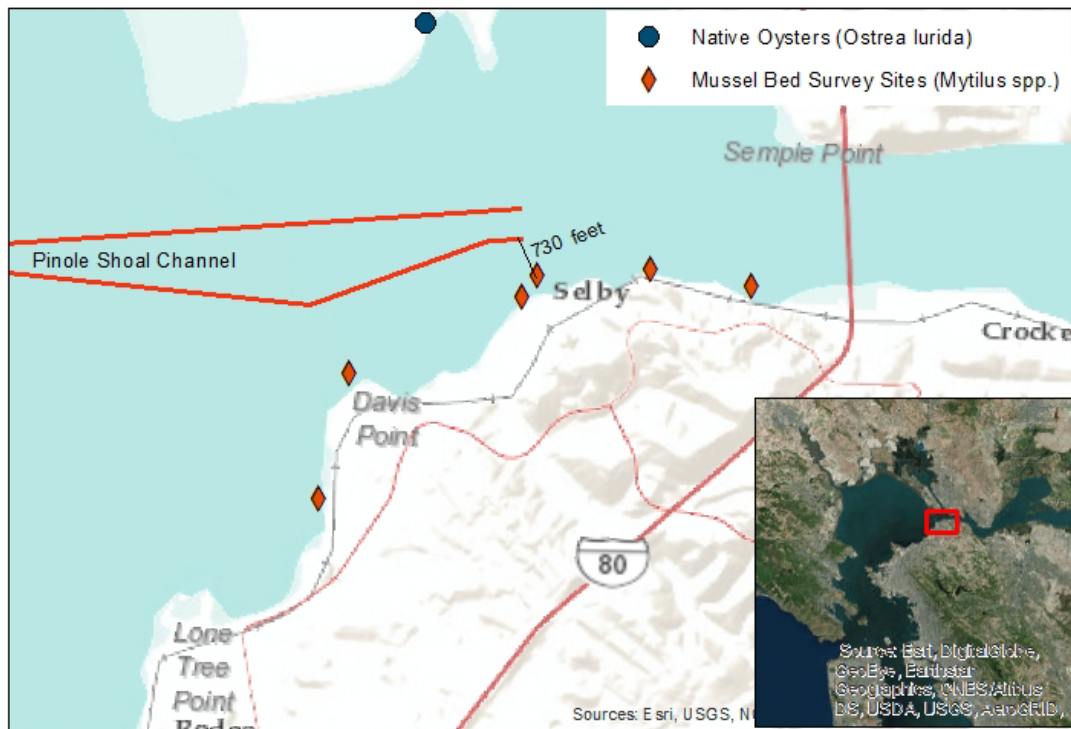


Figure 2. Location of Shellfish Beds. (Data from Subtidal Habitat Goals Report)

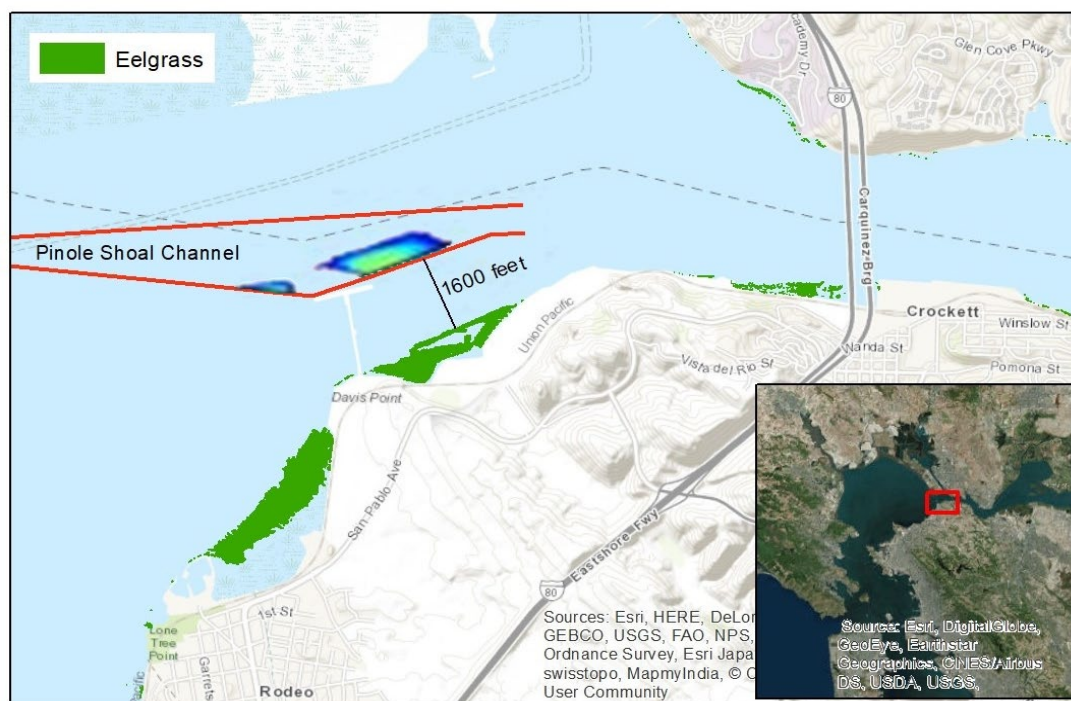


Figure 3. Location of known Eelgrass Beds According to 2014 Survey.

Increased turbidity can lead to increased nutrient levels in the water column and temporarily change other water quality parameters such as dissolved oxygen (DO) and pH. Results of sediment sampling of Pinole Shoal and Bulls Head Reach (at depths equal to or greater than

the proposed depth) have not shown levels of pollutants high enough to cause significant changes to water quality in the Bay, or prohibit the use of the dredged material for beneficial reuse as either wetland foundation or wetland cover material. (ECM 2014; Lee 2000; Kohn et al. 1991; Kohn et al. 1993; Kohn et al. 1994; Word and Kohn 1990). Confirmatory testing will be completed during the PED phase of the project. A Water Quality Certification under Section 401 of the Clean Water Act will be obtained for the proposed action. The proposed action is consistent with the Commission's water quality policies.

Water Surface Area and Volume

Placement of dredged material from deepening will not reduce water surface area and would nominally increase the volume of the Bay, which is consistent with the policy of increasing the volume of water in the Bay when possible.

Hydrodynamic simulations of flow, stage and salinity were performed to assess the effects of the proposed action on salinity in the Bay and Delta. Water circulation and tidal action were simulated with existing bathymetry (including existing deep-draft channels) and with the proposed deepened channels and sediment trap. The modeling predicted that the proposed action would not have a significant effect on water circulation and tidal action (See Appendix B Water Resources, Attachment 1 Salinity Modeling Report). The proposed action is consistent with the Commission's policies regarding Bay water surface area and volume.

Tidal Marshes and Tidal Flats

The proposed project would have no negative effect on tidal marshes or tidal flats. Dredged material from deepening will be placed at tidal marsh restoration sites, which would be consistent with the goals, findings and policies of the Bay Plan. The proposed action is consistent with the Commission's tidal marshes and tidal flats policies.

Smog and Weather

The policy of the Commission regarding smog and weather is concerned with the effect that the Bay has on climate of the Bay Area. The Commission's smog and weather policy is to maintain to the greatest extent feasible, the remaining water volume and surface area of the Bay. Infill of the Bay is not a feature of the proposed action. The proposed action is consistent with the Commission's policies regarding smog and weather.

Shell Deposits

The turbidity plume from deepening will not have a significant effect on shellfish beds (mussels or oysters) (see **Figure 2**). The proposed action is consistent with the Commission's shell deposits policies.

Freshwater Inflow

Diversion of fresh water is not a feature of the proposed action and therefore will have no effect on freshwater inflow. The proposed action is consistent with the Commission's freshwater inflow policies.

Subtidal Areas

The Commission's policies pertaining to subtidal areas (shallow and deep land and water below mean low tide) are related to avoidance of filling, dredging or changing use of subtidal areas that have an abundance and diversity of fish, other aquatic organisms and wildlife (e.g. eelgrass beds, sandy deep water or underwater pinnacles), and policies related to restoration of subtidal areas. The Pinole Shoal Channel is an existing deep-draft channel, which is promoted in the Bay Plan because of its regional economic benefits.

The proposed action will change the Bay's bathymetry by deepening the existing navigation channel. The channel does not contain special status submerged vegetation or aquatic habitat, and it is not a restoration project. The rock outcrop that will be removed from Pinole Shoal channel currently does not protrude above the bottom sediment, and so does not provide cover or habitat for fish.

Mapping of natural resources available from San Francisco Estuary Institute (SFEI) includes eelgrass beds and wetland types. Based on the most recent Bay wide eelgrass survey available (2014), the submerged eelgrass bed closest to Pinole Shoal Channel is approximately 1,600 feet from the channel to the east of the wharf at Davis Point (Phillips 66, Oleum Dock in Rodeo) (**Figure 3**). In contrast to previous surveys, the 2014 survey¹ was conducted with interferometric sidescan sonar. Deepening of Pinole Shoal Channel will not negatively affect this submerged eelgrass bed. The proposed action is consistent with the Commission's policies pertaining to subtidal areas.

Development of the Bay and Shoreline:

Climate Change

The Commission's climate change policies address sea level rise, shoreline flooding and flood protection. No shoreline development is included in the proposed project, and therefore, the proposed action is consistent with the Commission's policies regarding climate change.

Safety of Fills

The Commission's policies regarding construction on filled lands are not applicable to the proposed action because the proposed action does not include any construction on filled lands within the Bay and would not create risks for any marine petroleum terminal structures.

Shoreline Protection

The proposed action does not include any shoreline protection features and is not expected to have a negative effect on existing shoreline protection features by increasing erosion. Therefore, the proposed action is consistent with the Bay's policies.

¹ Performed in October 2014 by Merkel & Associates for NOAA Fisheries

Dredging

The second major proposal listed in the Bay Plan is to deepen shipping channels from the Golden Gate Bridge to the Delta if they limit marine terminal activity and are economically and environmentally acceptable. In its discussion of dredging, the Bay Plan finds that “dredging is often necessary to provide and maintain safe navigation channels and turning basins with adequate underkeel clearance” (Dredging finding b). The proposed deepening of the Pinole Shoal and Bulls Head Reach channels is meant to allow safe passage of Panamax vessels by providing the required underkeel clearance when they are more fully loaded. The deeper channels and more heavily loaded ships are expected to result in a reduction in vessel transits.

The Commission’s policies, consistent with the LTMS, include the goal of limiting in-Bay disposal volume at one million cubic yards per year. The proposed action is to either place the dredged material from deepening at Montezuma Wetlands, Cullinan Ranch Tidal Marsh Restoration or a similar, economically feasible, beneficial reuse site.

The proposed action is consistent with the Commission’s dredging policies.

Water-Related Industry

The proposed action is consistent with the Commission’s water-related industry policies. The Bay Plan recognizes that “navigable, deep water sites around the Bay are unique and limited resource and should be protected for uses requiring deep draft ship terminals, such as water-related industries and ports.” The proposed action is to improve accessibility to water-related industries by deepening channels transited by Panamax type ships. Deepening, by allowing ships to transit the channels more heavily loaded, is intended to increase shipping volume per transit and reduce ship traffic.

Ports

The proposed action is consistent with the Commission’s policies pertaining to ports, which is based on the Seaport Plan developed jointly by the Commission and the Metropolitan Transportation Commission (MTC). The Commission finds that “deeper shipping channels will be needed to preserve and enhance the standing of the Bay Area as a major world harbor and to keep pace with changes in shipping technology.” The proposed action is intended to improve the efficiency of vessels when transiting to and from marine terminals.

Airports

The Commission’s policies pertaining to airports are not applicable to the proposed action.

Transportation

The proposed action does not create an incentive to fill open-water areas of the Bay for new transportation infrastructure. The proposed action is consistent with the Commission’s policies regarding transportation on and around the Bay.

Commercial Fishing

The Commission's policies pertaining to commercial fishing, shellfishing, and mariculture in the Bay are not applicable to the proposed action.

Recreation

The proposed action to deepen the existing navigation channels would not change any portion of the Bay from its existing use. Beneficial use of the dredged materials in restoration of tidal marsh at sites such as Montezuma Wetlands and Cullinan Ranch would contribute to improvement of recreational opportunities in the Bay region. The proposed action is consistent with the Commission's policies regarding recreational facilities.

Public Access

The Commission's public access policies are not applicable because the proposed action will not alter public access to the Bay.

Appearance, Design, and Scenic Views

The Commission's policies regarding appearance, design and scenic views of development are not applicable to the proposed action.

Salt Ponds

The Commission's policies pertaining to salt ponds are not applicable because the proposed action will have no effect on existing natural or man-made salt ponds nor will it create any salt ponds.

Managed Wetlands

The Commission's managed wetlands policies are not applicable because there are no managed wetlands within the area of proposed dredging/deepening. The Bay Plan defines managed wetlands as "areas of historical tidal marshes that have been diked off from the Bay and are managed for wildlife, primarily waterfowl."

Other Uses of the Bay and Shoreline

The Commission's other uses of the Bay and shoreline policies are not applicable because the proposed action would not affect houseboats, desalination plant intakes, high voltage transmission or telephone lines, sewage treatment or wastewater reclamation plants, power plants, pipeline terminal and distribution facilities.

Fills in Accord with the Bay Plan

The Commission's policies on fills in accord with the Bay Plan are not applicable because the proposed action does not include fills in areas designated on Bay Plan maps for ports, water-related industry, water related recreation airports, roads, utility routes, shoreline improvements, or public access.

Fill for Commercial Recreation, Public Assembly and Public Trust Uses

The Commission's policies on fills for bay-oriented commercial recreation and bay-oriented public assembly on privately-owned or publicly-owned property are not applicable to the proposed action, nor are policies on fill for public trust uses on publicly-owned property granted in trust to a public agency.

Mitigation

In the USACE's planning process, the proposed action (with the proposed project depth) was selected as the alternative with the greatest net National Economic Development benefits that is environmentally acceptable.

The proposed action provides economic benefits while minimizing the potential for negative environmental effects, including effects related to salinity intrusion. USACE performed hydrodynamic modeling that considered both hydrologic (climatic) conditions and water project operations to predict the effect of the proposed action on salinity and has determined that salinity intrusion will not increase significantly as a result of the proposed action (Appendix B Water Resources, Attachment 1 Salinity Modeling Report). USACE recognizes that significant increase of salt intrusion into the Delta would not only affect fish and wildlife in the Commission's jurisdiction, it would also cause problems for freshwater intakes and diversions for water supply.

The distance in kilometers from the Golden Gate Bridge to the tidally-averaged near-bed 2-psi isohaline, known as X2, is the standard for how far salinity is penetrating into the Delta. Output from hydrodynamic simulations was used to predict the change in X2 by comparing simulations with the same hydrologic conditions and water project operations, one with existing bathymetry and one with the proposed deepened channels. Hydrologic conditions for a critical water year (2014), a below normal water year (2012), and a wet water year (2011) were simulated.

The hydrodynamic simulations predicted that the deepened channels would cause annual-average X2 to increase by 558 feet (170 m) upstream for a critical water year and existing water project operations. For a critical water year and the same (existing) water project operations, simulations that included sea level rise of 2.38 feet (0.73 m) predicted that the increase in X2 attributable to the deepened channels would be the same, 558 feet (170 m). During the wet water year and existing water project operations the deepened channels would cause annual-average X2 to increase by 886 feet (270 m), and during a below normal water year the annual-average X2 was predicted to increase by 689 feet (210 m).

The predicted maximum monthly change at any intake or export locations in the Delta was 1.5% of the allowable Cl⁻ concentration based on D-1641 water quality objective of 250 mg/L Cl⁻ concentration at the municipal water intakes during Year 0 conditions with existing water operations and 3.0% of the allowable Cl⁻ concentration under Year 50 conditions which included sea level rise with existing water operations.

The proposed action includes beneficial reuse of dredged material to offset the minimal effects due to the deepening. Using the material to contribute to restoration within the Bay minimizes the effects to the extent practicable, and therefore, no compensatory mitigation is expected due to this project. The proposed action is consistent with the Commission's mitigation policies.

Public Trust

Deepening the existing channels is consistent with trust uses, one of which is navigation. The proposed action is consistent with the Commission's public trust policies.

Navigational Safety and Oil Spill Prevention

Deepening the channel and removing the rock outcrop are intended to promote navigational safety of deep-draft vessels in the shipping channels. The proposed action is consistent with the Commission's navigational safety and oil spill prevention policies.

Consistency with Suisun Marsh Protection Plan

Most of the federally maintained navigation channels in Suisun Bay fall under the jurisdiction of the primary management area of the Commission's Suisun Marsh Protection Plan. The proposed action is to deepen only the westernmost portion of the Suisun Channel, called Bulls Head Reach with a length of about 15,983 feet.

Environment

Deepening the Bulls Head Reach, an element of the proposed action, will not affect the nearby tidal marsh and managed wetlands along the coastline of Solano County to the north. The proposed action is consistent with the Suisun Marsh Protection Plan.

Water Supply and Quality

Deepening the Bulls Head Reach will not have a significant effect on the salinity, turbidity, temperature or pollution levels in the Marsh. Hydrodynamic modeling of the proposed action predicts an insignificant increase in salinity in the Marsh (see Appendix B Water Resources, Attachment 1 Salinity Modeling Report). The proposed action is consistent with the Suisun Marsh Protection Plan.

Natural Gas Resources

The proposed action does not conflict with the Commission's natural gas resources policies because it would have no effect on the natural gas geologic formations several thousand feet below the tidal marshes. The proposed action is consistent with the Suisun Marsh Protection Plan.

Utilities, Facilities and Transportation

The proposed action will cause minor, localized, disruption to the Marsh ecosystem at the time of construction, but will have no lasting effects on wildlife by forming barriers and obstacles to their movement and will not stimulate urban development. The proposed action is consistent with the Commission's policies on utilities, facilities and transportation.

Recreation and Access

Deepening of the existing channel at the southwest extremity of the primary protection area would not deter recreation or access to the Marsh. The proposed action is consistent with the Commission's policies on recreation and access.

Water-Related Industry

The proposed action would improve navigation access to the Benicia water-related industry site and is consistent with the Commission's policies on water-related industry.

Land Use and Marsh Management

The proposed action would not convert any Marsh habitat to any other uses. The proposed action is consistent with the Commission's policies that, within the Marsh, existing land uses should continue and wetlands should be restored.

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SAN FRANCISCO BAY TO STOCKTON NAVIGATION IMPROVEMENT PROJECT
Draft General Reevaluation Report and Environmental Impact
Statement/Environmental Impact Report

Appendix G – Attachment 3
Regulatory Settings

This appendix lists applicable federal, state, and local laws, regulations, and plans that influence the implementation of water and related land projects in the study area. This proposed project is in compliance or will be in compliance upon circulation of the draft NEPA/CEQA document and once all permits are received. The resource categories are mirrored as written in Section 2 and Section 4 of the main draft GRR/EIS/EIR. The study area is situated within the San Francisco region of California and is subject to both federal and California state laws and regulations. All references are located in the main report.

Regulatory Settings for Resources within the Study Area

1.1 Geology and Seismicity

1.1.1 Federal Regulatory Setting

USACE Coastal Engineering Manual. The USACE Coastal Engineering Manual (USACE 2015a) provides a single, comprehensive technical document that incorporates tools and procedures to plan, design, construct and maintain coastal projects. The engineering manual includes the basic principles of coastal processes, methods for computing coastal planning and design parameters, and guidance on how to formulate and conduct studies in support of coastal flooding, shore protection and navigation projects. The manual includes sections related to dredging and disposal. Dredging and construction along the shoreline and at placement sites would comply with these standards.

National Earthquake Hazards Reduction Program. Under the National Earthquake Hazards Reduction Program, four federal agencies have responsibility for long-term earthquake risk reduction: the USGS, the National Science Foundation, FEMA, and the National Institute of Standards and Technology. These agencies assess U.S. earthquake hazards, deliver notifications of seismic events, develop measures to reduce earthquake hazards, and conduct research to help reduce overall vulnerability to earthquakes. The analyses discussed in this report are supported by assessments developed through the National Earthquake Hazards Reduction Program, including seismic hazard maps.

1.1.2 State Regulatory Setting

California Code of Regulations (CCR): Title 23, Division 1, Article 8, Sections 111 137. These standards govern the design and construction of encroachments that would affect flood control works and floodways, including limitations or approval requirements for placement of dredge material and channel excavation. Dredging of material from channel waterways generally must be confined to the area beyond 100 feet of the toe of the bank, and the slope of the “borrow” perimeter nearest the toe of the bank generally may not exceed five feet horizontal to one-foot vertical. Before any “borrow” operation (including dredging) is permitted within one mile of a bridge or 1,000 feet of any pipeline or cable crossing beneath any channel, a study must be submitted to show that the “borrow” operation will not adversely affect such facilities. Since habitat restoration placement sites have already been approved, placement standards under these regulations are not analyzed herein.

1.1.3 Local Regulatory Setting

City and County General Plans. City and county General Plans identify geologic hazards and associated policies at the local level. This includes identification of geologic and seismic hazard zones, often developed using state and federal hazard maps supplemented with local studies and investigations. General Plans typically establish policies and goals for minimizing geologic and seismic hazards, requirements to adhere to state and federal building standards, and requirements for supplemental geotechnical investigations or approvals for projects in identified seismic hazard areas. General Plans that would apply to the study area include those developed for the counties of Contra Costa, Marin, Solano, Sacramento and San Joaquin and the cities of Richmond, Pinole, Hercules, Martinez, Tiburon, Vallejo, Benicia, Pittsburg, Antioch, Oakley and Stockton. Dredging activities would occur in federal waters outside of these plan areas. Placement of dredge material would need to occur in consideration of policies contained in these plans.

1.2 Sediment and Sedimentation

1.2.1 Federal Regulatory Setting

Dredged Material Management Office Review. The Dredged Material Management Office (DMMO) is a joint program led by the USACE, and staffed by representatives from the USACE, USEPA, San Francisco Bay Conservation and Development Commission, San Francisco Bay Regional Water Quality Control Board (RWQCB) and California State Lands Commission (CSLC). Participating agencies include the California Department of Fish and Wildlife (CDFW), the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). The DMMO was established in 1998 as part of the Long-Term Management Strategy (LTMS) program to streamline the permitting processes for dredging projects in the San Francisco Bay. The purpose of the DMMO is to cooperatively review sediment quality sampling plans, analyze the results of sediment quality sampling, and make suitability determinations for material proposed for placement in San Francisco Bay, beneficially reused, or disposed offshore. All testing is done pursuant to applicable requirements such as the Inland and Ocean Testing Manuals, and other relevant requirements.

As such, the DMMO provides the basis for uniform federal and state dredged material disposal policies and regulations. The process for obtaining approvals for dredging or dredged material disposal has three phases: (1) suitability determination, (2) permit processing, and (3) episode approval. Applicants must submit results from recent sediment testing or submit sufficient data to support a finding by the agencies as to whether sediments are suitable for placement in the proposed disposal environment. The applicant must submit the sampling results to the DMMO for review, which then makes a determination about where the materials can be disposed.

Although the DMMO provides initial review of permit applications, applicants must eventually obtain separate approval from the appropriate DMMO member agencies as required. Those approvals include:

- DMMO review of the sediment characterization and approval to dispose or beneficially reuse material and meets the requirements for disposal site alternatives analyses under the CWA Section 404 and Section 103 of the Marine Protection Research and Sanctuaries Act.

- A water quality certification or a waiver, as required under Section 401 of the CWA from the RWQCB for dredging in the study area.
- For Civil Works projects, a federal consistency determination under CZMA is required from the San Francisco Bay Conservation and Development Commission.
- The USACE follows the Agreement on Programmatic Essential Fish Habitat Conservation Measures for Maintenance Dredging Conducted under the LTMS Program (USEPA and USACE 2011). Per the Agreement on Programmatic Essential Fish Habitat, if residual layer contamination exposed after maintenance dredging is greater than that in the overlying sediment and exceeds the bioaccumulation trigger values established, consideration of the need for potential management actions to address the residual contamination would be made on a case-by-case basis.

USACE Coastal Engineering Manual. The USACE Coastal Engineering Manual (USACE 2002) provides a single, comprehensive technical document that incorporates tools and procedures to plan, design, construct, and maintain coastal projects. The engineering manual includes the basic principles of coastal processes, methods for computing coastal planning and design parameters, and guidance on how to formulate and conduct studies in support of coastal flooding, shore protection and navigation projects. The manual includes sections related to dredging and disposal of dredged sediment. Dredging and construction along the shoreline and at ecosystem restoration or placement sites would comply with these standards.

1.2.2 State Regulatory Setting

Beneficial Reuse of Dredged Sediment. In the San Francisco Bay Area, placement of dredged material at upland sites or for beneficial reuse is regulated under California's Porter-Cologne Act and the McAteer-Petris Act. Screening guidance is provided in the San Francisco Bay RWQCB's May 2000 staff summary report, or the most current revised version. There are two levels of screening guidelines for beneficial reuse of sediments for wetland restoration: (1) guidelines for cover material and (2) guidelines for foundation material. The two classes of material are defined as follows:

- **Cover material** is a class of material that is not expected to pose a threat to water quality or to the aquatic environment, even in places where the material is in direct contact with surface waters or aquatic organisms, and is suitable for unconfined aquatic disposal.
- **Wetland foundation material** is not of a quality that constitutes a hazardous or listed waste but has a potential for biological effects if directly exposed to organisms. Wetland foundation material is not expected to be a threat to water quality when an adequate amount of cover material is used to reduce the risk of foundation material coming into contact with the aquatic environment. The amount of cover material needed to adequately reduce this risk depends on site-specific characteristics. Placement of dredged sediment at beneficial reuse sites is also governed by acceptance criteria included in project-specific biological opinions for placement activities that may affect threatened or endangered species.

California Code of Regulations: Title 23, Division 1, Article 8, Sections 111 137. These standards govern the design and construction of encroachments that would affect flood control works and floodways, including limitations or approval requirements for placement of dredged material and channel excavation. Dredging of material from channel waterways generally must be confined to the area beyond 100 feet of the toe of the bank, and the slope of the borrow perimeter nearest the toe of the bank generally may not exceed five feet horizontal to 1-foot vertical. Before any borrow operation (including dredging) is permitted within 1 mile of a bridge or 1,000 feet of any pipeline or cable crossing beneath any channel, a study must be submitted to show that the borrow operation will not adversely affect such facilities. Standards pertaining to placement of dredged material would apply to any future sites used that have not already been subjected to previous environmental evaluations and approved to receive dredged material.

1.2.3 Local Regulatory Setting

City and County General Plans. City and county General Plans identify local policies, studies and investigations, and requirements to adhere to state and federal standards. General Plans that would apply to the study area include those developed for the counties of Contra Costa, Marin, Solano, Sacramento and San Joaquin and the cities of Richmond, Pinole, Hercules, Martinez, Tiburon, Vallejo, Benicia, Pittsburg, Antioch, Oakley, and Stockton.

1.3 Water Quality and Hydrology

1.3.1 Federal Regulatory Setting

Clean Water Act (33 USC § 1257 et seq.). The Clean Water Act (CWA) established the federal structure for regulating surface water quality standards and discharges of pollutants into waters of the U.S. The objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The genesis of the CWA, enacted in 1948, was the Federal Water Pollution Control Act. It was significantly reorganized and expanded in 1972 by the CWA. The CWA requires states to set standards to protect water quality. Specific sections of the CWA control discharge of pollutants and wastes into marine and aquatic environments, as discussed below.

Section 303 – Water Quality Standards and Implementation Plans (Title 40 of the CFR pt. 131.2). This Section of the CWA describes water quality standards as the water quality goals for a particular water body. The water quality goals are the designated uses for the water and the criteria to protect those uses. A water quality standard defines the water quality goals for a water body, or portion thereof, by designating the use or uses to be made of the water, and by setting criteria necessary to protect those uses.

States adopt water quality standards that are approved by USEPA to protect public health or welfare, enhance the quality of water, and serve the purposes of the CWA. To serve the purposes of the CWA, as defined in Sections 101(a)(2) and 303(c), means that water quality standards should, wherever attainable, provide water quality for the protection and propagation of fish, shellfish, and wildlife, and provide water quality for recreation in and on the water. The standards should consider the use and

value of public water supplies, propagation of fish, shellfish, and wildlife, recreation in and on the water, and agricultural, industrial, and other uses including navigation.

The SWRCB administers the water quality standards developed under the CWA and the California Water Code. The SWRCB is required to routinely monitor the condition of water bodies in the state and maintain a list of impaired water bodies having water quality concerns as per Section 303(d) of CWA. The RWQCBs are required to develop measures to restore impaired water bodies.

Section 303(d) – Impaired Water bodies and Total Maximum Daily Loads. Under this Section of the CWA, each state is required to identify those waters within its boundaries that do not meet water quality standards. The state must establish priority rankings for these waters and develop TMDLs to maintain beneficial uses and improve water quality. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards. Seasonal variations in loading and a margin of safety are considered when TMDLs are established. In California, the SWRCB and RWQCBs prepare the CWA Section 303(d) List of Water Quality Limited Segments Requiring TMDLs.

As stated previously, San Francisco Bay is listed as impaired for pesticides (e.g., chlordane, DDT, dieldrin, dioxin, and furan compounds), mercury, invasive species, PCBs, selenium, and trash. In greater San Francisco Bay, Suisun Bay and San Pablo Bay are listed for these same parameters, except for trash (SFBRWQCB 2010). TMDLs have been established for these parameters.

The Delta is listed as impaired for insecticides (i.e., diazinon, chlorpyrifos), pesticides (e.g., chlordane, DDT, dieldrin, mercury, invasive species, PCBs, and selenium). TMDLs have been established for insecticides and pesticides. The Central Valley RWQCB anticipates TMDLs for PCBs, invasive species, and unknown toxicity to be established by 2019 (CVRWQCB 2009).

Section 401 – Water Quality Certification. Under Section 401 of the CWA, Water Quality Certification (WQC) is required for any activity that requires a federal permit or license, and that may result in discharge into navigable waters. To receive certification under Section 401, an application must demonstrate that activities or discharges into waters are consistent with state effluent limitations (CWA Section 301), water quality effluent limitations (CWA Section 302), water quality standards and implementation plans (CWA Section 303), national standards of performance (CWA Section 306), toxic and pretreatment effluent standards (CWA Section 307), and “any other appropriate requirements of State law set forth in such certification” (CWA Section 401).

In California, the authority to grant water quality certification is delegated to the SWRCB, and in the San Francisco Bay area and the Delta, applications for certification under CWA Section 401 are processed by SFBRWQCB and CVRWQCB, respectively. The CWA and USACE regulations (33 CFR § 336.1[a][1]) require USACE to seek state WQC for discharges of dredged or fill material into waters of the U.S. The appropriate RWQCB reviews a proposed project before granting or denying certification.

Section 404 – Discharge of Dredged or Fill Material. Section 404 of the CWA regulates the discharge of dredged or fill material (e.g., fill, pier supports, and piles) into waters and wetlands of the U.S., which includes the San Francisco Bay and Delta. The USACE implements Section 404 of the CWA. Section 404(b)(1) of the CWA establishes procedures for the evaluation of permits for discharge of dredged or fill material into waters of the U.S. In situations where the USACE proposes work that involves discharge

of dredged or fill material into waters of the U.S., the USACE must comply with the requirements of the Section 404(b)(1) Guidelines, although the USACE would not issue a permit for its own activities. Any discharge under Section 404 must also obtain a Section 401 WQC.

Rivers and Harbors Act of 1899. The Rivers and Harbors Act (RHA) of 1899 was the first federal water pollution act in the U.S. that focused on protecting navigation, protecting waters from pollution, and acted as a precursor to the CWA of 1972. Section 10 of the RHA regulates alteration of, and prohibits unauthorized obstruction of, navigable waters of the U.S. The RHA covers construction, excavation, or deposition of materials in, over, or under navigable waters, or any work that would affect the course, location, condition, or capacity of those waters unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army. Original construction of the federal navigation channels that span the study area was authorized under the RHA and by other Congressional authorities. The USACE maintains the navigability of the channels in accordance with their authorized dimensions. The USACE, as the implementing authority of Section 10 of RHA and ensures its work or structures do not impede navigation in waters of the U.S., and, therefore, does not need to issue itself a permit pursuant to Section 10.

Coastal Zone Management Act. The Coastal Zone Management Act (CZMA) of 1972 is the Congressional program for managing the nation's coasts. It was enacted to encourage the participation and cooperation of state, local, regional, and federal agencies and governments with programs affecting the coastal zone, and it is the only environmental program that requires a balance between economic development and resource protection within the coastal zone.

The provisions of the CZMA are administered by the NOAA's Office of Ocean and Coastal Resource Management. The CZMA allows states to develop a Coastal Zone Management Plan in which they define permissible land and water use within the state coastal zone, which extends 3 miles seaward and inland as far as necessary to protect the coastal zone. Federal agencies are required to carry out their activities in such a way that they conform to the maximum extent practicable with a state's Coastal Zone Management Plan. Construction of the navigation improvements are regulated under the CZMA.

For San Francisco Bay, the San Francisco Bay Conservation and Development Commission (BCDC) is the regional coastal zone management agency, and it is responsible for issuing concurrence with federal consistency determinations under the CZMA. The San Francisco Bay Plan (BCDC 2008), first adopted in 1969 and updated in 2011, is BCDC's policy document specifying goals, objectives, and policies for BCDC jurisdictional areas. Pursuant to the federal CZMA, the USACE is required to be consistent to the maximum extent practicable with the enforceable policies of the Bay Plan.

1.3.2 State Regulatory Setting

Porter-Cologne Act. The California Legislature enacted the Porter-Cologne Water Quality Control Act (Porter-Cologne) (SWRCB 2012) in 1969 to preserve, enhance, and restore the quality of the state's water resources. Porter-Cologne established the SWRCB and nine RWQCBs. These agencies are responsible for setting the state's water quality policy, and enforcing ground and surface water quality standards. The Porter-Cologne Act provides for the adoption of water quality control plans to designate beneficial uses of water, set water quality objectives to protect beneficial uses, and provide for a program to achieve those objectives. The plans may include prohibitions against the discharges of

waste or certain types of waste, in specified areas or under specified conditions. The RWQCBs are authorized to issue waste discharge requirements (WDRs) and WQCs for activities that may affect water quality. Dredging and discharge of dredged material throughout the study area would require WDRs under Porter-Cologne, which would be issued by the SFBRWQCB or the CVRWQCB. As the CEQA lead agency, the Port of Stockton must apply for a WDR from the RWQCB.

McAteer-Petris Act. The McAteer-Petris Act (California Government Code Section 66000 et seq.), first enacted in 1965, created BCDC to prepare a plan to protect the San Francisco Bay and shoreline, and provide for appropriate development and public access. The Act directs BCDC to exercise its authority to issue or deny permit applications for placing fill, dredging, or changing the use of any land, water, or structure in the area of its jurisdiction (i.e., San Francisco Bay waters and within 100 feet of the shoreline). The BCDC also carries out determinations of consistency with the CZMA for federally sponsored projects. The Bay Plan is BCDC's policy document specifying goals, objectives, and policies for BCDC jurisdictional areas. Pursuant to the federal CZMA, the USACE is required to be consistent to the maximum extent practicable with the enforceable policies of the Bay Plan.

Local Regulatory Setting D-1641 Water Rights Decision. D-1641, which was passed in 1999, describes the salinity criteria established in the Delta to meet municipal, industrial, agricultural, and biological requirements (SWRCB 2000). D-1641 stipulates salinity requirements as chloride concentration for municipal and industrial uses, and as electrical conductivity (EC) for agricultural and fish and wildlife uses.

Salinity reported as chloride concentration indicates the mass of chloride ion in a unit volume of water (milligrams chloride per liter [mg Cl⁻/L]). It is also reported in psu which represents the ratio of the EC of seawater with respect to a standardized salt solution. EC is reported in millimhos per centimeter (mmhos/cm). EC is a measure of the ability of water to conduct electric currents and is directly proportional to the concentration of ions (i.e., the dissolution product of salts, which includes chloride) in water.

1.3.3 Regional Water Quality Control Plans

Each RWQCB is required to develop, adopt, and implement a Basin Plan for the region. The Basin Plan is the master policy document that contains descriptions of the legal, technical, and programmatic bases of water quality regulation in the region. The plan must include:

- A statement of beneficial water uses that RWQCB will protect;
- The water quality objectives needed to protect the designated beneficial water uses; and
- The strategies and time schedules for achieving the water quality objectives.

The basin plan provides a definitive program of actions designed to preserve and enhance water quality and to protect beneficial uses in a manner that will result in maximum benefit to the people of California. Implementation would be required to comply with the applicable plans of their respective regions. The basin plans applicable to the study area are discussed in the following sections.

San Francisco Bay Basin. The San Francisco Bay Basin Plan is applicable throughout the study area. Water quality objectives specific to San Francisco Bay are contained in SFBRWQCB's Water Quality Control Plan for the San Francisco Bay Basin (San Francisco Bay Basin Plan; SFBRWQCB 2010). The San Francisco Bay Basin Plan identifies measures for protecting beneficial uses of the Bay, water quality objectives, and implementation plans. It also identifies the LTMS strategy as the key process for addressing dredging operations in San Francisco Bay, and for achieving the LTMS goals. The San Francisco Bay Basin Plan implements the LTMS Management Plan by setting a long-term overall target for in-Bay disposal of dredged material at designated disposal sites of 1.25 million cubic yards (or less) per year.

Central Valley Basin. Water quality objectives specific to the Delta are contained in the CVRWQCB's Water Quality Control Plan for the Sacramento River Basin and the San Joaquin River Basin (Central Valley Basin Plan) (CVRWQCB 1998). The Central Valley Basin Plan identifies beneficial uses, water quality objectives, and implementation programs for waters within the Central Valley Basin. The Central Valley Basin Plan is applicable to the study area.

San Francisco Bay/Sacramento-San Joaquin Delta Estuary. The Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (SWRCB 2006) consists of: (1) beneficial uses to be protected; (2) water quality objectives for the reasonable protection of beneficial uses; and (3) a program of implementation for achieving the water quality objectives and standards of the CWA. The plan provides reasonable protection for the estuary's beneficial uses that require control of salinity (caused by saltwater intrusion, municipal discharges, and agricultural drainage) and water project operations (flows and diversions). Most of the plan objectives are implemented by assigning responsibilities to water right holders because the parameters to be controlled are primarily impacted by flows and diversions. The SWRCB will consider, in future water rights proceedings, the nature and extent of water right holders' responsibilities to meet these objectives. Implementation of certain water quality objectives may require action in concert with other agencies. This plan is relevant throughout the study area.

1.4 Air quality

1.4.1 Federal

Clean Air Act (CAA). The CAA and its subsequent amendments form the basis for the national air pollution control effort. The USEPA is responsible for implementing most aspects of the CAA. Basic elements of the act include the National Ambient Air Quality Standards (NAAQS or "national standards") for major air pollutants, hazardous air pollutant standards, attainment plans, motor vehicle emission standards, stationary source emission standards and permits, acid rain control measures, stratospheric ozone protection, and enforcement provisions.

Criteria Pollutants. The 1970 CAA (last amended in 1990) required the USEPA to identify NAAQS, which are the concentrations of pollutants (with an adequate margin of safety) to which the public can be exposed without adverse health effects. They are designed to protect those segments of the public most susceptible to respiratory distress, including asthmatics, the very young, the elderly, people weak from other illness or disease, or persons engaged in strenuous work or exercise. Healthy adults can

tolerate occasional exposure to air pollution levels that are somewhat above ambient air quality standards before adverse health effects are observed. Pursuant to the 1990 CAA amendments, the USEPA classifies air basins (or portions thereof) as “attainment” or “nonattainment” for each criteria air pollutant based on whether or not the NAAQS had been achieved.

Table 1 shows the current national and state ambient air quality standards and the health effects that can result when the standards are exceeded. **Table 2** shows the current attainment status for the SFBAAB, SVAB, and SJVAB. All three air basins are classified as nonattainment for the federal and state ozone and PM_{2.5} standards.

Toxic Air Contaminants (TACs). TACs are regulated under both state and federal laws. Federal laws use the term “Hazardous Air Pollutants” (HAPs) to refer to the same types of compounds that are referred to as TACs under state law. Both terms encompass essentially the same compounds. The 1977 CAA amendments required the USEPA to identify National Emission Standards for Hazardous Air Pollutants to protect public health and welfare. These substances include certain volatile organic compounds (VOCs), pesticides, herbicides, and radionuclides that present a tangible hazard, based on scientific studies of exposure to humans and other mammals. Under the 1990 CAA amendments, 189 substances are regulated as HAPs.

State Implementation Plan. The CAA requires each state to prepare an air quality control plan referred to as the State Implementation Plan (SIP). The CAA amendments added requirements for states containing areas that violate the NAAQS to revise their SIPs to incorporate additional control measures to reduce air pollution. The SIP is a living document that is modified periodically to reflect the latest emissions inventories, planning documents, and rules and regulations of air basins as reported by the agencies with jurisdiction over them. The USEPA has responsibility to review all SIPs to determine if they conform to the mandates of the CAA amendments and will achieve air quality goals when implemented. If the USEPA determines a SIP to be inadequate, it may prepare a Federal Implementation Plan for the nonattainment area and may impose additional control measures. Failure to submit an approvable SIP or to implement the plan within mandated timeframes can result in sanctions being applied to transportation funding and stationary air pollution sources in the air basin.

The 1977 federal CAA amendments require that regional planning and air pollution agencies prepare a regional air quality plan to outline the measures by which both stationary and mobile sources of pollutants can be controlled in order to achieve all standards specified in the CAA. The 1988 California Clean Air Act (CCAA) also requires development of air quality plans and strategies to meet state air quality standards in areas designated as nonattainment (with the exception of areas designated as nonattainment for the state PM standards). Maintenance plans are required for attainment areas that had previously been designated nonattainment in order to ensure continued attainment of the standards. In California, these air quality plans are developed by the air districts and approved by CARB for inclusion in the SIP.

General Conformity Rule. Section 176(c) of the CAA states that a federal agency cannot issue a permit for or support an activity unless the agency determines it will conform to the most recent USEPA approved SIP. This means that projects using federal funds or requiring federal approval must not: (1) cause or contribute to any new violation of a NAAQS; (2) increase the frequency or severity of any existing violation, or (3) delay the timely attainment of any standard, interim emission reduction, or

other milestone. General conformity requirements were adopted by Congress as part of the CAA and were implemented by USEPA regulations in the November 30, 1993, Federal Register (40 Code of Federal Regulations [CFR] Sections 6, 51, and 93: “Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule”). General conformity requires that all federal actions conform to the SIP as approved or promulgated by the USEPA by determining that the action is either exempt from the General Conformity Rule requirements or subject to a formal conformity determination.

Appendix G – Attachment 3 Regulatory Settings

Table 1. Ambient Air Quality Standards.

Pollutant	Averaging Time	State Standard	Federal Primary Standard	Major Pollutant Sources
Ozone	8-hour	0.070 ppm	0.075 ppm	Formed when ROG and NO _x react in the presence of sunlight. Major sources include on-road motor vehicles, solvent evaporation, and commercial/ industrial mobile equipment
	1-hour	0.090 ppm	---	
Carbon Monoxide	8-hour	9.0 ppm	9.0 ppm	Internal combustion engines, primarily gasoline-powered motor vehicles
	1-hour	20 ppm	35 ppm	
Nitrogen Dioxide	Annual Average	0.030 ppm	0.053 ppm	Motor vehicles, petroleum refining operations, industrial sources, aircraft, ships, and railroads
	1-hour	0.180 ppm	0.100 ppm	
Sulfur Dioxide	Annual Average	---	0.03 ppm	Fuel combustion, chemical plants, sulfur recovery plants and metal processing
	24-hour	0.04 ppm	0.14 ppm	
	1-hour	0.25 ppm	0.075 ppm	
Particulate Matter (PM10)	Annual Arithmetic Mean	20 µg/m ³	---	Dust- and fume-producing industrial and agricultural operations, combustion, atmospheric photochemical reactions, and natural activities (e.g., wind-raised dust and ocean sprays)
	24-hour	50 µg/m ³	150 µg/m ³	
Particulate Matter (PM2.5)	Annual Arithmetic Mean	12 µg/m ³	12 µg/m ³	Fuel combustion in motor vehicles, equipment, and industrial sources; residential and agricultural burning; also, formed from photochemical reactions of other pollutants, including NO _x , sulfur oxides, and organics
	24-hour	---	35 µg/m ³	
Lead	Calendar Quarter	---	1.5 µg/m ³	Present sources: lead smelters, battery manufacturing and recycling facilities. Past source: combustion of leaded gasoline
	30-Day Average	1.5 µg/m ³	---	
Hydrogen Sulfide	1-hour	0.03 ppm	No federal standard	Geothermal Power Plants, Petroleum Production and refining
Visibility Reducing Particles	8-hour	Extinction of 0.23/km; visibility of 10 miles or more	No federal standard	See PM2.5

Notes:

NO_x = oxides of nitrogen; PM2.5 = fine particulate matter; PM10 = respirable particulate matter;
 ROG = reactive organic gases

Table 2. Air Quality Attainment Status of SFBAAB, SVAB, and SJVAB.

Pollutant	SFBAAB Attainment Status		SVAB Attainment Status		SJVAB Attainment Status	
	California Standard	Federal Standard	California Standard	Federal Standard	California Standard	Federal Standard
Ozone –8-hr	Non-Attainment	Non-Attainment	Non-Attainment	Non-Attainment	Non-Attainment	Non-Attainment
Ozone 1-hr	Non-Attainment	N/A	Non-Attainment	N/A	Non-Attainment	N/A
CO 8-hr	Attainment	Attainment, maintenance	Attainment	Attainment, maintenance	Attainment	Attainment, maintenance
CO 1-hr	Attainment	Attainment	Attainment	Attainment	Attainment	Attainment
NO ₂ Annual	Attainment	Attainment	Attainment	Attainment	Attainment	Attainment
NO ₂ 1-hr	Attainment	Unclassified	Attainment	Unclassified	Attainment	Unclassified
SO ₂ Annual	Attainment	Attainment	Attainment	Attainment	Attainment	Attainment
SO ₂ 24-hour	Attainment	Attainment	Attainment	Attainment	Attainment	Attainment
SO ₂ 1-hour	Attainment	Attainment	Attainment	Attainment	Attainment	Attainment
PM ₁₀ Annual	Non-Attainment	N/A	Non-Attainment	N/A	Non-Attainment	N/A
PM ₁₀ 24-hr	Non-Attainment	Unclassified	Non-Attainment	Unclassified	Non-Attainment	Unclassified
PM _{2.5} Annual	Non-Attainment	Attainment	Non-Attainment	Attainment	Non-Attainment	Attainment

Emission Standards for Marine Diesel Engines. To reduce emissions from Category 1 (at least 50 horsepower [hp] but less than 5 liters per cylinder displacement) and Category 2 (5 to 30 liters per cylinder displacement) marine diesel engines, the USEPA has established emission (tier) standards for new engines. Tier 2 standards were phased in from 2004 to 2007 (year of manufacture), depending on the engine size. Tier 3 and 4 emission standards for marine diesel engines were introduced in 2008. Tier 3 standards are designed to harmonize with international standards (IMO Marpol Annex VI). The Tier 4 standards are modeled after the 2007/2010 highway engine program and the Tier 4 nonroad rule, with an emphasis on the use of emission after treatment technology. For the purposes of this analysis, engine rules are assumed to affect harbor craft but not oceangoing vessels, as the latter would likely be manufactured overseas and therefore would be exempt from the rule. To enable catalytic after treatment methods, the USEPA established a sulfur cap in marine fuels, limiting sulfur to 15 ppm in marine diesel fuel by June 2012. California also currently requires the use of diesel fuel with a sulfur content of 15 ppm or less, which is applicable to all marine vessels.

1.4.2 State

California Clean Air Act. Although the CAA established national ambient air quality standards, individual states retained the option to adopt standards that are more stringent and to include other pollution sources. California passed the CCAA in 1988 (California Health and Safety Code Sections 39600 et seq.), which, like its federal counterpart, called for the designation of areas as attainment or nonattainment,

but based on state ambient air quality standards rather than the federal standards. **Table 1** above shows there is considerable diversity between California's and the NAAQS, with the state ambient standards being at least as protective as national ambient standards and often more stringent.

Toxic Air Contaminants. The State Air Toxics Program was established in 1983 under Assembly Bill (AB) 1807 (Tanner). A total of 243 substances have been designated TACs under California law, including the 189 (federal) HAPs adopted in accordance with AB 2728. The Air Toxics "Hot Spots" Information and Assessment Act of 1987 (AB 2588) seeks to identify and evaluate risk from air toxics sources; however, AB 2588 does not regulate air toxics emissions. In August 1998, CARB identified DPM emissions from diesel-fueled engines as TACs. CARB subsequently developed the Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles (CARB 2000). The document represents proposals to reduce diesel particulate emissions, with the goals of reducing emissions and associated health risks by 75 percent in 2010 and by 85 percent in 2020.

CARB Regulation to Reduce Emissions from Diesel Engines on Commercial Harbor Craft. In November 2007, CARB adopted a regulation to reduce DPM and NO_x emissions from new and in-use commercial harbor craft. Under CARB's definition, commercial harbor craft include tug boats, tow boats, ferries, excursion vessels, work boats, crew boats, and fishing vessels. The regulation implemented stringent emission limits on harbor craft auxiliary and propulsion engines. In 2010, CARB amended the regulation to add specific in-use requirements for barges, dredges, and crew/supply vessels.

CARB California Diesel Fuel Regulation 28. With this rule, CARB set sulfur limitations for diesel fuel sold in California for use in on-road and off-road motor vehicles (CCR Title 13, Sections 2281–2285; CCR Title 17, Section 93114). Harbor craft and intrastate locomotives were originally excluded from the rule, but were later included by a 2004 rule amendment (CARB 2005). Under this rule, diesel fuel used in motor vehicles, except harbor craft and intrastate locomotives, has been limited to 500-ppm sulfur since 1993. The sulfur limit was reduced to 15 ppm on September 1, 2006. A federal diesel rule similarly limited sulfur content nationwide to 15 ppm by October 15, 2006.

CARB Regulations for Fuel Sulfur and Other Operational Requirements for OGVs within California Waters and 24 Nautical Miles of the California Baseline. In 2008, CARB adopted a Clean Fuel Regulation for Ocean Going Vessels within 24 nautical miles of the California coast to further reduce emissions from shipping. Since then, the permitted sulfur content of marine gas oil and marine diesel oil has been progressively lowered and since 2014 may not exceed 0.1 percent. CARB passed a rule in 2014 that allows marine vessels to be considered in compliance with the California Ocean Going Fuel Regulation when they are complying with the North American Emission Control Area using alternative emission control technologies or non-distillate low sulfur (less than or equal to 0.1 percent sulfur) marine fuels.

1.4.3 Regional

California's air quality is monitored and regulated at the state level by CARB and at the local and regional level by air pollution control authorities known as Air Pollution Control Districts (APCD) or Air Quality Management Districts (AQMD). The air districts roles include developing clean air plans and CEQA guidance.

BAAQMD Rules, Regulations, and CEQA Guidelines. BAAQMD is the regional agency responsible for rulemaking, permitting, and enforcement activities affecting stationary sources in the Bay Area. BAAQMD does not have the authority to regulate emissions from personal motor vehicles. Specific rules and regulations adopted by BAAQMD limit the emissions that can be generated by emission sources and identify specific pollution reduction measures that must be implemented in association with various activities. These rules regulate not only emissions of the six criteria air pollutants, but also TAC emission sources, which are regulated through BAAQMD's permitting process and standards of operation.

BAAQMD adopted updated CEQA Air Quality Guidelines, including new thresholds of significance in June 2010, and revised them in May 2011. The CEQA Air Quality Guidelines advise lead agencies on how to evaluate potential air quality impacts, including establishing quantitative and qualitative thresholds of significance. The thresholds BAAQMD adopted were set aside by an Alameda County Superior Court ruling in March 2012. In May 2012, BAAQMD updated its CEQA Air Quality Guidelines to continue to provide direction on recommended analysis methodologies, but without recommended quantitative significance thresholds (BAAQMD 2012). On August 13, 2013, the First District Court of Appeal ordered the trial court to reverse the judgment and upheld BAAQMD's CEQA thresholds. This case is now pending before the California Supreme Court, and BAAQMD has not formally re-instated the thresholds. While the 2011 significance thresholds are not currently recommended by the BAAQMD, these thresholds are based on substantial evidence identified in BAAQMD's 2009 Justification Report (BAAQMD 2009) and are, therefore, used within the analysis presented in this report.

YSAQMD's Applicable Rules, Regulations, and CEQA Guidelines. The YSAQMD is the regional agency responsible for rulemaking, permitting and enforcement activities affecting stationary sources in the Yolo and Solano County portion of the SVAB. Its authority and specific rules and regulations and permitting processes mirror those of the BAAQMD. YSAQMD adopted its Handbook for Assessing and Mitigating Air Quality Impacts, including new thresholds of significance, in July 2007 (YSAQMD 2007). The guidelines advise lead agencies on how to evaluate potential air quality impacts, including establishing quantitative and qualitative thresholds of significance.

SJVAPCD's Applicable Rules, Regulations, and CEQA Guidelines. The SJVAPCD is the regional agency responsible for rulemaking, permitting, and enforcement activities affecting stationary sources throughout the San Joaquin Valley Air Basin. Its authority and specific rules and regulations and permitting processes mirror those of the BAAQMD and YSAQMD. SJVAPCD updated its Guidance for Assessing and Mitigating Air Quality Impacts, including new thresholds of significance, in March 2015 (SJVAPCD 2015). The guidelines advise lead agencies on how to evaluate potential air quality impacts, including establishing quantitative and qualitative thresholds of significance.

1.5 Climate change

1.5.1 Federal Regulatory Setting

The federal government administers a wide array of programs designed to reduce the United States' GHG emissions. These programs focus on energy efficiency, renewable energy, non-CO₂ gases, and implementation of technologies designed to achieve GHG reductions.

Greenhouse Gas Endangerment Finding (December 7, 2009). The 2007 U.S. Supreme Court decision (*Massachusetts et al. v. Environmental Protection Agency et al. 2007*), gave the USEPA the authority to regulate GHGs as air pollutants under the federal Clean Air Act (CAA).

GHG Tailoring Rule (adopted May 13, 2010; 40 CFR, Parts 51, 52, 70, and 71). The USEPA set GHG emissions thresholds to define when permits under the New Source Review Prevention of Significant Deterioration (PSD) and Title V Operating Permit programs are required for new and existing industrial facilities. This final rule tailors the requirements of these CAA permitting programs to limit covered facilities to the nation's largest GHG emitters: power plants; refineries; and cement production facilities. Although not directly applicable, this rule highlights the USEPA's effort to regulate GHG emissions.

Council on Environmental Quality (CEQ) NEPA Guidance on Consideration of Effects of Climate Change and GHG Emissions. In February 2010, the CEQ released a guidance memorandum on the ways in which federal agencies can improve their consideration of the effects of GHG emissions and climate change in their evaluation of proposals for federal actions under NEPA (CEQ 2010). The guidance was intended to help explain how agencies of the federal government should analyze the environmental effects of GHG emissions and climate change when they describe the environmental effects of a proposed agency action in accordance with Section 102 of NEPA and the CEQ Regulations for Implementing the Procedural Provisions of NEPA, 40 CFR parts 1500-1508. The guidance affirmed the requirements of the statute and regulations and their applicability to GHGs and climate change impacts. The CEQ proposed to advise federal agencies that they should consider opportunities to reduce GHG emissions caused by proposed federal actions, adapt their actions to climate change impacts throughout the NEPA process, and address these issues in their agency NEPA procedures.

The guidance advised federal agencies to consider whether analysis of the direct and indirect GHG emissions from their proposed actions may provide meaningful information to decision makers and the public. Specifically, if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons per year (mtpy) or more of CO₂-equivalent GHG emissions, agencies should consider this an indicator that a quantitative and qualitative effects assessment may be meaningful to decision makers and the public. The guidance identified a reference point of 25,000 mtpy of direct CO₂-equivalent GHG emissions as an indicator that the proposed federal action's anticipated GHG emissions warrant detailed consideration in a NEPA review. The guidance did not propose this reference point as an indicator of a level of GHG emissions that may significantly affect the quality of the human environment, but rather as a minimum standard for reporting emissions under the CAA.

In 2014, CEQ released revised draft guidance updating how federal departments and agencies should consider the effects of GHG emissions and climate change in NEPA reviews (CEQ 2014). The revised draft guidance supersedes the draft GHG and climate change guidance released by CEQ in February 2010. This guidance explains that agencies should consider both the potential effects of a proposed action on climate change, as indicated by its estimated GHG emissions, and the implications of climate change on the environmental effects of a proposed action. The guidance also emphasizes that agency analyses should be commensurate with projected GHG emissions and climate impacts, and should employ appropriate quantitative or qualitative analytical methods to ensure useful information is available to inform the public and the decision-making process in distinguishing between alternatives and mitigation. It recommends that agencies consider 25,000 mtpy of CO₂-equivalent emissions as a reference point below which a quantitative analysis of GHGs is not recommended unless it is easily

accomplished based on available tools and data. Unlike the 2010 draft guidance, the revised draft guidance applies to all proposed federal agency actions.

1.5.2 State Regulatory Setting

Assembly Bill 32 - California Global Warming Solutions Act of 2006, Scoping Plan (2008), and Scoping Plan Update (2014). The California Global Warming Solutions Act of 2006, widely known as Assembly Bill (AB) 32, required the California Air Resources Board (CARB) to develop and enforce regulations for the reporting and verification of statewide GHG emissions. CARB was directed to set a GHG emission limit, based on 1990 levels, to be achieved by 2020. The bill set a timeline for adopting a scoping plan for achieving GHG reductions in a technologically and economically feasible manner. AB 32 also required CARB to adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective GHG reductions.

On December 11, 2008, CARB adopted the AB 32 Scoping Plan, which set forth the framework for facilitating the state's GHG goal as described in Executive Order (EO) S-3-05 (CARB 2008). On October 20, 2011, CARB adopted the final cap-and-trade regulation. As part of finalizing the regulation, CARB considered the related environmental analysis (i.e., functional equivalent document) and written responses to environmental comments. CARB also approved an adaptive management plan to monitor progress of reductions and recommend corrective actions if progress is not as planned or if there are unintended consequences in other environmental areas (e.g., concentration of local criteria pollutants). In 2014, CARB adopted an update to the 2008 Scoping Plan that builds upon the initial Scoping Plan with new strategies and recommendations (CARB 2014b). The 2008 Scoping Plan and 2014 Scoping Plan Update requires that reductions in GHG emissions come from virtually all sectors of the economy and be accomplished from a combination of policies, planning, direct regulations, market approaches, incentives and voluntary efforts. These efforts target GHG emission reductions from cars and trucks, construction equipment, maritime vessels, electricity production, fuels, and other sources. The Scoping Plan includes recommendations for reducing GHG emissions from most sectors of the California economy; many of the Scoping Plan reduction measures can be advanced through local government actions.

Executive Order (EO) S-3-05. EO S-3-05, signed on June 1, 2005, established the following GHG reduction targets for California:

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

EO S-3-05 also called for the California EPA to prepare biennial reports on: (1) progress made towards achieving these goals; (2) impacts to California from global warming; and (3) mitigation and adaptation plans to combat these impacts.

California Senate Bill 97 and Amendments. Senate Bill (SB) 97, enacted in 2007, directed the State Office of Planning and Research to develop CEQA Guidelines "for the mitigation of GHG emissions or the effects of GHG emissions." In December 2009, the Office of Planning and Research adopted amendments to the CEQA Guidelines, Appendix G Environmental Checklist, which created a new

resource section for GHG emissions and indicated criteria that may be used to establish significance of GHG emissions.

1.5.3 Air District Climate Action Plans

California's air quality is monitored and regulated at the state level by the CARB and at the local and regional level by air pollution control authorities known as Air Pollution Control Districts (APCD) or Air Quality Management Districts (AQMD). Air districts are responsible for permitting all, except for vehicular, sources of air pollution. Under AB 32, air districts must develop plans to reduce regional GHG emissions in compliance with the state's GHG goal.

Bay Area Air Quality Management District: In November 2013, the Bay Area Air Quality Management District (BAAQMD) adopted a resolution to reduce GHG emissions. The resolution establishes three points of action: (1) a goal for the Bay Area region to reduce GHG emissions by 2050 to 80 percent below 1990 levels; (2) a Regional Climate Protection Strategy to make progress towards the 2050 goal using the BAAQMD's Clean Air Plan to initiate the process; and (3) a 10-point work program to guide the BAAQMD's climate protection activities in the near-term.

San Joaquin Valley Air Pollution Control District: The San Joaquin Valley Air Pollution Control District (SJVAPCD) adopted the Climate Change Action Plan (CCAP) in August 2008 to assist lead agencies in assessing and reducing the impacts of project-specific GHG emissions on global climate change. The CCAP relies on the use of performance-based standards, otherwise known as Best Performance Standards (BPS), to assess the significance of project-specific GHG emissions on global climate change. Projects implementing BPS are determined to have a less than significant impact. Otherwise, demonstration of a 29 percent reduction in GHG emissions from business-as-usual is required to classify a project's impact as less than significant.

In 2009, the SJVAPCD adopted its "Final Staff Report Climate Change Action Plan: Addressing GHG Emissions Impacts under CEQA." The SJVAPCD was not able to determine a specific quantitative level of GHG emissions increase above which a project would have a significant impact on the environment, and below which it would have an insignificant impact. SJVAPCD staff concluded that impacts of project-specific emissions on global climatic change are cumulative in nature, and that the significance of impacts should, therefore, be examined in that context. SJVAPCD requires all projects (including dredging) to reduce their GHG emissions, whether through project design elements or mitigation. Projects achieving performance-based standards that have been demonstrated to be BPSs would be considered to have a less than significant cumulative impact on global climate change (SJVAPCD 2008, 2009).

1.5.4 County Climate Plans

Under AB 32, counties must also develop plans to achieve the AB 32 mandate. The following plans would include those developed for the counties of Contra Costa, Marin, and Solano.

A summary of various climate action plans is as follows:

- **Contra Costa County:** In 2015, the County adopted its Climate Action Plan (CAP) (Contra Costa County 2015b). The draft Plan identifies specific measures to achieve a GHG reduction target of 15 percent below baseline levels by the year 2020.
- **Marin County:** The County Board of Supervisors adopted a Final CAP (Update 2015) and updated their emissions reduction target of 30 percent below 1990 levels by 2020 on November 10, 2015 (Marin County 2015).
- **Solano County:** The County adopted its CAP in June 2011 (Solano County 2011). The Plan establishes a GHG emissions reduction goal of 20 percent below 2005 levels by 2020, which exceeds guidance provided in the Scoping Plan and BAAQMD CEQA Guidelines.

1.6 Biological Resources

1.6.1 Federal Regulatory Setting

Fish and Wildlife Coordination Act. Under the Fish and Wildlife Coordination Act, any federal agency that proposes to control or modify any body of water must first consult with the USFWS or the NMFS, as appropriate, and with the head of the appropriate state agency exercising administration over wildlife resources of the affected state.

Endangered Species Act (16 United States Code [USC] 1531 et seq.), as amended. The federal ESA protects threatened and endangered species and their designated critical habitat from unauthorized take. Section 9 of the ESA defines take as to “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” Take incidental to otherwise lawful activities can be authorized under Section 7 of the ESA when there is federal involvement and under Section 10 when there is no federal involvement. The USFWS and the NMFS share responsibilities for administering the ESA. The ESA consultation would occur under Section 7. The outcome of the consultation would determine whether a “take authorization” would be required.

Magnuson-Stevens Fishery Conservation and Management Act (16 USC Section 1801 et seq.; Pub. L. 104-297; Pub. L. 109-479). The 1996 amendments to the Magnuson-Stevens Act require federal agencies that fund, permit, or carry out activities that may adversely impact EFH of commercial fishery managed species to consult with the NMFS on the potential adverse effects of their actions on EFH. The NMFS is required to comment and provide conservation recommendations for any activity (either federal or state agency-sponsored) that could impact EFH. The USACE, acting as the federal nexus, would consult with the NMFS for actions. Through the consultation process, the NMFS will provide the USACE with Conservation Recommendations to avoid, offset, or compensate for impacts to EFH and EFH-managed species. Conservation Recommendations agreed upon by the USACE and the NMFS will be incorporated into the Final EIS/EIR.

Marine Mammal Protection Act (16 USC 1361 et seq.). The Marine Mammal Protection Act (MMPA) was enacted on October 21, 1972, and was reauthorized by the MMPA amendments of 1994 (Public Law 103-238). Under the MMPA, all species of marine mammals are protected. The MMPA prohibits, with certain exceptions, the “take” of marine mammals. Under the MMPA, take is defined as the means “to hunt, harass, capture, or kill, or attempt to hunt, harass, capture, or kill.” Harassment is defined as:

“...any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild; or that has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.”

Under Section 101(a)(5)(D), an incidental harassment permit may be issued for activities other than commercial fishing that may impact small numbers of marine mammals. The project is not expected to result in impacts to marine mammals.

Executive Order 11990: Protection of Wetlands. This order (42 FR 26961, May 25, 1977) requires federal agencies to minimize destruction of wetlands when managing lands, when administering federal programs, or when undertaking construction. Agencies are also required to consider the effects of federal actions on the health and quality of wetlands. The dredge footprint does not include wetlands and placement sites have been pre-approved for use. Therefore, wetlands would not be directly affected by the project.

Executive Order 13112: Invasive Species. The purpose of this order is to prevent the introduction of invasive species and to provide control for the spread of invasive species that have already been introduced. This order states that the federal government:

“...shall, to the extent practicable and permitted by law, not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.”

The project would need to manage ballast water in consideration of invasive species effects.

1.6.2 State Regulatory Setting

California Endangered Species Act of 1974, as amended. The CESA provides for the protection of CDFG-recognized rare, threatened, and endangered plants and animals and prohibits take of such species without CDFG authorization under Section 2081 of the Fish and Game Code. The lead agencies must consult with the CDFG during the CEQA process if state listed threatened or endangered species are present and could be affected by a project. For projects that could affect both state and federally listed species, compliance with the federal ESA satisfies the CESA as long as the CDFG determines that the federal incidental take authorization is consistent with the CESA under the Fish and Game Code Section 2080.1. The CESA includes a requirement for full mitigation for take of listed species, and no net impacts to listed species may occur under the CESA. The CESA defines impacts that must be minimized and fully mitigated as “all impacts on the species that result from any act that would cause the proposed taking (CESA Sec. 2081[b][2]).” It goes on to require mitigation measures be “roughly proportional” to the impacts caused by a project (CESA 2052.1 Sec. 2081[b]). The CESA consultation would need to occur for both Phases I and II to obtain approval and develop mitigation strategies for effects to CESA listed species.

D-1641 Water Rights Decision. The D-1641 water rights decision (hereafter referred to as D-1641), which was passed in 1999, describes the salinity criteria established for the Delta to meet municipal, industrial, agricultural, and biological requirements. D-1641 is based on observations that the abundance or survival of several estuarine biological populations in the San Francisco Estuary is positively related to freshwater flow (Jassby et al. 1995; Kimmerer et al. 2009, 2013). D-1641 stipulates salinity requirements as chloride concentration for municipal and industrial uses, and as electrical conductivity (EC) for agricultural and fish and wildlife uses. The abundance or survival of several estuarine biological populations in the San Francisco Estuary have historically been positively related to freshwater flow, as indexed by the position of the daily averaged 2 practical salinity unit (psu) near-bed (i.e., bottom) salinity, referred to as X2 (Jassby et al. 1995). In 1995, the State Water Resources Control Board adopted X2 as a water quality standard to help restore the relationship between springtime precipitation and the geographic location and extent of estuarine habitat. As implemented in D-1641, this standard requires freshwater inflows to the Bay sufficient to maintain X2 at specific locations for specific numbers of days each month during the spring (February through June). The objective of this “Spring X2” requirement is to help restore the relationship between springtime precipitation and the geographic location and the extent of estuarine habitat.

1.6.3 Local Regulatory Setting

Suisun Marsh Habitat Management, Preservation, and Restoration Plan. The Suisun Marsh Habitat Management, Preservation, and Restoration Plan is a 30-year plan being led by a consortium of federal and state agencies that is intended to balance tidal wetland restoration values among environmental benefits such as salt marsh harvest mouse habitat, managed wetlands, public use, and upland habitat. This is achieved through ESA and CESA compliance, managed wetland activities, restoration activities, and maintenance activities related to certain SWP and CVP mitigation commitments. The principal component of the plan is the restoration of 7,000 acres of tidal salt marsh in Suisun Bay. The project would not conflict with this plan.

Regional Habitat Conservation Plans. The study area is within the coverage area of several Habitat Conservation Plans (HCPs). HCPs provide a pathway forward to balance wildlife conservation with development. The primary objective of the HCP program is to conserve species and the ecosystems they depend on while streamlining permitting for economic development. Regional HCPs are developed in order to anticipate, prevent, and resolve controversies and conflict associated with project-by-project permitting.

City and County General Plans. Most county and city General Plans within the study area contain a conservation element outlining policies and goals for preservation of natural resources. These may include policies such as preservation of heritage trees, protection of sensitive habitat types, and protection of sensitive flora and fauna, among others.

1.7 Land Use and Planning

1.7.1 Federal Regulatory Setting

Coastal Zone Management Act. The Coastal Zone Management Act, established in 1972 and administered by NOAA’s Office of Ocean and Coastal Resource Management, provides for management of the nation’s coastal resources. The overall purpose is to balance competing land and water use issues in the coastal zone. The Coastal Zone Management Act encourages states to develop coastal management programs. Under the Coastal Zone Management Act, any federal agency conducting or supporting activities directly affecting the coastal zone must proceed in a manner consistent with the federally approved state coastal zone management programs, to the maximum extent practicable.

Commerce Clause of the Constitution. Navigable servitude is a United States constitutional doctrine that gives the federal government the right to regulate navigable waterways as an extension of the Commerce Clause of the United States Constitution. The federal navigational servitude entitles the government to exert a dominant servitude in all lands below the ordinary high water mark of navigable waters.

Submerged Lands Act. The Submerged Lands Act of 1953 (43 USC § 1301 et seq.) grants states title to all submerged navigable lands within their boundaries. This includes navigable waterways, such as rivers, as well as marine waters within the state’s boundaries, generally three geographical miles from the coastline. In compliance with this Act, the California State Land Commission (CSLC) will receive a copy of this EIS/EIR and will have the opportunity to comment on its potential impacts to submerged lands.

1.7.2 State Regulatory Setting

California Environmental Quality Act. The California Environmental Quality Act (CEQA- California Public Resources Code Sections 21000-21178) and the CEQA Guidelines (14 California Code of Regulations 15000-15387) are the primary policies that require projects to analyze potential impacts to land use, as well as to analyze a project’s consistency with land use planning policies applicable to that project. This report fulfills the requirements of CEQA and the CEQA Guidelines.

Public Trust Doctrine. The CSLC manages lands in California according to the Public Trust Doctrine. Several of the guiding principles of the Public Trust are:

- I. Lands under the ocean and under navigable streams are owned by the public and held in trust for the people by the government. These are referred to as public trust lands, and include filled lands formerly under water. Public trust lands cannot be bought and sold like other state-owned lands. Only in rare cases may the public trust be terminated, and only when consistent with the purposes and needs of the trust.
- II. Uses of trust lands, whether granted to a local agency or administered by the state directly, are generally limited to those that are water-dependent or related, and include commerce, fisheries, and navigation, environmental preservation and recreation. Public trust uses include, among others, ports, marinas, docks and wharves, buoys, hunting, commercial and sport fishing, bathing, swimming and boating. Public trust lands may also be kept in their natural state for habitat, wildlife refuges, scientific study, or open space. Ancillary or

incidental uses are also permitted—that is, uses that directly promote trust uses such as those directly supportive and necessary for trust uses or those that accommodate the public’s enjoyment of trust lands.

- III. Because public trust lands are held in trust for all citizens of California, they must be used to serve statewide, as opposed to purely local, public purposes.

California Coastal Act. The California Coastal Act includes specific policies (Division 20 of the California Public Resources Code) for planning and regulatory decisions made by the California Coastal Commission and local governments. The California Coastal Act regulates development activities, such as the construction of buildings, division of lands, and activities that change the intensity of use of land or public access to coastal waters. The coastal zone established by the California Coastal Act does not include San Francisco Bay. Development in the Bay system is regulated by the San Francisco Bay Conservation and Development Commission (BCDC). The San Francisco BCDC is responsible for reviewing consistency determinations under the Coastal Zone Management Act in San Francisco Bay. For activities outside of the Golden Gate National Recreation Area, consistency determinations are reviewed by the California Coastal Commission.

McAteer-Petris Act. The McAteer-Petris Act (California Government Code Section 66000, et seq.), first enacted in 1965, created the San Francisco BCDC to prepare a plan to protect the San Francisco Bay and shoreline, and provide for appropriate development and public access. This Act directs San Francisco BCDC to exercise its authority to issue or deny permit applications for placing fill; dredging; or changing the use of any land, water, or structure in the area of its jurisdiction. The San Francisco BCDC also reviews determinations of consistency with the Coastal Zone Management Act for federally sponsored projects. The San Francisco Bay Plan (BCDC 2008) is the San Francisco BCDC’s policy document specifying goals, objectives, and policies for the BCDC’s jurisdictional areas. Pursuant to the federal Coastal Zone Management Act, the USACE is required to be consistent to the maximum extent practicable with the enforceable policies of the San Francisco Bay Plan.

1.7.3 Local Regulatory Setting

General Plans for each County contain a land use element, which functions as a blueprint for short- and long-term community goals and policies for development and conservation.

1.8 Mineral Resources

1.8.1 Federal Regulatory Setting

There are no applicable federal regulatory requirements with regards to mineral resources.

1.8.2 State Regulatory Setting

California Surface Mining and Reclamation Act. The California Surface Mining and Reclamation Act (SMARA) of 1975 mandates mineral resource zone classifications by the State Geologist in order to help identify and protect mineral resources in areas within the State subject to urban expansion or other irreversible land uses that would preclude mineral extraction. SMARA also allows the State Mining and

Geology Board to designate lands containing mineral deposits of regional or statewide significance after receiving classification information from the State Geologist. The law provides for significant mineral resources to be recognized and considered before land use decisions are made that compromise the availability of these resources.

1.8.3 Local Regulatory Setting

General Plans for each county have established mineral resource policies to ensure the continued viability of mineral extraction operations while minimizing impacts on surrounding land uses and the environment.

1.9 Agriculture

1.9.1 Federal Regulatory Setting

The Farmland Protection Policy Act of 1981 (CFR, 1990). This Act ensures that federal programs are compatible with state, local and private programs and policies to protect farmland. It calls for the use of the Land Evaluation and Site Assessment system developed by the NRCS in 1981.

1.9.2 State Regulatory Setting

California Land Conservation Act of 1965. The California Land Conservation Act or, the Williamson Act, allows owners of agricultural lands and open space to pay lower property tax on those lands in exchange for a ten-year agreement that the land will not be developed or otherwise converted to another use (California Farm Bureau Federation 2015) [CFBF]. The purpose of the Williamson Act is to control urban sprawl and protect valuable farmland and open space.

California Public Resources Code Section 21095. Section 21095 seeks “to provide lead agencies with an optional methodology to ensure that significant effects on the environment of agricultural land conversions are quantitatively and consistently considered in the environmental review process” (CDC 1997). The California Agricultural Land Evaluation and Site Assessment Model (Model) provides a quantitative methodology to assure that goal is met.

1.9.3 Local Regulatory Setting

County General Plans often include goals and policies regarding the protection of land used for agricultural production, such as a right-to-farm ordinance. General Plans include those developed for the counties of Contra Costa, Marin, and Solano; and the cities of Richmond, Pinole, Hercules, Martinez, Tiburon, and Vallejo. Dredging activities would occur in navigable waters outside of these plan areas.

1.10 Aesthetics

1.10.1 Federal Regulatory Setting

Currently no federal policies and/or mandates related to aesthetics exist.

1.10.2 State Regulatory Setting

Currently no state policies and/or mandates related to aesthetics exist.

1.10.3 Local Regulatory Setting

The General Plans of the cities and counties occurring within the study area may include goals and policies regarding aesthetics and urban design of structures and development. Since the proposed navigation project would not include the construction or alteration of any structures, the General Plan goals and policies regarding aesthetics and structural design would not be applicable.

1.11 Cultural Resources and Native American Trust Assets

1.11.1 Federal Regulatory Setting

Applicable federal laws regarding cultural resources are summarized below:

Executive Order 13158. This EO requires federal agencies to: (1) identify actions that affect natural or cultural resources occurring within a Marine Protected Area (MPA); and (2) avoid harm to the natural and cultural resources that are protected by a MPA when taking actions in such areas.

National Historic Preservation Act (NHPA) (16 USC 470 et seq.). The 1966 National Historic Preservation Act (NHPA) set forth national policy for recognizing and protecting historic properties. It established the National Register of Historic Places (NRHP), State Historic Preservation Officers and programs, and the Advisory Council on Historic Preservation. Under Section 106 of the Act, federal agencies are required to take into account the effects of their undertakings on historic properties and provide the Advisory Council on Historic Preservation an opportunity to comment on those undertakings.

The NRHP is the nation's master inventory of historic places deemed worthy of preservation. It is administered by the U.S. National Parks Service and includes listings of buildings, structures, sites, objects, and districts that possess historic, architectural, engineering, archaeological, or cultural significance at the national, state, or local level.

Such resources over 50 years of age can be listed in the NRHP as significant historic resources. However, properties under 50 years of age that are of exceptional importance, or are contributors to a district, can also be included in the NRHP.

The significance of cultural resources is defined in 36 Code of Federal Regulations (CFR) 60.4 as follows:

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

1. that are associated with events that have made a significant contribution to the broad patterns of history;
2. that are associated with the lives of persons significant in our past;

3. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
4. that have yielded or may likely yield information important in prehistory or history.

Integrity refers to a property's ability to convey its historical significance. There are seven aspects of integrity: location, design, setting, materials, workmanship, feeling and association. The importance and applicability of these qualities depend upon the historical significance of the resource and the nature of its character-defining features (U.S. National Parks Service 1997).

Under federal regulations (36 CFR 800.5), an adverse effect occurs when a project alters directly or indirectly, any of the characteristics of a historic property that qualifies that property for inclusion on the NRHP in a way that diminishes the integrity of the property. Adverse effects on historic properties include, but are not limited to, the following:

- physical destruction of all or part of the property;
- alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, and hazardous material remediation, that is not consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties;
- removal of the property from its historic location;
- change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance; or
- introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features (36 CFR 800.5).

1.11.2 State Regulatory Setting

Applicable state laws regarding cultural resources are found below:

California Environmental Quality Act (CEQA). State historic preservation regulations that apply to this analysis include the statutes and guidelines contained in CEQA, under Public Resources Code (PRC), Sections 20183.2 and 21084.1 and Section 15064.5 of the CEQA Guidelines. Per CEQA, public agencies must consider the effects of their actions on both "historical resources" and "unique archaeological resources." Pursuant to PRC Section 21084.1, a "...project 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."

"Historical resource" is a term with a defined statutory meaning (PRC, Section 21084.1). Under CEQA Guidelines Section 15064.5(a), historical resources include the following:

1. A resource listed in, or determined to be eligible by the State Historical Resources Commission, for listing in the California Register of Historical Resources (CRHR) (PRC, Section 5024.1).

2. A resource included in a local register of historical resources, as defined in Section 5020.1(k) of the PRC or identified as significant in a historical resource survey meeting the requirements of Section 5024.1(g) of the PRC, will be presumed to be historically or culturally significant. Public agencies must treat any such resource as significant unless the preponderance of evidence demonstrates that it is not historically or culturally significant.
3. Any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California may be considered to be a historical resource, provided the lead agency's determination is supported by substantial evidence in light of the whole record. Generally, a resource will be considered by the lead agency to be "historically significant" if the resource meets the criteria for listing in the CRHR (PRC, Section 5024.1), including the following:
 - a. is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;
 - b. is associated with the lives of persons important in our past; or
 - c. 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 may be likely to yield, information important in prehistory or history.
4. The fact that a resource is not listed in, or determined to be eligible for listing in the CRHR, not included in a local register of historical resources (pursuant to Section 5020.1(k) of the PRC), or identified in a historical resources survey (meeting the criteria in Section 5024.1(g) of the PRC) does not preclude a lead agency from determining that the resource may be an historical resource as defined in PRC Section 5020.1(j) or 5024.1.

Properties listed, or formally designated as eligible for listing, on the NRHP are automatically listed on the CRHR, as are certain State Landmarks and Points of Interest.

CEQA also requires lead agencies to consider whether projects will impact "unique archaeological resources." Public Resources Code Section 21083.2, subdivision (g), states that a unique archaeological resource is 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; or
3. is directly associated with a scientifically recognized important prehistoric or historic event or person.

Public Resources Code § 5097.9. Section 5097.9 of the California PRC states that:

“...No public agency, and no private party using or occupying public property, or operating on public property, under a public license, permit, grant, lease, or contract made on or after July 1, 1977, shall in any manner whatsoever interfere with the free expression or exercise of Native American religion as provided in the U.S. Constitution and the California Constitution; nor shall any such agency or party cause severe or irreparable damage to any Native American sanctified cemetery, place of worship, religious or ceremonial site, or sacred shrine located on public property, except on a clear and convincing showing that the public interest and necessity so require.”

According to Section 15064.5 of the CEQA Guidelines, all human remains are a significant resource. That Section also assigns special importance to human remains and specifies procedures to be used when Native American remains are discovered. These procedures are spelled out under PRC Section 5097.

Health and Safety Code § 7050.5. Section 7050.5 of the California Health and Safety Code states that it is a misdemeanor to knowingly disturb a human grave. In the event that human graves are encountered, work should halt in the vicinity and the County Coroner should be notified immediately. At the same time, an archaeologist should be contacted to evaluate the situation. If human remains are of Native American origin, the Coroner must notify the Native American Heritage Commission within 24 hours of this identification.

1.11.3 Local Regulatory Setting

The General Plans of the cities and counties occurring within the study area may include goals and policies regarding cultural resources. Since the proposed navigation project would not include the construction or alteration of any structures or the alteration of any historic settings, General Plan goals and policies regarding historic buildings or structures would not be applicable.

1.12 Environmental Justice and Community Effects

1.12.1 Federal Regulatory Setting

Presidential Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. EO 12898 requires all federal agencies to “...make achieving environmental justice part of [their] mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.”

The EO directs federal agencies to perform the following activities:

- Analyze the environmental effects, including human health, economic, and social effects, of federal actions, including the effects on minority and low-income communities, when required by the NEPA,
- Provide opportunities for community input during the NEPA process, including potential effects and mitigation measures, and

- Ensure that the public, including minority and low-income communities, have adequate access to public information relating to human health or environmental planning, regulations, and enforcement.

Title VI of the Civil Rights Act of 1964 (42 U.S. Code 2000). Title VI prohibits discrimination based on race, color, sex, and national origin in the provision of benefits and services resulting from federally assisted programs and activities.

Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. EO 13045 requires federal agencies to prioritize the identification and assessment of environmental health risks and safety risks that may disproportionately affect children and ensure that policies, programs, and standards address disproportionate environmental health or safety risks to children that result from a project (68 FR 19931).

1.12.2 State Regulatory Setting

California Public Resources Code Section 71113. On the state level, Public Resources Code Section 71113 states that the mission of the California Environmental Protection Agency includes ensuring that any activities substantially affecting human health or the environment are conducted in a manner guaranteeing the fair treatment of people of all races, cultures, and income levels, including minority and low income populations. This state statute is applicable because both require CEQA review.

1.13 Navigation, Transportation, and Circulation

1.13.1 Federal Regulatory Setting

Navigational Rules. Under Title 14 and Title 33 of the United States Code (USC), the USCG has authority for maritime law enforcement and rule-making with regard to navigation, as well as responsibility for search and rescue on the navigable waters of the United States.

USCG Vessel Traffic Service, San Francisco (Vessel Traffic Service) implements this authority in the study area. Located on Yerba Buena Island, Vessel Traffic Service designates traffic lanes for inbound and outbound vessel traffic, specifies separation zones between vessel traffic lanes, and governs vessels entering and leaving ports (USCG 2015). Although small and private vessels are not required to coordinate their movements by contacting Vessel Traffic Service, the USCG monitors all commercial, U.S. Navy, and most private marine traffic in San Francisco Bay from local coastal waters to the Ports of Stockton and Sacramento.

The Inland Navigational Rules Act of 1980 (Public Law 96-591, 94 Statute 3415, 33 CFR 83), more commonly known as the Inland Rules, governs many rivers, lakes, harbors, and inland waterways. The International Regulations for Preventing Collision at Sea have also been incorporated into federal regulations (Public Law 95-75, 91 Statute 308, 33 USC 1-8). Together, these regulations (known as the Rules of the Road) govern open bodies of water to promote navigational safety, including requirements for steering and sailing practices, navigation lights and day-shapes, and sound signals for both good and restricted visibility.

These navigational rules govern marine transportation throughout the shipping channels in the study area.

America's Marine Highways Program. The Energy Independence and Security Act of 2007 established the America's Marine Highways Program, a U.S. Department of Transportation (USDOT) initiative to expand the use of waterborne transportation to relieve landside congestion and to reduce carbon emissions. America's Marine Highways are defined as navigable waterways that have demonstrated the ability to provide additional capacity to relieve congested landside routes serving freight and passenger movement (USDOT 2015a).

Section 405 of the Coast Guard and Maritime Transportation Act of 2012 further expanded the scope of the program beyond reducing landside congestion to efforts that generate public benefits by increasing the use or efficiency of domestic freight or passenger transportation on Marine Highway Routes between ports in the United States. Sponsors in the private sector or state/local governments develop and operate marine highway services.

The study area includes the Marine Highway 580 Connector, a spur of Marine Highway 5, which serves the entire West Coast. Marine Highway 580 begins in Oakland, California, includes the San Joaquin and Sacramento rivers, and connects commercial navigation channels, ports, and harbors in Central California. Using Marine Highway 580 to its full capacity has the potential to save 7 million gallons of fuel and reduce congestion between the Port of Oakland and destinations in the San Joaquin Valley (USDOT 2015b).

1.13.2 State Regulatory Setting

California Harbors and Navigation Code. The California Harbors and Navigation Code vests authority with the Department of Boating and Waterways (DBW) to regulate matters of navigational safety for the state's boating public. The code establishes laws and regulations governing the equipment and operation of vessels on waters of the state, including the study area.

1.14 Noise

1.14.1 Federal Regulatory Setting

Noise Control Act (42 USC 4910). This Act required the USEPA to establish noise emission criteria, as well as noise testing methods (40 CFR Chapter 1, Subpart Q). These criteria generally apply to interstate rail carriers and to some types of construction and transportation equipment. Guidelines published by the USEPA (1974) contained recommendations for acceptable noise level limits affecting residential land use of 55 dBA (L_{dn}) for outdoors and 45 dBA (L_{dn}) for indoors.

Department of Housing and Urban Development Environmental Standards (24 CFR Part 51). These regulations set forth the following exterior noise standards for new home construction:

- 65 L_{dn} or less – Acceptable
- 65 L_{dn} to < 75 L_{dn} – Normally unacceptable (appropriate sound attenuation measures must be provided)

- 75 L_{dn} – Unacceptable

For interior noise levels, a goal of 45 dBA is set forth and attenuation requirements are geared to achieve that goal.

Federal Transit Administration’s (USFTA) Transit Noise and Vibration Impact Assessment (FTA-VA-90-1003-06). These guidelines provide a commonly accepted industry standard for analysis of construction noise impacts.

National Technical Information Service (NTIS) 550\9-74-004, 1974 (“Information on Levels of Environmental Noise Requisite to Protect Health and Welfare with an Adequate Margin of Safety”). Commonly referenced as the, “Levels Document,” this USEPA guidance established an L_{dn} of 55 dBA as the safe level of environmental noise exposure for areas of outdoor uses including residences and recreation areas. The USEPA guidance should not be construed as standards or regulations because technical or economic feasibility or other potentially relevant considerations may need to be taken into account for a particular project or activity.

1.14.2 State Regulatory Setting

Currently no state policies and/or mandates related to noise exist.

1.14.3 Local Regulatory Setting

City and county General Plans include goals and policies regarding noise. However, local noise regulations are not applicable to navigation improvements, because they apply only to development projects on land within the jurisdiction of the cities and counties.

1.15 Public Health and Environmental Hazards

1.15.1 Federal Regulatory Setting

Comprehensive Environmental Response, Compensation and Liability Act/Superfund Amendments and Reauthorization Act (CERCLA). CERCLA authorizes removal and remedial actions to clean up sites contaminated by hazardous substances. The National Oil and Hazardous Substances Pollution Contingency Plan outlines CERCLA’s implementing regulations and provides the guidelines and procedures needed to respond to releases and threatened releases of hazardous substances at identified sites on the National Priority List. CERCLA regulations apply if the National Priority List sites would be affected by the alternatives.

Resource Conservation and Recovery Act (RCRA). RCRA provides for cradle-to-grave regulation of hazardous waste and addresses used oil management and recycling, storage of hazardous materials, underground storage tanks, handling of medical wastes, and disposal of hazardous waste. RCRA requires federal agencies to establish programs to procure recovered or recycled materials. Like CERCLA, RCRA regulations apply to projects that involve hazardous waste sites or are sites used for the storage of hazardous materials.

Toxic Substances Control Act. The Toxic Substances Control Act limits or prohibits the manufacture, processing, distribution, use and disposal of certain toxic substances. The Toxic Substances Control Act contains requirements specific to asbestos, indoor radon abatement and lead exposure reduction. Hazardous materials transported through the study area would be subject to these regulations.

Oil Pollution Act. The Oil Pollution Act (Title 33 USC Section 2701 et seq.) establishes a liability system for oil spills into navigable waters or adjacent shorelines that injure or are likely to injure natural resources and/or the services that those resources provide to the ecosystem or humans. Pursuant to this act, federal and state agencies and Native American tribes may act as trustees on behalf of the public to assess the injuries, scale restoration to compensate for those injuries, and implement restoration. Liability and restoration activities for oil spills in the study area would be determined based on this act.

Transportation of Hazardous Materials and Waste. Transportation of hazardous materials and hazardous waste is regulated by Title 40 CFR Section 260.10, which establishes Hazardous Waste Manifest System requirements. This includes requirements for forms, reports, and procedures to track movement of hazardous waste from the time it leaves the generator facility until it reaches the receiving waste management facility. Hazardous materials transported through the study area would be subject to these regulations.

Hazardous Materials Transportation Act. Enacted in 1975, the Hazardous Materials Transportation Act's (HMTA's) primary objective is to provide adequate protection against risks to life and property inherent in commercial transportation of hazardous materials. Hazardous materials, as defined by the Secretary of Transportation are any "particular quantity or form" of a material that "may pose an unreasonable risk to health and safety or property." HMTA governs safety aspects, including security, of the transportation of hazardous materials that the Secretary of the USDOT considers appropriate. Enforcement responsibility for the HMTA is shared by several agencies, including the Federal Highway Administration for motor carriers and the U. S. Coast Guard for shipments by water. Hazardous materials transported through the study area would be subject to these regulations.

1.15.2 State Regulatory Setting

California Hazardous Substance Account Act. The Carpenter-Presley-Tanner Hazardous Substance Account Act (California Health and Safety Code, Chapter 6.8), adopted in 1999, is the state equivalent of CERCLA. It requires past and present owners and operators to assume liability for the remediation of hazardous waste sites within California. Existing hazardous waste sites within and surrounding the study area are mandated to complete remediation in compliance with these requirements.

California Hazardous Waste Control Law. Administered by the CDTSC, the California Hazardous Waste Control Law (California Health and Safety Code Chapter 6.5 of Division 20) is the basic hazardous waste statute in California. It requires recycling and waste reduction programs for a range of hazardous wastes, with more stringent requirements than the similar federal RCRA requirements. This law applies to projects that involve hazardous waste sites or are sites used for the storage of hazardous materials.

California Department of Toxic Substances Control (CDTSC). The CDTSC administers laws and regulations related to hazardous waste and hazardous substances pursuant to Division 20, Chapters 6.5

and 6.8 of the California Health and Safety Code and Title 22 of the California Code of Regulations (CCR), which are the state equivalents of RCRA and CERCLA, respectively.

Regional Water Quality Control Board. The Regional Water Quality Control Board enforces laws and regulations governing releases of hazardous substances and petroleum pursuant to Division 20, Chapters 6.7, 6.75, and 6.8 of the California Health and Safety Code and the Porter-Cologne Water Quality Control Act (Division 7, Section 13100 et seq. of the California Water Code) and CCR Title 23. In particular, the Regional Water Quality Control Board focuses on all petroleum releases and those hazardous substance releases that may impact groundwater or surface water.

California Division of Occupational Safety and Health. The California Division of Occupational Safety and Health is responsible for assuring worker safety and assumes primary responsibility for developing and enforcing standards for safe workplaces and work practices. Regulations that specifically address protection of construction workers from exposure to hazardous substances are found in Title 8 of the CCR. These regulations would apply to any workers involved with dredging or placement of dredged materials.

California Office of Emergency Services. The California Office of Emergency Services administers the emergency response plan to coordinate emergency services provided by federal, state, and local government and private agencies. This includes responding to hazardous materials incidents. The California Office of Emergency Services is also the state administering agency for the California Accidental Release Prevention Program and California’s Hazardous Materials Release, Response, and Inventory Law. In the event of an emergency during implementation of alternatives, emergency response plans developed by the California Office of Emergency Services would be implemented.

Oil Spill Prevention and Response Programs in California. Passed in 1990, the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (California Government Code 8670.1 et seq.; California Public Resources Code 8750 et seq.) requires all marine facilities and vessels to comply with an integrated system of statewide regulations, operation manuals, inspections, training and drill programs. Compliance is aimed at providing the “best achievable protection” of the state’s coastal and marine resources through the use of “best achievable technologies” and practices. Vessels and facilities operating within the study area would be required to comply with these requirements.

1.15.3 Local Regulatory Setting

Individual Certified Uniform Program Agencies. Certified Uniform Program Agencies are local government agencies responsible for implementing administrative requirements, permits, inspections and enforcements pertaining to hazardous waste and materials as required through the California Environmental Protection Agency Unified Program (a consolidation of six environmental programs at the local level). The Certified Uniform Program Agencies program streamlines and provides consistent regulatory activities, including inspections, permitting and enforcement related to hazardous materials management. **Table 4** identifies the Certified Uniform Program Agencies for each county in the study area.

Table 4. Certified Uniform Program Agencies for Study Area Counties

County	Certified Uniform Program Agencies
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Contra Costa	Hazardous Materials Program
Marin	Public Works Department
Solano	Health Services Division
San Joaquin	Environmental Health Department
Sacramento	Environmental Management Department

San Francisco Bay Area Water Emergency Transportation Authority. In 2007, the California State Legislature authorized the San Francisco Bay Area Water Emergency Transportation Authority to oversee and operate a public water transit system in the San Francisco Bay Area. This resulted in the Authority creating and adopting in 2009 the Emergency Water Transportation System Management Plan for the San Francisco Bay Area. This plan integrates and complements the emergency plans of other agencies to ensure mobility in the San Francisco Bay Area following a major disaster.

San Francisco Bay Area Water Emergency Transportation Authority. City and county General Plans typically include a safety element that identifies and establishes policies and goals for minimizing exposure to local hazards. This often includes maps of hazard areas, general policies for minimizing hazards, and requirements to adhere to state and federal regulations. General Plans developed for Contra Costa, Marin, and Solano Counties and the cities of Richmond, Pinole, Hercules, Martinez, Tiburon, and Vallejo would apply. Dredging activities would occur in navigable waters outside of the areas covered by these plans.

Emergency Response Plans. Each of the counties within the study area maintains and implements its own emergency operations plans. This includes the Marin (Marin County Sheriff 2006), Contra Costa (2015), Solano (2012), Sacramento (2012) and San Joaquin (2012) Counties. These plans generally identify potential emergency hazards, prescribe emergency avoidance measures and outline response actions for emergencies. Several cities within the study area also coordinate their own emergency management services, often led by the police or fire departments.

1.16 Recreation

The federal, state, and local regulations discussed under Land Use and Planning also apply to recreational resources. These management plans, policies, and acts describe management guidelines for multiple land uses including recreation.

1.17 Socioeconomics

There are no known federal, state, or local regulatory requirements specifically related to socioeconomics.

1.18 Utilities and Public Services

1.18.1 Federal Regulatory Setting

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR 300). Authorized under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 USC 9605, as amended by the Superfund Amendments and Reauthorization Act of 1986, Public Law 99-499; and by the CWA Section 311(d), as amended by the Oil Pollution Act of 1990 (OPA), Public Law 101-380. The NCP outlines requirements for responding to both oil spills and releases of hazardous substances, including spills from underwater pipelines. It specifies compliance, but does not require the preparation of a written plan. It also provides a comprehensive system for reporting, spill containment, and cleanup. The U.S. Coast Guard and the USEPA co-chair the National Response Team. In accordance with 40 CFR 300.175, the U.S. Coast Guard has responsibility for oversight of regional response for oil spills in “coastal zones,” as described in 40 CFR 300.120.

49 USC Section 60101 et seq. and 49 CFR Section 190.1. The U.S. Department of Transportation’s Pipeline and Hazardous Materials Safety Administration regulates interstate and intrastate hazardous liquids transmission pipelines. The Office of Pipeline Safety ensures safety in the design, construction, operation and maintenance, and spill response planning of oil, natural gas and hazardous liquid transportation per the duties regarding pipeline safety set forth in 49 USC Section 60101 et seq. and 49 CFR Section 190.1. The regulations apply to the owners and operators of the facilities and they cover the design, installation, inspection, emergency plans and procedures, testing, construction, extension, operation, replacement, and maintenance of pipeline facilities transporting oil, gas, and hazardous liquid. The regulations require operators of gas pipelines to participate in a public safety program, such as a one-call system to notify the operator of any proposed demolition, excavation, tunneling, or construction that would take place near or affect the facility.

1.18.2 State Regulatory Setting

State Fire Marshal, Pipeline Safety Division. The Office of the State Fire Marshal, Pipeline Safety Division, regulates the safety of approximately 5,500 miles (8,851 kilometers) of intrastate hazardous liquid (e.g., oil, gas) transportation pipelines and acts as an agent of the Federal Office of Pipeline Safety concerning the inspection of more than 2,000 miles (3,219 kilometers) of interstate pipelines. Pipeline safety staff inspects, tests, and investigates to ensure compliance with all federal and state pipeline safety laws and regulations. All spills, ruptures, fires, or similar incidents are responded to immediately and are investigated for cause.

California Code of Regulations: Title 23, Division 1, Article 8, Sections 111- 137. These standards govern the design and construction of encroachments that would affect flood control works and floodways, including limitations or approval requirements for placement of dredged material and channel excavation. Dredging of material from channel waterways generally must be confined to the area beyond 100 feet of the toe of the bank, and the slope of the borrow perimeter nearest the toe of the bank generally may not exceed five feet horizontal to one-foot vertical. Before any borrow operation (including dredging) is permitted within one mile of a bridge or 1,000 feet of any pipeline or cable

crossing beneath any channel, a study must be submitted to show that the borrow operation will not adversely affect such facilities.

1.18.3 Local Regulatory Setting

There are no local regulatory requirements regarding utilities.

SAN FRANCISCO BAY TO STOCKTON NAVIGATION IMPROVEMENT PROJECT
Draft General Reevaluation Report and Environmental Impact
Statement/Environmental Impact Report

Appendix G – Attachment 4
United States Fish and Wildlife Coordination

Species List Request
Biological Assessment
Draft Fish and Wildlife Coordination Act Report (Draft CAR)



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713



In Reply Refer To:

November 27, 2017

Consultation Code: 08ESMF00-2018-SLI-0501

Event Code: 08ESMF00-2018-E-01377

Project Name: San Francisco Bay to Stockton Navigation Improvement Project

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to

utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm>; <http://www.towerkill.com>; and <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
-

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office

Federal Building

2800 Cottage Way, Room W-2605

Sacramento, CA 95825-1846

(916) 414-6600

This project's location is within the jurisdiction of multiple offices. Expect additional species list documents from the following office, and expect that the species and critical habitats in each document reflect only those that fall in the office's jurisdiction:

San Francisco Bay-Delta Fish And Wildlife

650 Capitol Mall

Suite 8-300

Sacramento, CA 95814

(916) 930-5603

Project Summary

Consultation Code: 08ESMF00-2018-SLI-0501

Event Code: 08ESMF00-2018-E-01377

Project Name: San Francisco Bay to Stockton Navigation Improvement Project

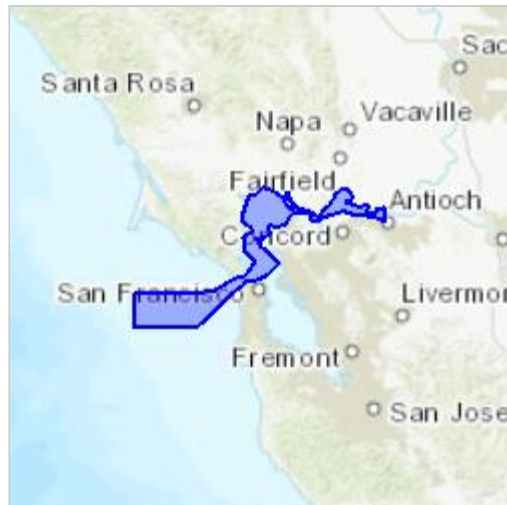
Project Type: DREDGE / EXCAVATION

Project Description: Deepen portions of the John F. Baldwin channel to 38 feet mean lower low water (MLLW), plus up to 2 feet of overdepth (for a total of 40 feet MLLW); this includes the Pinole Shoal and Bulls Head Reach Channels. The West Richmond Channel is also included in this project; however, it is currently below 38 feet MLLW and will not require deepening. Deepen a sediment basin in a portion of the Bulls Head Reach to 42 feet MLLW, plus up to 2 feet of overdepth (for a total of 44 feet MLLW). Beneficially use the dredged material at Cullinan Ranch, Montezuma Wetlands, or other permitted beneficial use site. Should sites not be able to take portions of the dredged material, the deep ocean disposal site, SF-DODS would be available as a back-up placement site. Deepening would be conducted with a mechanical clamshell dredge to reduce entrainment risk to species. Continue to maintain dredge the deepened navigation channels on annual basis. Future maintenance dredging would use the respective project's federal standard dredge plant and placement site. The current federal standard for Pinole Shoal is dredging with a hopper dredge and placing material at SF-10. The federal standard for Bulls Head Reach is currently dredging with a clamshell and placing material at SF-16; however, a hopper dredge has been the federal standard in the past.

Project Location:

Approximate location of the project can be viewed in Google Maps:

<https://www.google.com/maps/place/37.894739958149756N122.40543628193376W>



Counties: Alameda, CA | Contra Costa, CA | Marin, CA | Sacramento, CA | San Francisco, CA | Solano, CA | Sonoma, CA

Endangered Species Act Species

There is a total of 45 threatened, endangered, or candidate species on this species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse <i>Reithrodontomys raviventris</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/613	Endangered
San Joaquin Kit Fox <i>Vulpes macrotis mutica</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2873	Endangered
Southern Sea Otter <i>Enhydra lutris nereis</i> No critical habitat has been designated for this species. <i>This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.</i> Species profile: https://ecos.fws.gov/ecp/species/8560	Threatened

Birds

NAME	STATUS
California Clapper Rail <i>Rallus longirostris obsoletus</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern <i>Sterna antillarum browni</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet <i>Brachyramphus marmoratus</i> Population: U.S.A. (CA, OR, WA) There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/4467	Threatened
Northern Spotted Owl <i>Strix occidentalis caurina</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1123	Threatened
Short-tailed Albatross <i>Phoebastria (=Diomedea) albatrus</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/433	Endangered
Western Snowy Plover <i>Charadrius alexandrinus nivosus</i> Population: Pacific Coast population DPS-U.S.A. (CA, OR, WA), Mexico (within 50 miles of Pacific coast) There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8035	Threatened
Yellow-billed Cuckoo <i>Coccyzus americanus</i> Population: Western U.S. DPS There is proposed critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened

Reptiles

NAME	STATUS
Alameda Whipsnake (=striped Racer) <i>Masticophis lateralis euryxanthus</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5524	Threatened
Giant Garter Snake <i>Thamnophis gigas</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4482	Threatened
Green Sea Turtle <i>Chelonia mydas</i> Population: East Pacific DPS No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6199	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog <i>Rana draytonii</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander <i>Ambystoma californiense</i> Population: U.S.A. (Central CA DPS) There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2076	Threatened

Fishes

NAME	STATUS
Delta Smelt <i>Hypomesus transpacificus</i> There is final critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened
Tidewater Goby <i>Eucyclogobius newberryi</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/57	Endangered

Insects

NAME	STATUS
Bay Checkerspot Butterfly <i>Euphydryas editha bayensis</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2320	Threatened
Callippe Silverspot Butterfly <i>Speyeria callippe callippe</i> There is proposed critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/3779	Endangered
Delta Green Ground Beetle <i>Elaphrus viridis</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2319	Threatened
Lange's Metalmark Butterfly <i>Apodemia mormo langei</i> There is proposed critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/4382	Endangered
Mission Blue Butterfly <i>Icaricia icarioides missionensis</i> There is proposed critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/6928	Endangered
San Bruno Elfin Butterfly <i>Callophrys mossii bayensis</i> There is proposed critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/3394	Endangered
Valley Elderberry Longhorn Beetle <i>Desmocerus californicus dimorphus</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7850 Habitat assessment guidelines: https://ecos.fws.gov/ipac/guideline/assessment/population/436/office/11420.pdf	Threatened

Crustaceans

NAME	STATUS
California Freshwater Shrimp <i>Syncaris pacifica</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7903	Endangered
Conservancy Fairy Shrimp <i>Branchinecta conservatio</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8246	Endangered
Vernal Pool Fairy Shrimp <i>Branchinecta lynchi</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp <i>Lepidurus packardii</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Flowering Plants

NAME	STATUS
Antioch Dunes Evening-primrose <i>Oenothera deltoides</i> ssp. <i>howellii</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5970	Endangered
Colusa Grass <i>Neostapfia colusana</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5690	Threatened
Contra Costa Goldfields <i>Lasthenia conjugens</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7058	Endangered
Contra Costa Wallflower <i>Erysimum capitatum</i> var. <i>angustatum</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7601	Endangered
Franciscan Manzanita <i>Arctostaphylos franciscana</i> There is final critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5350	Endangered
Keck's Checker-mallow <i>Sidalcea keckii</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5704	Endangered
Marin Dwarf-flax <i>Hesperolinon congestum</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5363	Threatened
Marsh Sandwort <i>Arenaria paludicola</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2229	Endangered
Presidio Clarkia <i>Clarkia franciscana</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3890	Endangered
Presidio Manzanita <i>Arctostaphylos hookeri</i> var. <i>ravenii</i> No critical habitat has been designated for this species.	Endangered

Species profile: <https://ecos.fws.gov/ecp/species/7216>

San Francisco Lessingia *Lessingia germanorum* (= *L.g. var. germanorum*)

Endangered

No critical habitat has been designated for this species.

Species profile: <https://ecos.fws.gov/ecp/species/8174>

Showy Indian Clover *Trifolium amoenum*

Endangered

No critical habitat has been designated for this species.

Species profile: <https://ecos.fws.gov/ecp/species/6459>

Soft Bird's-beak *Cordylanthus mollis ssp. mollis*

Endangered

There is **final** critical habitat for this species. Your location overlaps the critical habitat.

Species profile: <https://ecos.fws.gov/ecp/species/8541>

Tiburon Jewelflower *Streptanthus niger*

Endangered

No critical habitat has been designated for this species.

Species profile: <https://ecos.fws.gov/ecp/species/4187>

Tiburon Mariposa Lily *Calochortus tiburonensis*

Threatened

No critical habitat has been designated for this species.

Species profile: <https://ecos.fws.gov/ecp/species/2858>

Tiburon Paintbrush *Castilleja affinis ssp. neglecta*

Endangered

No critical habitat has been designated for this species.

Species profile: <https://ecos.fws.gov/ecp/species/2687>

White-rayed Pentachaeta *Pentachaeta bellidiflora*

Endangered

No critical habitat has been designated for this species.

Species profile: <https://ecos.fws.gov/ecp/species/7782>

Critical habitats

There are 2 critical habitats wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Delta Smelt <i>Hypomesus transpacificus</i> https://ecos.fws.gov/ecp/species/321#crithab	Final
Franciscan Manzanita <i>Arctostaphylos franciscana</i> https://ecos.fws.gov/ecp/species/5350#crithab	Final



United States Department of the Interior



FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish And Wildlife
650 Capitol Mall
Suite 8-300
Sacramento, CA 95814
Phone: (916) 930-5603 Fax: (916) 930-5654
[http://kim_squires@fws.gov](mailto:kim_squires@fws.gov)

In Reply Refer To:

November 27, 2017

Consultation Code: 08FBDT00-2018-SLI-0050

Event Code: 08FBDT00-2018-E-00097

Project Name: San Francisco Bay to Stockton Navigation Improvement Project

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having

similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at:

<http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm>;

<http://www.towerkill.com>; and

<http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
-

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

San Francisco Bay-Delta Fish And Wildlife

650 Capitol Mall

Suite 8-300

Sacramento, CA 95814

(916) 930-5603

This project's location is within the jurisdiction of multiple offices. Expect additional species list documents from the following office, and expect that the species and critical habitats in each document reflect only those that fall in the office's jurisdiction:

Sacramento Fish And Wildlife Office

Federal Building

2800 Cottage Way, Room W-2605

Sacramento, CA 95825-1846

(916) 414-6600

Project Summary

Consultation Code: 08FBDT00-2018-SLI-0050

Event Code: 08FBDT00-2018-E-00097

Project Name: San Francisco Bay to Stockton Navigation Improvement Project

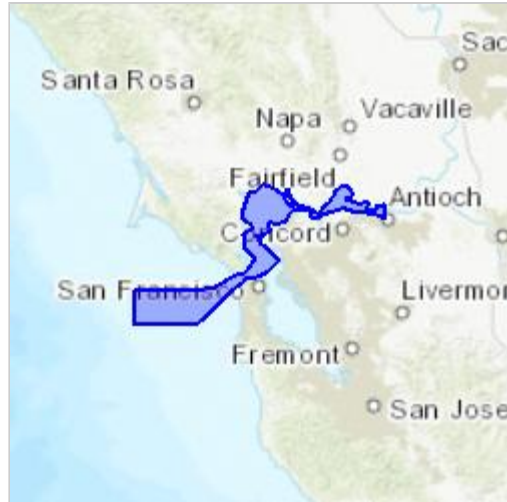
Project Type: DREDGE / EXCAVATION

Project Description: Deepen portions of the John F. Baldwin channel to 38 feet mean lower low water (MLLW), plus up to 2 feet of overdepth (for a total of 40 feet MLLW); this includes the Pinole Shoal and Bulls Head Reach Channels. The West Richmond Channel is also included in this project; however, it is currently below 38 feet MLLW and will not require deepening. Deepen a sediment basin in a portion of the Bulls Head Reach to 42 feet MLLW, plus up to 2 feet of overdepth (for a total of 44 feet MLLW). Beneficially use the dredged material at Cullinan Ranch, Montezuma Wetlands, or other permitted beneficial use site. Should sites not be able to take portions of the dredged material, the deep ocean disposal site, SF-DODS would be available as a back-up placement site. Deepening would be conducted with a mechanical clamshell dredge to reduce entrainment risk to species. Continue to maintain dredge the deepened navigation channels on annual basis. Future maintenance dredging would use the respective project's federal standard dredge plant and placement site. The current federal standard for Pinole Shoal is dredging with a hopper dredge and placing material at SF-10. The federal standard for Bulls Head Reach is currently dredging with a clamshell and placing material at SF-16; however, a hopper dredge has been the federal standard in the past.

Project Location:

Approximate location of the project can be viewed in Google Maps:

<https://www.google.com/maps/place/37.894739958149756N122.40543628193376W>



Counties: Alameda, CA | Contra Costa, CA | Marin, CA | Sacramento, CA | San Francisco, CA | Solano, CA | Sonoma, CA

Endangered Species Act Species

There is a total of 42 threatened, endangered, or candidate species on this species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse <i>Reithrodontomys raviventris</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/613	Endangered
San Joaquin Kit Fox <i>Vulpes macrotis mutica</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2873	Endangered
Southern Sea Otter <i>Enhydra lutris nereis</i> No critical habitat has been designated for this species. <i>This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.</i> Species profile: https://ecos.fws.gov/ecp/species/8560	Threatened

Birds

NAME	STATUS
California Clapper Rail <i>Rallus longirostris obsoletus</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern <i>Sterna antillarum browni</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8104	Endangered
Northern Spotted Owl <i>Strix occidentalis caurina</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1123	Threatened
Western Snowy Plover <i>Charadrius alexandrinus nivosus</i> Population: Pacific Coast population DPS-U.S.A. (CA, OR, WA), Mexico (within 50 miles of Pacific coast) There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8035	Threatened
Yellow-billed Cuckoo <i>Coccyzus americanus</i> Population: Western U.S. DPS There is proposed critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened

Reptiles

NAME	STATUS
Alameda Whipsnake (=striped Racer) <i>Masticophis lateralis euryxanthus</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5524	Threatened
Giant Garter Snake <i>Thamnophis gigas</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4482	Threatened

Amphibians

NAME

STATUS

California Red-legged Frog *Rana draytonii*

Threatened

There is **final** critical habitat for this species. Your location is outside the critical habitat.

Species profile: <https://ecos.fws.gov/ecp/species/2891>

California Tiger Salamander *Ambystoma californiense*

Threatened

Population: U.S.A. (Central CA DPS)

There is **final** critical habitat for this species. Your location is outside the critical habitat.

Species profile: <https://ecos.fws.gov/ecp/species/2076>

Fishes

NAME

STATUS

Delta Smelt *Hypomesus transpacificus*

Threatened

There is **final** critical habitat for this species. Your location overlaps the critical habitat.

Species profile: <https://ecos.fws.gov/ecp/species/321>

Insects

NAME	STATUS
Bay Checkerspot Butterfly <i>Euphydryas editha bayensis</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2320	Threatened
Callippe Silverspot Butterfly <i>Speyeria callippe callippe</i> There is proposed critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/3779	Endangered
Delta Green Ground Beetle <i>Elaphrus viridis</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2319	Threatened
Lange's Metalmark Butterfly <i>Apodemia mormo langei</i> There is proposed critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/4382	Endangered
Mission Blue Butterfly <i>Icaricia icarioides missionensis</i> There is proposed critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/6928	Endangered
Myrtle's Silverspot Butterfly <i>Speyeria zerene myrtleae</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6929	Endangered
San Bruno Elfin Butterfly <i>Callophrys mossii bayensis</i> There is proposed critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/3394	Endangered
Valley Elderberry Longhorn Beetle <i>Desmocerus californicus dimorphus</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7850	Threatened

Crustaceans

NAME	STATUS
California Freshwater Shrimp <i>Syncaris pacifica</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7903	Endangered
Conservancy Fairy Shrimp <i>Branchinecta conservatio</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8246	Endangered
Vernal Pool Fairy Shrimp <i>Branchinecta lynchi</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp <i>Lepidurus packardii</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Flowering Plants

NAME	STATUS
Antioch Dunes Evening-primrose <i>Oenothera deltoides</i> ssp. <i>howellii</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5970	Endangered
California Seablite <i>Suaeda californica</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6310	Endangered
Colusa Grass <i>Neostapfia colusana</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5690	Threatened
Contra Costa Goldfields <i>Lasthenia conjugens</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7058	Endangered
Contra Costa Wallflower <i>Erysimum capitatum</i> var. <i>angustatum</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7601	Endangered
Franciscan Manzanita <i>Arctostaphylos franciscana</i> There is final critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5350	Endangered
Marsh Sandwort <i>Arenaria paludicola</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2229	Endangered
Pallid Manzanita <i>Arctostaphylos pallida</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8292	Threatened
Presidio Clarkia <i>Clarkia franciscana</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3890	Endangered
Presidio Manzanita <i>Arctostaphylos hookeri</i> var. <i>ravenii</i> No critical habitat has been designated for this species.	Endangered

Species profile: <https://ecos.fws.gov/ecp/species/7216>

San Francisco Lessingia *Lessingia germanorum* (= *L.g. var. germanorum*)

Endangered

No critical habitat has been designated for this species.

Species profile: <https://ecos.fws.gov/ecp/species/8174>

Sebastopol Meadowfoam *Limnanthes vinculans*

Endangered

No critical habitat has been designated for this species.

Species profile: <https://ecos.fws.gov/ecp/species/404>

Soft Bird's-beak *Cordylanthus mollis ssp. mollis*

Endangered

There is **final** critical habitat for this species. Your location overlaps the critical habitat.

Species profile: <https://ecos.fws.gov/ecp/species/8541>

Sonoma Sunshine *Blennosperma bakeri*

Endangered

No critical habitat has been designated for this species.

Species profile: <https://ecos.fws.gov/ecp/species/1260>

Suisun Thistle *Cirsium hydrophilum var. hydrophilum*

Endangered

There is **final** critical habitat for this species. Your location is outside the critical habitat.

Species profile: <https://ecos.fws.gov/ecp/species/2369>

Tiburon Jewelflower *Streptanthus niger*

Endangered

No critical habitat has been designated for this species.

Species profile: <https://ecos.fws.gov/ecp/species/4187>

Tiburon Mariposa Lily *Calochortus tiburonensis*

Threatened

No critical habitat has been designated for this species.

Species profile: <https://ecos.fws.gov/ecp/species/2858>

Critical habitats

There are 3 critical habitats wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Delta Smelt <i>Hypomesus transpacificus</i> https://ecos.fws.gov/ecp/species/321#crithab	Final
Franciscan Manzanita <i>Arctostaphylos franciscana</i> https://ecos.fws.gov/ecp/species/5350#crithab	Final
Soft Bird's-beak <i>Cordylanthus mollis ssp. mollis</i>	Final

<https://ecos.fws.gov/ecp/species/8541#crithab>

BIOLOGICAL ASSESSMENT/ESSENTIAL FISH HABITAT ASSESSMENT

SAN FRANCISCO BAY TO STOCKTON, CALIFORNIA NAVIGATION IMPROVEMENT STUDY



April 2019



**US Army Corps
of Engineers** ®
San Francisco District

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Appendices

Appendix A: Summary of Sediment Sampling and Analysis

Appendix B: Special Status Species and Critical Habitat Included on the USFWS Official Species List (November 27, 2017)

1.0 Introduction

This Biological Assessment/Essential Fish Habitat Assessment (BA/EFH Assessment) was prepared to meet the consultation requirements under section 7 of the Endangered Species Act (ESA), pursuant to 50 C.F.R. § 402.12, and the Magnuson-Stevens Fisheries Conservation and Management Act (Magnuson-Stevens Act; 50 C.F.R 600.920(e)). The purpose of this BA/EFH Assessment is to analyze the potential effects from the proposed San Francisco Bay to Stockton Navigation Improvement Project (proposed action) on ESA-listed threatened and endangered species, designated critical habitat within the project's action area, and EFH. Although not required by the ESA, this BA also analyzes the potential effects of the proposed action on federal candidate species that have the potential to become federally-listed prior to or during construction of the proposed action.

1.1 Document Organization

As discussed, this document is intended to comply with two separate laws, ESA and Magnuson-Stevens Act. In addition, it provides the effects analysis and determination for ESA-protected resources managed by both the USFWS and NMFS. As such, the document is organized such that there are separate sections for USFWS-managed ESA resources, NMFS-managed ESA resources, and EFH, as described below.

- Section 2.0: Consultation history. This section provides an overview of the consultation history for the proposed project and maintenance dredging of the channels proposed for deepening.
- Section 3.0: Project location and action area. This section discusses the project location and action area. The action area is limited to the aquatic environment that could be affected by dredging and dredged material transport to upland beneficial use site.
- Section 4.0: Pinole Shoal Channel, Bulls Head Reach, and Project Description. This section provides an overview of the existing uses of the channels proposed for dredging, as well as the ongoing maintenance dredging.
- Section 5.0: Environmental Baseline and General Effects Analysis. This section discusses the environmental baseline of the action area and the effects of the proposed action on aquatic resources. This section also discussed the types of projects which could result in cumulative effect on aquatic resources. This section is limited to the impacts on aquatic resources that may result in impacts to ESA and EFH protected resources.
- Section 6.0: USFWS-managed ESA Species and Critical Habitat and Effects Determination. This section provides a description of the USFWS-managed species and critical habitat, as well as the effects determination and conclusions.
- Section 7.0: NMFS-managed ESA Species and Critical Habitat and Effects Determination. This section provides a description of the NMFS-managed species and critical habitat, as well as the effects determination and conclusions.
- Section 7.0: Essential Fish Habitat Assessment.
- Section 8.0: Literature Cited.

2.0 Consultation History

This section provides an overview of the consultation history for dredging the Pinole Shoal and Bulls Head Reach channels.

U.S. Fish and Wildlife Service:

- This project will follow the applicable best management practices (BMPs) and reasonable and prudent measures (RPMs) of the Long Term Management Strategy for the Placement of Dredge Material in the San Francisco Bay Region (LTMS) for which USFWS issued a biological opinion (BO) on March 12, 1999.
- On November 27, 2017, USACE requested and received a species list from USFWS.
- On March 6 and 22, 2018, USACE and USFWS staff discussed the biological assessment and potential effects of the project. On December 5, 2018 USACE presented a summary of project effects including updated salinity modeling results to several resource agencies; USFWS staff were in attendance.

National Marine Fisheries Service:

- This project will follow the applicable BMPs and RPMs of the LTMS for which NMFS most recently issued a BO on July 9, 2015, and a clarification on July 20, 2015.
- On November 28, 2017, USACE requested a species list from NMFS. On February 20, 2018, NMFS confirmed that all species and critical habitat assessed for the LTMS should be considered in the consultation for the San Francisco Bay to Stockton Navigation Improvement Project.
- On December 5, 2018 USACE presented a summary of project effects including updated salinity modeling results to several resource agencies; NMFS staff were in attendance.

3.0 Project Location and Action Area

The San Francisco Bay to Stockton Navigation Improvement Project was originally authorized by Congress in the Rivers and Harbors Act of 1965. The authorization allowed for deepening the John F. Baldwin Channels to 45 foot MLLW from the Golden Gate to approximately Chipps Island, and the Stockton Deep Water Ship Channel to 35 foot MLLW from Chipps Island to the Port of Stockton. The Sacramento District completed deepening the Stockton DWSC to 35 feet MLLW in 1988. Construction of the remaining portions of the channel was not conducted. The current project investigates dredging approximately 13.2 miles in the Pinole Shoal Channel and Suisun Bay Channel, terminating in Avon.

The project area also includes the dredging material placement transportation corridor within San Pablo and Suisun Bays, from the deep draft navigation channels to the upland beneficial use sites, Cullinan Ranch and Montezuma Wetlands, respectively (**Figure 1**). The project, including the beneficial use sites, is located in Marin, Sonoma, Napa, Alameda, and Contra Costa counties, California. The Pinole Shoal Channel is located in San Pablo Bay. It begins off the north shore of North Richmond and terminates at the western end of the Carquinez Strait near the mouth of Mare Island Strait. The Bulls Head Reach channel is located in Suisun Bay and is a sub-reach of the larger Suisun Bay Channel. It extends from the eastern portion of Carquinez Strait, north of Martinez, to just north of the town of Avon. A detailed project description is provide in **Section 4.3**.



Figure 1: San Francisco Bay to Stockton Navigation Improvement Project Location—Pinole Shoal Channel, Bulls Head Reach, and Beneficial Reuse Sites

3.1 Action Area

The action area is defined as all areas directly or indirectly affected by the proposed action (50 C.F.R. § 402.02). The proposed project's action area (**Figure 1**) includes:

- Pinole Shoal Channel and Bulls Head Reach;
- The dredged material transportation corridor between the locations of proposed dredging and the dredged material offloading sites at Cullinan Ranch and Montezuma Wetlands;
- The waters within the embayments where dredging would occur (i.e., San Pablo Bay and Suisun Bay);
- The waters immediately surrounding the dredged material transportation corridors; and
- The maximum upstream limit of salinity intrusion that could result from construction of the proposed project.

The dredged material placement sites, Cullinan Ranch and Montezuma Wetlands, are excluded from this ESA/EFH analysis and action area because these sites are fully permitted to accept dredged material for wetland restoration, including compliance with the ESA and MSFCMA.

4.0 Pinole Shoal Channel, Bulls Head Reach, and Project Description

This section provides a discussion of the existing Pinole Shoal Channel and Bulls Head Reach, including an overview of the navigation channel use and maintenance dredging activities; as well as a detailed project description and description of future maintenance dredging.

4.1 Existing Use of the Pinole Shoal and Bulls Head Reach Channels

Pinole Shoal Channel provides deep draft navigation accessibility through San Pablo Bay to the Carquinez Strait. The Bulls Head Reach channel continues navigation access from the eastern portion of the Carquinez Strait and continues underneath the Benicia-Martinez Bridge and Amtrak Bridge to the Town of Avon. The channels provide deep draft navigation access to the six oil refineries in the vicinity of the Carquinez Strait, beginning in Rodeo and ending in Avon (**Figure 1**, inset). They are part of a series of channels that provide deep draft navigation access extending from the San Francisco Main Channel, located outside of the Golden Gate, all the way to the Port of West Sacramento to the northeast and Port of Stockton to the southeast.

Given that the Pinole Shoal and Bulls Head Reach channels are maintained at 35 feet mean lower low water (MLLW), most vessels must be “light-loaded”, or less than fully loaded with cargo, to navigate the channels with sufficient under-keel clearance (i.e., 2 feet for non-hazardous cargo, and 3 feet for hazardous cargo such as petroleum). Light-loading increases the cost of transportation and, in turn, the cost of the shipped products because more trips must be made to carry the same volume of cargo.

The channels are used heavily under current conditions. According to data from the Waterborne Commerce Statistics Center, 20 - 27 million tons of commodities (primarily crude oil) moved through the Carquinez Strait annually between 2005 and 2013.

4.2 Existing Operations and Maintenance Dredging of the Pinole Shoal and Bulls Head Reach Channels

To facilitate safe and efficient deep draft navigation to ports and facilities along and beyond the Pinole Shoal and Bulls Head Reach channels, USACE maintains these navigation channels annually, according to the project’s federal standard. Maintenance dredging includes dredging to the permitted depth of 35 feet MLLW, plus up to 2 feet of overdepth (for a total allowable depth of 37 feet MLLW). Existing maintenance dredging of Pinole Shoal Channel and Bulls Head Reach is discussed below.

4.2.1 Pinole Shoal Channel

The Pinole Shoal Channel was historically dredged annually with a hydraulic hopper dredge and, at times, a clamshell dredge was used. However, as a requirement of the 5-year water quality certification for federal maintenance dredging in San Francisco Bay (California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB) 2015), dredging with a hopper dredge is limited to one in-bay channel each year. Since 2015, the USACE has dredged the Pinole Shoal Channel with a hopper dredge every other year. Dredged material is typically placed at the project’s federal standard placement site, the SF-10 in-bay disposal site, located approximately 3.0 miles northeast of Point San Pedro in Southern San Pablo Bay, Marin County. SF-10 is a 1,500-foot by 3,000-foot rectangular, open-water disposal site located in water depths of approximately 30 to 45 feet. The annual disposal limitation is 500,000 cubic yards (cy). Approximately 150,000 cy annually requires maintenance dredging; however, in wet years, this volume can be higher. Sediment composition of dredged material varies along the channel, with a majority of the material being at least 80 percent sand, particularly in the western and eastern portions of the channel. Since 2010, the USACE has conducted fish entrainment monitoring aboard the federal *Essayons* hydraulic hopper dredge when it dredges the Pinole Shoal Channel to document any take of special status fishes.

4.2.2 Bulls Head Reach

Bulls Head Reach is dredged annually with a hydraulic hopper dredge or clamshell dredge. Since 2015, dredging Bulls Head Reach has occurred using a clamshell dredge exclusively to reduce the potential risk for entrainment of the federally-threatened delta smelt (*Hypomesus transpacificus*). Approximately 25,000 cy of sediment is dredged from the Bulls Head Reach portion of the Suisun Bay Channel each year. Material dredged from this channel is typically placed at the project's federal standard sites, SF-16 or SF-9 (SF-9 is used as a backup site when SF-16 is at capacity). SF-16 is a 500-foot by 11,200-foot open-water placement site located adjacent to the Suisun Bay Channel, approximately 1 mile upstream of the Interstate 680 Bridge in Suisun Bay. The annual disposal limitation at SF-16 is 200,000 cy and only material from the federal Suisun Bay and New York Slough Channels can be placed at this site. SF-9 is a 1,000-foot by 2,000-foot open water rectangle located in approximately 10 to 55 feet of water, approximately 0.9 mile west of the entrance of Mare Island Strait in Carquinez Strait. Past maintenance dredging at Bulls Head Reach has included dredging up to 4 feet of advance maintenance material or emergency maintenance dredging outside of normal maintenance dredging to accommodate rapid shoaling. Since 2000, nine emergency dredging episodes have occurred in Bulls Head Reach. There is a half-mile section that shoals rapidly, and has become a routine navigation hazard. The shoaling occurs as a result of the proximity of channel to the Benicia-Martinez Railroad Drawbridge Regulated Navigation Area where vessels must stay in the center of the navigation channel to safely transit under the bridge (USACE 2014). As a result, the U.S. Coast Guard has asked USACE to declare an emergency in the past and conduct maintenance dredging in this reach in spring and early summer, which is outside of the LTMS work window (i.e., August 1 – November 30; USACE 2014). This area is now dredged annually to help avoid emergency dredging.

4.3 Project Description

The San Francisco Bay to Stockton Navigation Improvement project proposes to deepen approximately 10.3 miles (stations 0+00 to 548+00) of the Pinole Shoal Channel, located in San Pablo Bay (**Figure 2**), and 2.9 miles of Bulls Head Reach to Avon (stations 0+00 62+00 and 88+00 to 159+00), located in Suisun Bay (**Figure 3**). The proposed action would deepen these channels from 35 feet MLLW, plus 2 feet of allowable overdepth, to 38 feet MLLW, plus 2 feet of allowable overdepth. Most of the deepening in Bulls Head Reach includes constructing a 0.5 mile long (located between stations 62+00 and 88+00) that would be deepened to 42 feet MLLW, plus 2 feet of overdepth to reduce the advanced maintenance dredging or need for emergency dredging in the high shoaling area. Deepening the entire prism, including the sediment basin and overdepth, would result in approximately 1.6 million cy being dredged from the Pinole Shoal and Bulls Head Reach channels. **Figures 2 and 3** provide an overview of the deepening proposed for the navigation channels. **Table 1** provides an overview of the proposed project for each component of the deepening project (i.e., Pinole Shoal Channel, Bulls Head Reach sediment basin, and the remanding portions of Bulls Head Reach).



Figure 2: Project impacts to physical habitat in Pinole Shoal Channel.

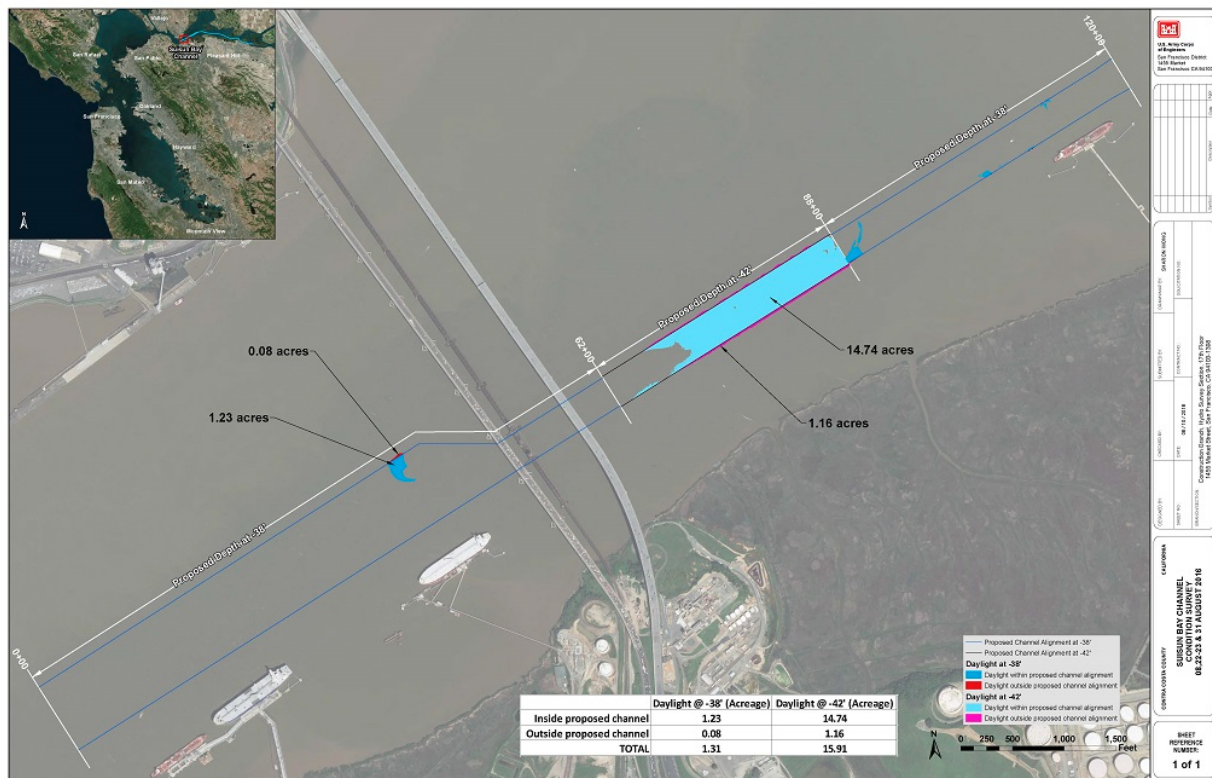


Figure 3: Project impacts to physical habitat in Bulls Head Reach.

Deepening would occur between the existing channel toes; widening the channel is not part of the project. However, the channel side slopes require a 3-foot horizontal to 1-foot vertical (3:1) side slope to ensure slope stability. Therefore, dredging would occur on the side slopes of the channel to ensure the side slopes maintain stability following construction. **Figure 4** provides a typical cross section of the navigation channel showing where dredging would occur in the channel toes and along the side slopes.

Mechanical clamshell dredging (up to three dredges) is the proposed dredge type for this project in order to minimize and reduce the potential risk of entrainment of special-status fishes. Dredged material would be placed in shallow-bottom scows and, once full, transported by tugs to the dredged material placement site(s). The project proposes to maximize the use of the dredged material by placing the dredged sediment at two wetland restoration beneficial use sites. Specifically, Pinole Shoal Channel sediments would be placed at Cullinan Ranch and Bulls Head Reach sediments would be placed at Montezuma Wetlands. These proposed dredged material placement sites are already fully permitted to accept dredged material from Bay Area dredging projects; permits include Endangered Species Act and Magnuson-Stevens Act approvals (NMFS 2001, 2010a, 2011, 2015a; USFWS 2001, 2003, 2004a, 2010a, b).

4.3.1 Construction Timing and Duration

It is expected that the project would be completed in one dredging season and, to the extent feasible, be completed during the existing work windows. Dredging timing and duration is discussed below. Section 4.3.2 provides a detailed discussion of the environmental work windows for each channel.

- Pinole Shoal: it is expected that Pinole Shoal would be dredged within the existing 6-month work window (June 1 through November 30). However, should deepening not be completed during the first 6-month work window, the USACE proposes to dredge outside the work window complying with the terms and conditions of the SF Bay LTMS programmatic maintenance dredging biological opinion (NMFS 2015b) by dredging with a clamshell dredge and beneficially using dredged material to create habitat which benefits listed species present in the action area. Should dredging outside of the work window not be allowed through this consultation, dredging would resume during the following work window.
- Bulls Head Reach: dredging Bulls Head Reach, including the sediment trap, would take approximately 1 month.

4.3.2 Environmental Work Windows

All dredging would be conducted during the existing LTMS environmental work windows for San Pablo Bay and Suisun Bay, unless expanded environmental work windows are provided through appropriate consultation. Dredging within the environmental work windows would reduce the potential impacts of the proposed action on sensitive life stages of threatened and endangered species. The environmental work windows for each channel are discussed below.

4.3.2.1 Pinole Shoal Channel Work Window

The environmental work window for the Pinole Shoal Channel is from June 1 through November 30, with specific conditions for dredging outside of the work window (i.e., dredging December 1 through May 31). This work window is designed to protect ESA-listed salmonids and green sturgeon (NMFS 2015). However, the current NMFS biological opinion (No. WCR-2014-1599) for LTMS (NMFS 2015) allows for maintenance dredging of the Pinole Shoal Channel beyond the November 30 work window under the following

conditions: dredging occurs with a mechanical clamshell dredge and dredged material is placed at wetland restoration beneficial use sites that benefit ESA-protected salmonids and green sturgeon. Although the NMFS LTMS biological opinion specifically addresses maintenance dredging projects in San Francisco Bay and is not intended to address new work, this deepening project proposes to comply with all terms and conditions provided therein, within the proposed action. Therefore, this project proposes to dredge Pinole Shoal outside the work windows (i.e., between December 1 and May 31) only with a clamshell dredge and dredged material would be beneficially reused at wetland restoration sites that would benefit listed salmonids (NMFS 2000).

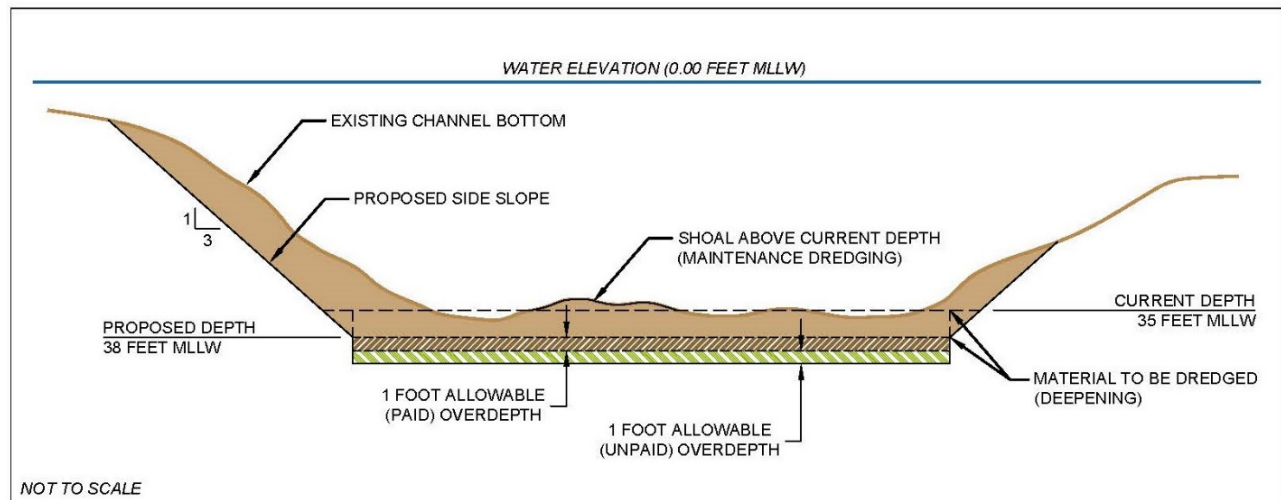


Figure 4: Typical Cross Section of a Navigation Channel Where Dredging Would Occur

4.3.2.2 Bulls Head Reach Work Window

The environmental work window for Bulls Head Reach is from August 1 through November 30 (**Table 1**). This environmental work window is designed to reduce the potential impacts of in-water work on delta smelt, but also would be protective of ESA-listed salmonids and green sturgeon. The project will comply with these work windows during dredging activities to avoid and minimize any potential impacts on listed species.

4.3.3 Construction Methods

This section discusses details regarding the construction methods that would be employed to deepen the navigation channels and transport and place dredged material.

4.3.3.1 Dredging

The following construction assumptions were used for cost estimating purposes for the channel deepening elements of the proposed action:

- Two dredge plants will be used with 21-CY clamshell buckets in the Pinole Shoal Channel
- Four 2,000 CY scows and two 1,800 HP tug boats will be used for dredged material placement at Cullinan Ranch from Pinole Shoal Channel
- One 21-CY clamshell dredge plant will be used in the Bull's Head Reach Channel

- Two 4,000 CY scows and one 1,800 HP tug boat for placement at Montezuma Wetlands Restoration Project From the Bull's Head Reach Channel

The dredged material will be hauled by scow from the Pinole Shoal channel to the Cullinan Ranch beneficial use placement site, and dredged material from the Bulls Head Reach channel will be hauled to the Montezuma Wetlands Restoration Project site where offloaders will be stationed to unload scows and pump the dredged material into both sites. The Napa River that leads to the Cullinan Ranch site is too shallow for fully loaded 4,000 CY scows, so it is assumed that the scows will be loaded to only 65 percent of their capacity, or less, in order to transit to the offloader location. It is also possible that the contractor may use 2,000 CY scows that can be fully loaded.

A mechanical clamshell dredge consists of a crane mounted on a floating deck barge, with a clamshell bucket on the end of the crane boom (**Figure 5**). The deck barge has two to four spud piles attached to the platform, generally at the corners. The spud piles are long pipes that are driven vertically into the bay bottom by hydraulic assistance. The spud piles are used to anchor the dredge barge. Clamshell dredges are not self-propelled so they require a tug boat to tow or push the dredge to and from the dredge sites. Once a tug moves the dredge into place, the spuds are driven into the bay bottom anchoring the dredge.

Table 1: Pinole Shoal Channel and Bulls Head Reach Dimensions and Project Features

Channel	Engineering Stations	Length ^(a)	Width ^(a) (channel toe)	Existing Channel Area (acre)	Proposed Depth (feet MLLW)	Channel Toe Area Proposed for Dredging (acre)	Channel Side Slopes Proposed for Dredging (acre)	Volume Proposed for Dredging (cubic yards)	Work Window
Pinole Shoal Channel	0+00 to 547+00	54,700 feet (10.36 miles)	600 feet	753	38 + 2 feet overdepth (up to 40 feet MLLW)	281.65	19.5	1,443,860	Jun 1 – Nov 30 a
Bulls Head Reach (not including the sediment basin)	0+00 to 62+00 and 88+00 to 150+00	12,400 feet (2.35 miles)	300 - 700 feet	119	38 + 2 feet overdepth (up to 40 feet MLLW)	1.11	0.2	38,747	Aug 1 – Nov 30
Sediment Basin (in Bulls Head Reach)	62+00 to 88+00	2,600 feet (0.49 mile)	300 feet	15	42 + 2 feet overdepth (up to 44 feet MLLW)	15.01	0.9	120,549	Aug 1 – Nov 30

Once the dredge is anchored in place, dredging can begin. Relocating the dredge requires approximately 1 hour to complete. On average, the mechanical clamshell dredge plant for this project will need to be relocated approximately every 3 hours. In addition, the dredge would need to be moved out of the shipping channel to allow deep draft vessels to transit the channel.

The crane has a boom that is long enough to extend out beyond the end of the work barge in any direction and is able to swivel 360 degrees on its mount. A large clamshell bucket is attached to the end of a series of cables at the end of the boom, which allows the bucket to be raised and lowered into the water. The cables also open and close the bucket as it is filled with sediment and then emptied into scows. The scows are open barges that can carry large quantities of sediment, up to the capacity of the scow, and are towed with tug boats to and from disposal sites. As soon as one scow is filled and hauled away, another empty scow is maneuvered into place alongside the dredge and the dredging continues.

Although the clamshell is raised from and lowered to the channel bottom using a system of cables, due to its weight it falls through the water column into the channel sediment. The cables restrict the clamshell from going too deep, or beyond the maximum allowable overdepth. The clamshell then closes and is pulled up through the water column to above the scow. Once over the scow, the clamshell opens and deposits the dredged material into the scow. When all the material within reach of the clamshell is dredged, the spuds are raised and the tender tug transports the dredge and scow to the next area requiring dredging. The process is repeated until all material is dredged from the channel. Following



Figure 5: Typical Mechanical Clamshell Dredge and Scow

dredging, hydrographic surveys are conducted to ensure that the entire area is dredged to the desired depth.

During dredging, clamshells place a slurry of sediment and water in the scows. Depending on the sediment type being dredged, the sediment-to-water ratio of the slurry is expected to be approximately 60 to 70 percent sediment and 30 to 40 percent water. To increase the sediment volume in the scows, the scows may decant water back to the water column in a process called overflow. Overflowing the scows increases the sediment volume, compared to water, which can decrease the number of scow-tug trips to placement sites, thereby decreasing construction costs. The San Francisco Bay Regional Water Quality Control Board allows unrestricted overflow in San Francisco Bay when sediment is greater than 80 percent sand. When sediment is less than 80 percent sand, overflow is only allowed if turbidity monitoring is conducted within 500 feet of dredging operations to demonstrate that the turbidity plume generated by overflow activities does not increase the ambient turbidity by more than 10 percent, does not reduce dissolved oxygen concentrations to below 5.0 milligrams per liter (mg/L) in the Pinole Shoal Channel and 7.0 mg/L in Bulls Head Reach, or result in the pH going below 6.5 or above 8.5.

Sediment proposed for dredging is classified as sand (including gravel) and fine-grained (silt and clay). In Pinole Shoal Channel, the content physical composition of the sediment changed from finer grained sediment at the very western end of the channel (>70 percent silt and clay), to predominately sandy material in much of the central portion of the channel (>70 percent sand and gravel), back to fine-grained sediment near the very eastern end of the channel (25 to 90 percent fine grained). In the Bulls Head Reach Channel, the sediment proposed for dredging is predominately sand, with pockets of fine-grained material. In general, sand ranges from 19 to 98 percent throughout the channel, with small areas of less than 54 percent silt and clay. Therefore, overflow turbidity monitoring would be required to demonstrate that the turbidity plumes are not adversely affecting water quality in the vicinity of the dredge. In addition, an overflow turbidity monitoring plan approved by the RWQCB would be required.

4.3.3.2 Removal of Rock Obstruction in Pinole Shoal

A small rock outcrop is present immediately north of the downstream portion of the Suisun Bay Channel (**Figures 6 and 7**). The top of the outcrop is currently at a depth of 39.7 feet MLLW. While coordinating with the San Francisco Bay Bar Pilots, the Bar Pilots expressed safety concerns as the outcrop poses a threat to safe navigation. Even though this rock formation is not in the federal channel, it is located in the shipping lane and will need to be addressed as part of this project to provide safe navigation. The rock formation will be lowered so that there is a minimum of 3-ft of additional clearance below the 2-ft of overdepth tolerance. As part of the project, the outcrop would be lowered by approximately 3.3 feet, to a depth of 43 feet MLLW.

Following discussions with the Bar Pilots, the outcrop was surveyed to determine the depth of the outcrop and if the outcrop was actually rock or a sunken ship. The surveys indicated that the formation is a rock outcrop. The formation is presumed to be associated with the San Franciscan formation on the San Pablo Bay bottom. Lowering of the outcrop would occur using a pneumatic jackhammer attachment mounted to an excavator (**Figure 8**). The excavator would be secured on a floating work barge. The jackhammer would chisel the rock down to a depth of 43 feet MLLW over a period of up to 20 hours spanning 1-2 days. As the material is chiseled from the outcrop, it would fall through the water column to the bay floor where

it would remain. Lowering the outcrop would result in approximately 40 cy of material being removed from the top of the outcrop, affecting approximately 950 square feet (0.02 acres) of benthic habitat.

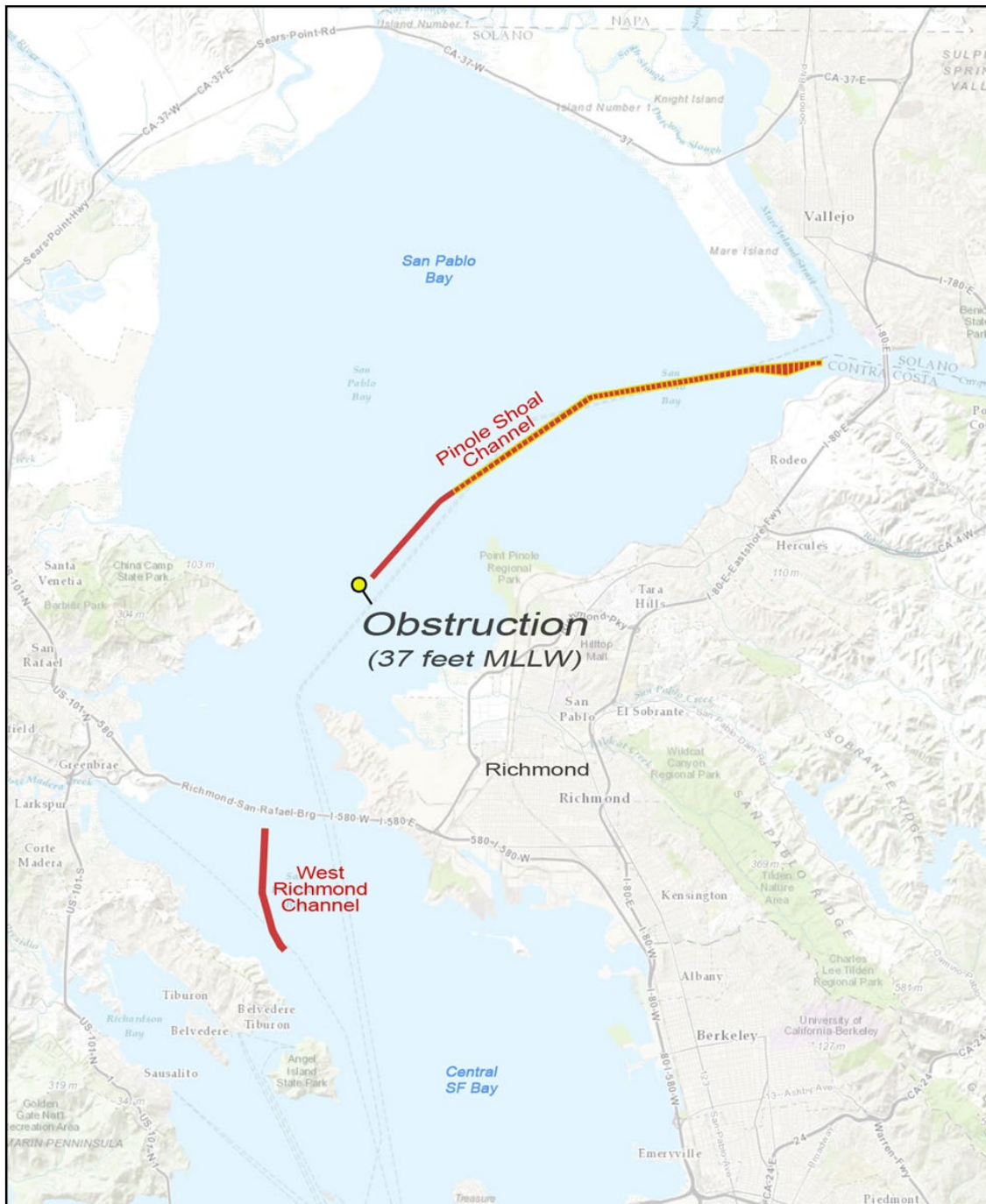


Figure 6: Pinole Shoal Channel Obstruction.

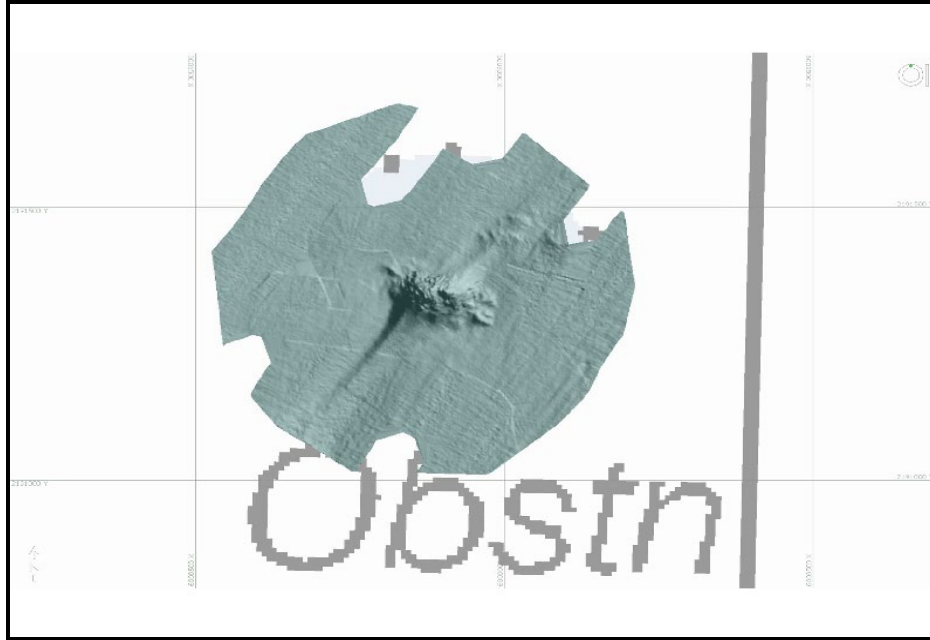


Figure 7: Side Scan Sonar of the Obstruction near the Western End of the Pinole Shoal Channel, San Pablo Bay



Figure 8: Excavator with a Jackhammer.

4.3.3.3 Dredge Material Transport and Placement

When scows are full, they are transported to the dredged material placement site by diesel-powered tug boats. Scows transporting dredged material to the beneficial use sites would moor to an offloader at the respective site such that sediment can be pumped out of the scow and onto the restoration site. Pumping the sediment out of the scow, or offloading, typically involves the use of a modified hydraulic pipe dredge which serves as an offloader. Montezuma Wetlands typically uses the Liberty offloader (**Figure 9**), which is secured on a floating barge. Cullinan Ranch uses an offloader that is land-based (**Figure 10**). Once moored, the offloader would insert a snorkel into the scow, simultaneously injecting water into the scow to create a water-sediment slurry and pump the slurry from the scow to a designated cell within the site. The offloader's water intake system must be screened in accordance with the California Department of Fish and Wildlife's screening criteria.

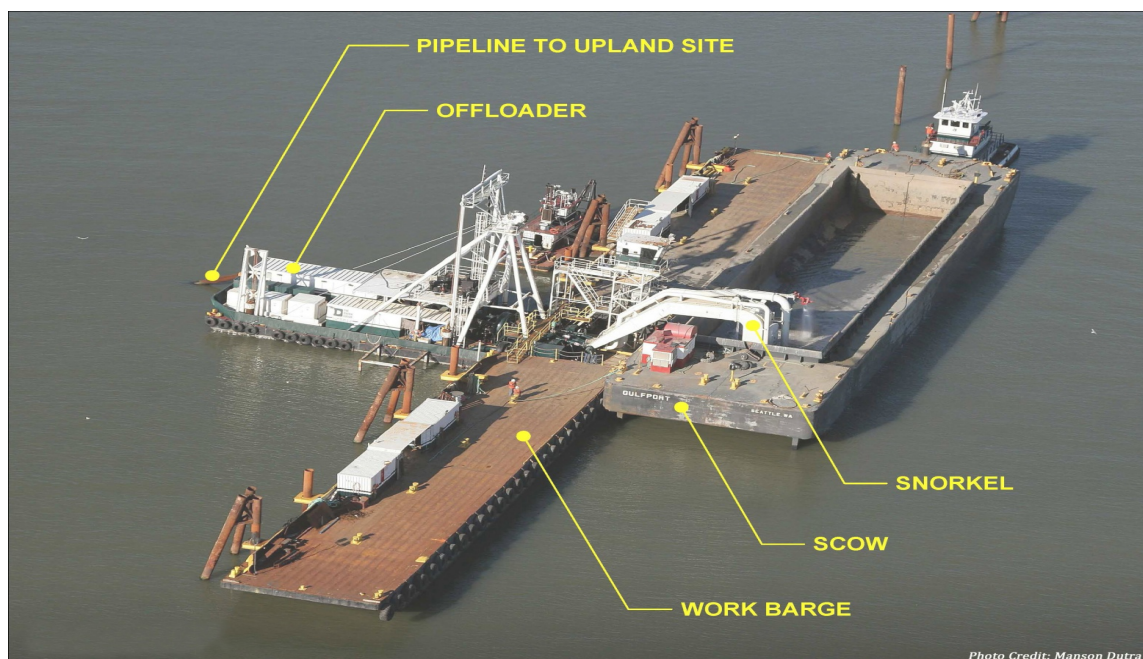


Figure 9: Liberty Offloader—Typically Offloading at Montezuma Wetlands Restoration Project

It takes approximately 2 hours to completely offload dredged sediment from a scow. Scows-tugs transporting dredged material from the Pinole Shoal Channel would travel an average of 10 miles one-way from dredging locations to Cullinan Ranch. Scows transporting material from Bulls Head Reach to Montezuma Wetlands would travel an average of 13 miles one-way. Scows-tugs would travel approximately 7 knots (8 miles per hour) from dredge sites to the beneficial use sites. On average, each scow-tug trip to and from the beneficial use sites, including offloading, would take approximately 6 hours.

The project proposes to use existing dredged material placement sites which have all environmental approvals to accept dredged material, including biological opinions, incidental take permits, and EFH conservation recommendations. The intent is to maximize the use of dredged material for construction/enhancement of wetlands. Dredged material placement sites included in the project description are discussed below.

4.3.3.4 Cullinan Ranch Restoration Project

The Cullinan Ranch Restoration Project is located along the northern shoreline of San Pablo Bay near the city of Vallejo in Solano and Napa Counties. The site consists of diked baylands that was used for agriculture until the late 1980s. Following diking and draining the site, much of the land lost up to 6 feet of elevation as a result of sediment deposition, soil compaction, and loss of organic matter (USFWS 2010). The USFWS is currently restoring over 1,500 acres of the site to tidal wetlands consistent with the



Figure 10: Modified Offloader Currently Offloading Dredged Material at Cullinan Ranch (Dutchman Slough)

USFWS' recovery plan for salt marsh harvest mouse and California clapper rail. In addition, it is believed that the restored marsh will provide suitable habitat for delta smelt, Central California coastal steelhead, Central Valley steelhead, winter-run Chinook salmon, Central Valley spring-run Chinook salmon, green sturgeon, and western snowy plover (USFWS 2010). The Cullinan Ranch Restoration Project also is expected to provide food and nutrients for aquatic species in the adjacent Napa River Estuary and San Pablo Bay.

In 2014, regulatory permits were revised to increase the volume of dredged sediment authorized for placement in support of tidal marsh habitat restoration at Cullinan Ranch. Specifically, the amount was increased from 450,000 cy to restore 50 acres to 2.8 million cy to restore 290 acres of the 1,575-acre site to elevations suitable for marsh plain establishment. As of December 2017, approximately 800,000 cy had been placed at Cullinan Ranch, leaving a remaining capacity of approximately 2 million cy. A detailed description of the restoration activities and associated impacts to special status species and critical habitat are fully described in the Cullinan Ranch Restoration Project's biological opinion (USFWS 2010b); NMFS 2015a)

4.3.3.5 Montezuma Wetlands

Montezuma Wetlands Restoration Project is a privately-owned restoration project located on the eastern edge of Suisun Marsh, north of the confluence of the Sacramento and San Joaquin Rivers near the town of Collinsville, in Solano County. In the early 1900s, the site was diked, drained, and used for agriculture. Since the site was diked, the land has subsided up to 10 feet and dredged material is being used to raise site elevations for wetland restoration. Once completed, Montezuma Wetlands is expected to restore 1,820 acres of tidal, seasonal, and managed wetlands. Approximately 17.5 million cubic yards of dredged material are needed to raise site elevations. As of August 2017, approximately 4 million cy of dredged material had been placed at Montezuma Wetlands, contributing to the restoration of over 350 acres of wetlands (https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/dredging.html). The site can accept both cover and foundation material. Foundation material is allowed only in the deepest portions of the site and must be covered with at least 3 feet of clean cover material.

A detailed description of the restoration activities and associated impacts to special status species and critical habitat are fully described in the Montezuma Wetland Restoration Project's biological opinions (NMFS 2001, 2011; USFWS 2001, 2003, 2004a, 2010a)

Based on the above information for Cullinan Ranch and Montezuma Wetlands, 9000 to 11,429 cy of dredged sediment is required to create 1 acre of wetland habitat at the above locations. Using an intermediate value of 10,000 cy per acre of habitat, the approximately 1.6 million cy of dredged sediment resulting from the proposed project is expected to create 160 acres of wetland habitat due to it being beneficial reused at the restoration sites.

4.4 Future Operations and Maintenance Activities

Once deepened, the navigation channels would be maintained to their new regulatory depths of 38 feet MLLW in Pinole Shoal Channel and in a majority of Bulls Head Reach, and to 42 feet MLLW in the sediment basin. Maintenance dredging, including placement of dredged material, would be conducted, in accordance with each channel's federal standard. Maintenance dredging will occur as part of the San Francisco Bay federal navigation channel maintenance dredging program, and would include dredging up to 2 feet of overdepth. It is expected that the volume of material requiring dredging would increase by approximately 15 percent compared to current conditions. Dredged material would be placed at the respective project's federal standard site or base plan (least costly, environmentally acceptable placement site); typically SF 10 for the Pinole Shoal Channel and SF-16 for Bulls Head Reach. Maintenance dredged material could be beneficially reused if the beneficial site is as cost efficient as the federal standard placement site.

5.0 Environmental Baseline and General Effects Analysis

This section discusses the existing environmental baseline and aspects of the proposed project that could result in effects to listed species, critical habitat, and/or EFH. The proposed action is located entirely within the aquatic habitat of San Pablo and Suisun Bay; therefore, effects of the action analyzed herein are anticipated to be in the aquatic environment affecting special status fishes and their habitats. This section discusses the general impact mechanisms of the project which would be similar for all special status species and habitat analyzed herein. The determinations of effects on listed species, critical habitat, and

EFH and conclusions are provided in **Section 6.0** (USFWS-ESA managed species and critical habitat), **Section 7.0** (NMFS-managed ESA species and critical habitat), and **Section 8.0** (essential fish habitat).

The environmental baseline includes current on-going federal and non-federal projects which operate and are maintained in the San Francisco Bay-Delta region. These include, but are not limited to on-going maintenance dredging of existing federal and non-federal navigation channels, deep draft and shallow draft navigation, operations of the Central Valley Project and State Water Projects, other water exports in, and existing outfalls, urban runoff, and other sources of contaminants.

The federal ESA defines effects as wholly beneficial, direct (i.e., effects occurring during construction of the project), indirect (i.e., effects caused by the proposed action at a later time), interrelated (i.e., effects caused by actions that depend on the larger action for justification), or interdependent (i.e., effects caused by actions that have no independent utility apart from the proposed action), as required by 50 C.F.R § 402.14(14) and defined at § 50 C.F.R. 402.02).

The Magnuson-Stevens Act defines adverse effects on EFH as “any impact that reduces quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions” (50 CFR § 600.810).

A summary of the types of impacts and resources expected to be impacted are provided below.

- Wholly beneficial impacts: beneficial reuse of dredged material would result in long-term beneficial impacts to both USFWS and NMFS managed ESA species, as well as EFH.
- Direct impacts: direct impacts could occur through dredging and dredged material transportation. These impacts include increased hydrodynamic noise, increased concentrations of suspended sediment and turbidity during dredging activities, which may result in release of constituents of concern. These impacts could range from injury or death of special status fishes or changes in their behavior, to adverse effects on critical habitat and essential fish habitat.
- Indirect impacts: indirect impacts could result exposure to constituents of concern, changes in habitat, including loss of shallow habitat, loss of benthic or other prey resources, salinity intrusion and resulting alterations to the low salinity zone. These effects could result in alterations in behavior or sub-lethal effects resulting in alterations to habitat and foraging resources.
- Interrelated and interdependent effects: interrelated and interdependent effects could include vessel traffic already existing in the federal navigation channels. However, vessel traffic and use of the channels is not expected to increase compared to baseline conditions. Therefore, these impacts are not discussed further in this document.
- Cumulative effects: the federal ESA defines cumulative effects as effects resulting from the proposed action combined with any future state, Tribal, local, or private actions that are reasonably certain to occur in the area (50 CFR 402.02). Future federal actions that are unrelated to the proposed action are not considered in a biological opinion. While the scope of cumulative effects are not defined for EFH, cumulative effects are included in the definition of adverse effects.

5.1 Impacts Associated with Clamshell Dredging and Dredged Material Transportation

Maintenance dredging in San Francisco Bay is a regular occurrence that removes an annual average of about 3.0 to 3.5 million cubic yards from navigation channels, with the federal dredging assuming 1.5 to 2.0 million cubic yards. Methods of maintenance dredging include hopper, clamshell-bucket, and cutterhead-pipeline dredging. Disposal sites include aquatic in-bay placement sites; offshore sites, such as SF-DODS and SF-17; and beneficial reuse locations, such as wetland restoration sites. Dredging and dredged material placement is regulated by the inter-agency San Francisco Bay LTMS (USACE et al. 1998; 2001). The LTMS includes several avoidance and minimization measures to protect ESA-listed species, such as environmental work windows, which were developed through ESA consultations. Additionally, clamshell dredging has been employed in the Suisun Bay in recent years to reduce the entrainment risk to delta smelt (USACE 2018). This project proposes to use a clamshell dredge for Pinole Shoal and Bulls Head Reach.

Special status fishes have the potential to be directly injured by construction equipment through contact with the dredge clamshell bucket or contact with the tugs and scows. In addition, fish may become entrained in propeller wash from tugs or other shallow-draft skiff vessels transporting crew and equipment. The most likely cause of injury would be from the clamshell bucket falling through the water column or entrainment in tug propeller wash.

While individual fish have the potential to be struck or entrained by clamshell bucket as it falls through the water column to the channel bottom, the falling bucket would generate a pressure wave around it that would force small fish away from the falling bucket. As a result of the pressure wave, mechanical clamshell dredging has a very low risk of entraining fishes (Reine and Clarke 1998). As such, the use of a clamshell dredge minimizes the risk of fish entrainment for all fishes.

Special status fish also have the potential to be entrained in tug prop wash. The project proposes to use two 1800 hp tugs to transport scows to and from the beneficial use sites, and up to three 1,000 hp tugs to maneuver the clamshell dredges. The smaller tugs would remain in the vicinity of the dredge area; whereas the larger tugs would move between the dredge areas and the placement sites. The dredges would draft between 10 and 18 feet MLLW. While operating, the tugs would create propeller wash as they move through the water. Propeller wash is a pressure disturbance that results in a system of diverging and transverse waves. As the propeller spins, it generates a turbulent, continuous stream of fast moving water (AMOG Consulting 2010). Fish entrained in propeller wash may become disoriented or injured.

5.2 Habitat Alteration

The proposed project area provides habitat for a wide variety of aquatic species, including species associated with the benthos (e.g., annelids, mollusks, and crustaceans); phytoplankton and zooplankton; common fish species; special status fish species; invasive aquatic plants, fish, and invertebrates; and marine mammals. Aquatic habitats include tidal marsh and tidal mudflats; intertidal, shallow sub-tidal, and deep sub-tidal habitats; managed wetlands; rocky intertidal and subtidal; and open bay waters. Much of the land adjacent to Suisun Bay, the Carquinez Strait, San Pablo Bay, and San Francisco Bay is developed. Suisun Bay is adjacent to Suisun Marsh and other wetland areas, as well as some developed shorelines. Pinole Shoal Channel is surrounded by extensive mudflats and wetland restoration projects to the north of the channel, as well as developed shorelines. The habitat types around the Bay and Delta often blend

with one another and with nearby upland habitats in transition zones called ecotones. Species found in these areas often occur in more than one habitat type (USACE 2014).

The proposed project would remove several feet of substrate and deepen an estimated 318 acres of bay floor, including 301 acres of benthic habitat in Pinole Shoal Channel and 1.3 acres in Bulls Head Reach from 35 feet MLLW to 38 feet MLLW plus 2 feet of overdraft. Additionally, the sediment basin in Bulls Head Reach would be deepened to 42 feet, which would impact an additional 16 acres of habitat. Removal of benthos may temporarily reduce the food supply for special status fish species that are benthic predators, such as green sturgeon. Benthic recolonization of the dredged area may take months or years (Oliver et al. 1977). Of the total acreage disturbed, approximately 12 acres would be on the side slopes of the channel. However, there would be no disturbance to shallow water habitat, which is defined as < 10 feet deep.

5.3 Water and Sediment Quality

The project has the potential to affect water and sediment quality by temporarily increasing suspended sediment during dredging. This could also result in releases of constituents of concern attached to sediment particles, salinity intrusion, and changing the sediment quality of the channel bed following dredging (e.g., the z-layer). Salinity intrusion could affect the quantity and quality of habitat available for fishes that depend on a particular range of salinity as suitable habitat; of particular concern is delta smelt. These potential impacts to water and sediment quality are discussed in greater detail below.

5.3.1 Turbidity and Suspended Sediment

The proposed action could produce increased suspended sediments and turbidity in the action area from clamshell dredging operations and placement of spoils at the disposal site. Background turbidity in the estuary is naturally high, with total suspended solids (TSS) levels ranging up to more than 200 mg/L (Rich 2010). However, sediment plumes would be generated from excess sediment and other entrained material (e.g. air bubbles) being discharged back into the water column during dredging, thus elevating turbidity concentrations. The degree of sediment re-suspension depends on the physical composition of the material, with fine-grained material remaining in suspension longer and sandy material falling through the water column and resettling much faster. Plume size, concentration, and duration also depend on environmental and operational specific factors. During dredging, sediments may become suspended as a result of the clamshell bucket's impact to the channel bottom, material washing from the top and side of the bucket as it passes through the water column, sediment spillage as it breaks the water surface, spillage of material during barge loading, and intentional overflow of scows. In addition, the movement of water associated with tides, river outflow, wind, and waves also determine turbidity plumes, all of which can disperse suspended particles and turbidity plumes around the Bay.

Sediment proposed for dredging is considered Young Bay Mud and further classified as sand (including gravel) and fine-grained (silt and clay). The alternating layers of silty clay, clayey silt, sandy silt, silty sand, sand, and inter-bedded clay and sand are discontinuous and of varying thickness. Shells, wood debris (e.g., branches, twigs, and rootlets), and organic soils grading to peat also are expected to be encountered. In Pinole Shoal Channel, the content physical composition of the sediment changes from finer grained sediment at the very western end of the channel (>70 percent silt and clay), to predominately sandy material in much of the central portion of the channel (>70 percent sand and gravel), back to fine-grained

sediment near the very eastern end of the channel (25 to 90 percent fine grained). In the Bulls Head Reach Channel, the sediment proposed for dredging is predominately sand, with pockets of fine-grained material. In general, sand ranges from 19 to 98 percent throughout the channel, with small areas of less than 54 percent silt and clay. Dredging in areas with fine-grained material, such as the western and eastern portions of the Pinole Shoal Channel could result in turbidity plumes with higher concentrations remaining in the water column longer and traveling farther from the dredging or overflow source. Dredging in areas of sandy material would likely result in turbidity plumes settling out of the water column faster.

Turbidity plumes were measured during clamshell dredging in the Oakland Harbor and Richmond Inner Harbor, located in Central San Francisco Bay, and Redwood City Harbor, located in the South San Francisco Bay in 2016 and 2017. Sediment in these channels ranges from very fine silt to sandy-silt. The purpose of the turbidity monitoring was to determine if dredging or overflowing of scows exceeded the turbidity requirements in the projects' water quality certification. The San Francisco Bay federal navigation channel maintenance dredging water quality certification requires that increased turbidity be less than 50 NTU or no greater than 10 percent if the baseline NTU is greater than 50 at the point of compliance (i.e., 500 feet downstream of dredging). During the scow overflow monitoring, ambient turbidity was measured at a reference site 200 feet up current from dredging operations, in areas that were not affected by the turbidity plume, 200 feet down current from the dredge (referred to as the early warning location), and at the point of compliance 500 feet down current from the dredge. For each location, turbidity was measured near the surface (approximately 2 feet below the surface), mid-depth, and near the bottom (approximately 2 feet above the bed). Turbidity was measured when the scow was overflowing (decanting) and when the scow was not overflowing, and also during various tidal cycles, represented the range of tides in the bay. Measurements were taken every 10 minutes at each location. Exceedances of the water quality turbidity standards at the point of compliance occurred periodically for all channels, with most exceedances occurring in the Richmond Inner Harbor, where sediment is very fine-grained.

Sediment in the Oakland Harbor and Richmond Inner Harbors are predominately fine-grained, with much less sand, compared to the sediments proposed for dredging in Pinole Shoal and Bulls Head Reach. It is expected that overflowing scows during the deepening project would result in plumes with less concentrations of suspended sediment and turbidity. However, tides and river outflow through Bulls Head Reach, the Carquinez Strait, and Pinole Shoal could be greater than those found in Oakland Harbor and Richmond Inner Harbor, possibly carrying plumes farther. Regardless, as mentioned, should scow overflow be allowed, turbidity monitoring would be conducted in compliance with anticipated requirements of a water quality certification, biological opinion, or other regulatory permits.

The response of fish to suspended sediments varies among species and life stages as a function of suspended particle size, particle shape, water velocities, suspended sediment concentrations, water temperature, depressed dissolved oxygen concentrations, contaminants, and exposure duration (Sherk 1972; O'Connor et al. 1976; Newcombe and Jensen 1996). Short-duration exposure to elevated suspended sediment concentration could result in sublethal effects; however, potential exposure and dosage of suspended sediment concentrations drops exponentially from the source of the plume. Exposure to excessive suspended sediment concentrations generated during dredging operations could result in behavioral avoidance and exclusion from otherwise suitable habitat, disrupt movement and migration patterns, reduce feeding rates and growth, sublethal and lethal physiological stress, habitat degradation, or delayed hatching; and, under severe circumstances, could result in mortality (Newcombe

and Jensen 1996; Clarke and Wilber 2000). Physiological stresses could include clogged gills, eroded gill and epithelial tissues, impaired foraging activity and feeding success, and altered movement and migration patterns of juvenile and adult fishes (Clarke and Wilber 2000; Newcombe and Jensen 1996; Newcombe and MacDonald 1991).

5.3.2 Exposure to Constituents of Concern and Bioaccumulation

To address the potential for exposure to constituents of concern and bioaccumulation, sediment sampling and testing analyses were reviewed and summarized in detail in Appendix A, with a condensed summary of the results pertaining to elevated constituents of concern and toxicity and bioaccumulation provided below.

The USACE initially studied deepening the Pinole Shoal and Bulls Head Reach channels to a depth of 45 feet MLLW in the early 1990s and 2000s. As part of this study, sediment was sampled throughout the Pinole Shoal Channel and Bulls Head Reach. Sampled sediment underwent physical, chemical, and bioaccumulation analyses, as well as studies to determine if the sediment is suitable for wetland creation. In all studies, sediment was sampled to a depth of 45 feet MLLW, plus 2 feet of overdepth, for a total sampled depth of 47 feet MLLW. This represents sampling an additional 7 feet of sediment in Pinole Shoal Channel and Bulls Head Reach, and an additional 5 feet in the sediment basin, compared to the proposed action. While the sampling represents a deeper depth than what is currently proposed, the sediment has remained in place and the chemical and biological composition has not been altered. Therefore, the previous sediment sampling and analysis studies can be used to evaluate the suitability of dredged material for aquatic placement and wetland creation, as well as whether dredging and dredging material placement would pose a contamination or bioaccumulation risk to special status species in the action area.

Although these early studies are being used for planning purposes, the USACE proposes to conduct confirmatory sediment sampling and analysis to the depths proposed for this project, plus the required overdepth, prior to construction deepening. Confirmatory testing will verify that the sediment layers in the shallower depths are suitable for placement at Cullinan Ranch, Montezuma Wetlands, and SF-DODS, and that the z-layer sediment that would form the new channel bottom would not result in contamination surrounding ecosystem.

Physical and chemical properties were analyzed for sediment grain size, total organic compounds, total volatile solids, oil and grease, total petroleum hydrocarbons, percentage of petroleum, polynuclear aromatic hydrocarbons, chlorinated pesticides and polychlorinated biphenyls, and ten metals (Battelle Marine Sciences Laboratory 1990, 1993). Full Tier III testing included suspended-particulate-phase toxicity test, solid-phase toxicity tests, and bioaccumulation tests, as well as grain and chemistry analyses (Battelle Marine Sciences Laboratory 1993). Suspended-particulate-phase toxicity tests test for the effects of dissolved contaminants and contaminants associated with particles suspended in the water column after during dredging and aquatic placement. Solid-phase toxicity tests are benthic toxicity and bioaccumulation tests that examine the effects of dredged sediment on sensitive benthic organism.

Pinole Shoal Sediment Sampling and Analysis: Sediment proposed for dredging in the northeast portion of Pinole Shoal had elevated levels of aluminum, arsenic, and mercury that were not correlated to the

concentration of total organic carbon or grain size. In addition, pockets of elevated chromium (i.e., exceeding in-bay reference samples by 20 to 35 mg/kg) were detected in three composite samples. Total organic compounds were generally higher in the western portion of Pinole Shoal, and decreased moving eastward. Total volatile solids increased slightly moving eastward. Total organic compounds and total volatile solids were well correlated with sediment size, with the fine-grained sediment contained higher total organic compounds. Oil and grease and total petroleum hydrocarbons were generally low throughout the channel. However, PAHs did not exceed any in-bay reference sites. Overall, sediment proposed for dredging are suitable for wetland cover material.

Pinole Shoal sediment toxicity tests indicated that there were some acute toxicity to larvae; however, LC50s could not be calculated because mortality did not exceed 50 percent of the population. The results showed some increased abnormal growth and development in larval echinoderm (*Dendraster excentricus*). However, toxicity tests did not show effects to mysid (*Holmesimysis sculpta*) or juvenile sanddab (*Citharichthys stigmaeus*). Overall, survival rate of species was exposed to Pinole Shoal sediment for 10 to 28 days was 93 percent.

Bulls Head Reach Sediment Sampling and Analysis: Chemical analysis showed that the sediments were relatively uncontaminated. Organic compounds were present in low concentrations, including PAHs, butyltins, and 4'4-DDD. Sediment total organic compounds, total volatile solids, total petroleum hydrocarbons, and sulfides were well correlated with grain size; with fine-grained sediment tending to have higher concentrations. Overall, the analysis indicates that the material is suitable for in-bay and ocean disposal, as well as beneficial use.

Toxicity tests indicated that survival rates ranged from 81 to 98 percent for the amphipod *Rhepoxynius abronius* and 74 to 98 percent for *Echaustorius estuaries*. Longer-term exposure (i.e., 28 days) showed some toxicity and reduced development when exposed to one composite sample. It is believed that the toxicity was due to elevated concentrations of ammonia. Many advances were made regarding reducing ammonia input from sources in the San Francisco Bay area and tributaries. However, confirmatory sediment sampling and analyses during the PED phase will provide further investigation as to the source of toxicity.

Post-deepening Z-Layer Sediment Quality: Although sediment sampling and analysis was conducted to depths deeper than proposed, it is assumed that the sediment sampling and analysis conducted to 45 feet (plus 2 feet overdepth) is characteristic of deepening to 38 foot MLLW channel and 42 foot MLLW sediment basin (plus 2 feet overdepth). The assumption is based on a thorough review of the sediment sampling data, which indicates that the sediment proposed for dredging did not result in significant toxicity to test species and it can be used for wetland cover. However, as discussed, confirmatory testing would be conducted during PED to ensure validate this assumption. Although unlikely, if the confirmatory analysis indicates that the z-layer left behind would be contaminated, appropriate over-excavation and disposal of sediment would be required or the sediment would be left in place and appropriate environmental analysis and consultation would occur at that time.

5.3.3 Hydrology and Salinity Intrusion

This section discusses the existing hydrodynamics and salinity intrusion (defined as the movement of X2 further east into the Delta) in the action area and potential effects that may result from deepening and

selective widening of the proposed project. A discussion of the low salinity zone (LSZ) is also included in this section because of its importance to delta smelt and a variety of juvenile fishes.

5.3.3.1 Overview of Delta Hydrodynamics and Salinity Intrusion in the Delta

The San Francisco Bay-Delta region comprises a large network of estuarine embayments, river channels, smaller sloughs, and canals that convey water from approximately 60 percent of California to the San Francisco Bay and Delta watershed. Two major factors that affect hydraulics in the Delta are tides and river flow. During flood tides, the direction of flow is into the Delta, and the river stage increases. During ebb tides, water from the Sacramento and San Joaquin Rivers and their tributaries flow out of the Delta, and the river stage falls. River inflow in the Delta is largely controlled by upstream reservoir releases.

The mixing of freshwater with salt water from the Pacific Ocean results in an estuary-wide horizontal salinity gradient, with salinity varying from full marine conditions (more than 30 practical salinity units [psu]) near the Golden Gate Bridge to freshwater conditions (less than 0.1 psu) in the Sacramento River (<https://sfbay.wr.usgs.gov/access/wqdata/yearsdata/charts/sal9395.html>). Ideally, there is a net westward water flow from the Delta through the San Francisco Bay resulting from the freshwater outflow from the Delta. However, inflows into the Delta are controlled by upstream dams and reservoirs, which restrain peak flows in the winter and spring for flood control and water storage. At times, flows in Old and Middle rivers in the south Delta can be reversed toward the U.S. Bureau of Reclamation's Central Valley Project and the California Department of Water Resources' State Water Project. Releases in the summer and fall are tailored to meet agricultural and municipal demands. Outflows from the American, Feather, and Sacramento rivers in particular also are used intentionally to reduce salinity to acceptable levels at diversion locations in the Delta (SWRI 2004).

As precipitation-induced channel inflows increase in the winter months, flows in some Delta channels can become one-directional (i.e., downstream). During this period, the tidal influence is minimal and overshadowed by the inflows. During the summer months, the flow patterns more closely correspond with the flood/ebb tidal cycles because net inflows to the Delta and San Francisco Bay tend to be lower during the summer months.

5.3.3.2 X2 and the Low Salinity Zone

The LSZ is the region in the estuary where the average daily salinity ranges from about 0.5 to 6 psu. The X2 is the region within the LSZ where the daily-averaged 2 psu isohaline near the channel bed exists, and is measured in kilometers east of the Golden Gate (**Figure 11**; Jassby et al. 1995; Kimmerer et al. 2009). The X2 fluctuates east and west within the western delta region in the vicinity of Suisun Bay and the confluence of the Sacramento and San Joaquin rivers, depending on Delta freshwater outflow and tides. Within the study area, salinity varies significantly both geographically and seasonally. At the western end of the project area near the West Richmond Channel, salinity is typically around 30 psu, except during periods of very high Delta outflow. At the eastern end of the study area near Avon, salinity levels can be less than 1 psu during very high Delta outflows, but are generally more than 10 psu during periods of lower Delta outflow. Salinity gradients are also pushed seasonally westward into San Pablo Bay during typical periods of high Delta outflow in the winter and spring. In turn, salinity levels in Suisun Bay and the western Delta gradually increase in the summer and fall during periods of generally low Delta outflow.

During critically low water years, Delta outflows can remain low throughout the year, leading to higher salinity in Suisun Bay and the western Delta than during wet water years.

A change in salinity distribution (which could result from a change in freshwater inflows, change in operations of the delta, dredging, etc.) affects the location of the X2 and hence the location of the LSZ habitat and its availability to fishes. A change in the location of the X2 could affect water supply reliability during periods of the year when the position of X2 is managed by regulating (i.e., increasing) Delta outflow to push the X2 farther west. The abundance or survival of several estuarine biological populations in the San Francisco Estuary have historically been positively correlated with freshwater flow and the LSZ. When the X2 is located in Suisun Bay, the area and quality of LSZ habitat available for species that rely on the LSZ (including delta smelt) is increased. As the X2 moves farther east, habitat quantity and quality appear to diminish.

Because of the correlation between the location of the X2 and LSZ habitat quality and quantity, the State Water Resources Control Board (SWRCB) included X2 in the 1995 Water Quality Control Plan (https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/wq_control_plans/1995wqcp/1995_plan.shtml) as a water quality standard to help restore the relationship between springtime precipitation and the geographic location and extent of LSZ habitat. The biological opinion assessing the impacts of the long-term operations criteria and plan (OCAP) of the Central Valley Project (CVP) and State Water Project (SWP) on delta smelt (<https://www.fws.gov/sfbaydelta/CVP-SWP/index.htm>) furthered the efforts to increase the quantity and quality of LSZ habitat. Both the Water Quality Control Plan and the biological opinion manage the location of X2 and thus the area of LSZ habitat by regulating Delta outflow. The X2 has been a water quality standard since 1995 and is used by resource agencies to quantify effects to ESA-listed species related to changes in salinity.

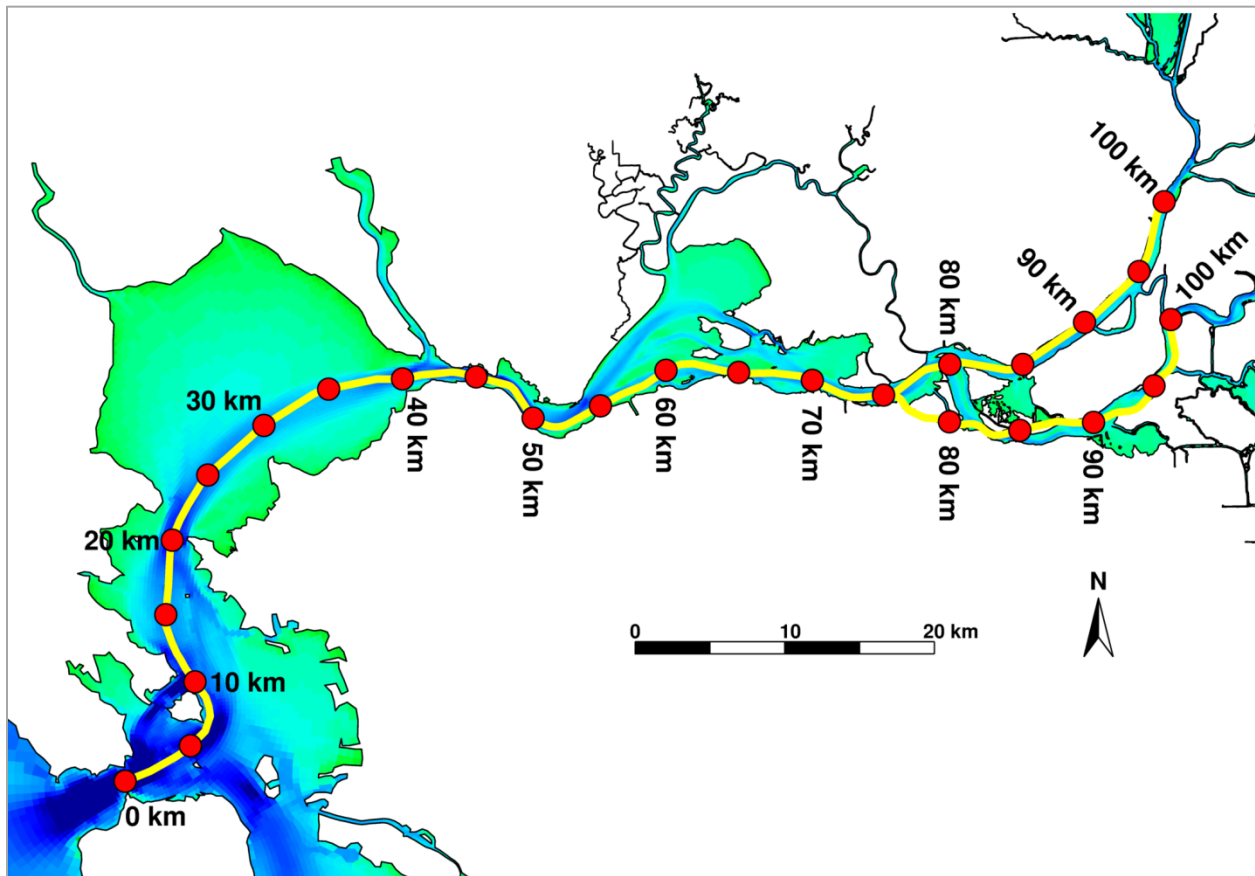


Figure 11: Transects Along Axis of Northern San Francisco Bay Used to Measure X2.

5.3.3.3 Delta Outflow and X2 Requirements

The 1995 Water Quality Control Plan requires the X2 to be maintained at certain locations for a specified number of days each month. Specific locations include 81 kilometers (at Collinsville), 75 kilometers (at Chipps Island), and 64 kilometers (at Port Chicago) from the Golden Gate. The biological opinion further included requirements during fall months following wet or above normal water years. The current X2 requirements from both the Water Quality Control Plan and biological opinion are discussed in detail below.

A significant fraction of inflow is exported out of the Delta by the Central Valley Project and State Water Project for agricultural and urban use. Together, these two projects divert approximately 40 percent of the freshwater river inflows to the Delta and supply two-thirds of the state with drinking water. These alterations have removed much of the variation in through-estuary outflow creating lower outflow in the winter and higher outflow in the summer compared to historical values. Both the CVP and the SWP are considered part of the baseline conditions for hydraulics and salinity concentrations in the action area.

The 2008 USFWS OCAP BO concluded that operations of these projects would jeopardize the continued existence of delta smelt and adversely modify delta smelt critical habitat. The OCAP BO Reasonable and Prudent Alternative (RPA) to avoid jeopardy from operations of the CVP and SWP identified several reasonable and prudent measures, including implementing a fall X2 standard. Specifically, the RPA calls for Delta outflow to be adaptively managed such that the monthly fall X2 must average either 74 kilometers (west of Chipps Island) following a wet year or 81 kilometers (at Collinsville) following an above normal year upstream from the Golden Gate during September and October. In addition, a storage-related requirement to enhance Delta outflow in November was identified; however, a specific X2 target was not. The objective of the fall X2 standard is to improve fall habitat for rearing delta smelt when the preceding water year is above normal or wet, as there appears to be an association in delta smelt abundance and the summer and fall LSZ habitat conditions.

In order to meet the fall X2 standard, the CVP and SWP curtails exports such that the outflow from the Old and Middle Rivers is enough to maintain the required average fall X2. The first fall X2 standard was implemented in fall 2011, which followed the spring 2011 wet year, and was maintained at 75 (September) and 74 (October) kilometers. The years in between 2011 and 2017 did not require use of the RPA because they did not follow above normal or wet years. The second time the fall X2 standard was implemented occurred in fall 2017 when it was maintained at 74 kilometers in September and October.

The 1995 Bay-Delta Water Quality Control Plan established the D1641 flow and X2 standards, including the spring X2 standard, which regulates the degree to which salinity can intrude into the Delta during the spring months. The spring X2 standard requires that the location of X2 be west of Port Chicago (X2 = 64 kilometers) during February through June. The spring X2 requirement must only be met in a respective month if the 14-day average electrical conductivity is less than 2.64 mmhos/cm (approximately 2 ppt) on the last day of the month prior. This 14-day average trigger is intended to avoid large, sudden gyrations in Delta outflows. However, when X2 is less than 64 km, there are no current regulatory requirements that address the position of X2. The objective of the spring X2 requirement is to help restore the relationship between springtime precipitation and the geographic location and extent of the LSZ estuarine habitat.

According to the 1999 and updated 2000 SWRCB Decision 1641, diversion at the Central Valley Project is not authorized when the Delta salinity standards are not met. The salinity standards are considered exceeded when the upstream reservoir releases and unregulated natural flow exceed Sacramento Valley in-basin uses, plus exports, and additional diversions from the Central Valley Project would cause X2 to shift upstream so far that:

- It is east of Chipps Island (75 river kilometers upstream of the Golden Gate) during the months of February through May; or
- It is east of Collinsville (81 river kilometers upstream of the Golden Gate) during the months of January, June, July, or August; or
- During December, it is east of Collinsville and delta smelt are present at the Contra Costa Water District's point of diversion.

Other water diversions also may impact X2. In 1997, the CDFW initiated a study to document all water diversions in the Delta and within the Sacramento and San Joaquin River Basins (Herren and Kawasaki 2001). Of these, 424 were documented along the Sacramento River above I Street Bridge in Sacramento,

298 were found within the San Joaquin River Basin, 2,209 were within the Delta, and 366 were in Suisun Marsh. Although not as big as the CVP or the SWP, together these diversions consume water that would flow to the San Francisco Bay and may have resulted in cumulative salinity intrusion in the Delta (Herren and Kawasaki 2001).

5.3.3.4 Potential Impacts to X2 and the LSZ Resulting From Salinity Intrusion

To analyze the potential hydrodynamic and salinity intrusion that could result from deepening the channel, the three-dimensional hydrodynamic model UnTRIM San Francisco Bay-Delta Model (Anchor QEA, LLC 2019 – salinity model report available upon request) was used. The UnTRIM San Francisco Bay-Delta model (UnTRIM Bay-Delta model) is a 3-D hydrodynamic model of San Francisco Bay and the Sacramento-San Joaquin Delta, which was developed using the UnTRIM hydrodynamic model (Casulli and Zanolli 2002, 2005; Casulli 2009). The model provides a detailed evaluation of the effect of the proposed action under both wet and critically dry conditions, representing the range of possible conditions. The analysis was conducted for both base year (year 0) and future (year 50) conditions for the project, and included sea level rise.

Modeling indicates that the average annual predicted shift in X2 would be 0.17 km during a critical water year and 0.27 km during a wet water year (**Table 2**). In wet years, the slightly larger shifts in X2 corresponds to the periods when the salinity gradients were pushed west into San Pablo Bay. Consequently, the effects on species such as delta and longfin smelt would be expected to be greatest during critical water years because available LSZ habitat in Suisun Bay would be more likely to be reduced. However, these predicted shifts in X2 are on the same order of magnitude as the accuracy to which X2 can be measured operationally, and hence would be insignificant (i.e., not detectable).

Additional modeling for a below normal water year indicates that upstream movement of X2 caused by the project may actually result in LSZ area being either gained or lost due to the large variance in the shoreline, primarily in Suisun Bay (i.e., average monthly change from -556 to 446 acres; Anchor QEA, LLC 2019). However, the area gained would be at the upstream end of the LSZ, whereas the area lost would be at the downstream end where more desirable habitat is likely to be located. Still, the overall monthly average area of the LSZ would range from 13,966 to 26,807 acres with the project versus 14,083 acres to 26,705 acres without the project. These small differences again may not be detectable and hence insignificant.

The effect of the proposed project on salinity was also evaluated for a critical water year representative of possible year 50 conditions, which included 2.38 feet of sea level rise based on the USACE high curve (<http://corpsclimate.us/ccaceslcurves.cfm>). Under year 50 conditions, the predicted annual average increase in X2 resulting from the project deepening is expected to be 0.17 km, which is identical to what was predicted for year 0 conditions for a critical water year (**Table 2**). This suggests that the project effects on X2 are likely to be nearly identical under future conditions as under existing conditions for a given hydrology and outflow regime. Modeled year 50 conditions did not include changes to Delta water operations to offset the increased salinity intrusion resulting from sea level rise, so the baseline X2 (i.e., without the project) under year 50 was on average 4.31 km higher than under year 0 baseline conditions resulting in higher baseline salinity conditions in the Delta under year 50. Therefore, the effects of the proposed project in year 50 would be expected to be, on average, 0.17 km divided by 4.31 km, or less than 4 percent of the total upstream change in the location of X2.

Water Year Type	Change in X2 (km)	
	Annual Average	Change for X2 > 64
Critically Dry (Year 0)	0.17	0.17
Wet (Year 0)	0.27	0.23
Critically Dry (Year 50)	0.17	0.17

Table 2: Predicted change in X2 from the proposed project in a critically dry and wet water year in year 0 (i.e., under baseline conditions), and a critically dry water year in year 50 (i.e., including sea level rise) based on the modeling results of Anchor QEA, LLC (2019). Port Chicago is located at X2 = 64. Fish habitat upstream of this location is of special concern, and salinities measured at this location trigger spring X2 water quality requirements.

5.4 Noise

Underwater sound pressure waves can harass and harm fish species (Teachout 2012, Caltrans 2015). As the pressure wave passes through a fish, the swim bladder is rapidly squeezed due to the high pressure, and then rapidly expanded as the under pressure component of the wave passes through the fish. This can cause effects including changes in behavior and physiological damage such as rupture of the swim bladder or capillaries, internal hemorrhage, neurological stress, and auditory damage. Extreme sound waves can cause instantaneous death, latent death within minutes after exposure, or can occur several days later. Increase in sound waves can also result in reduced fitness of fish, making it susceptible to predation, disease, starvation, or ability to complete its life cycle.

The proposed action is expected to cause increased underwater sound pressures waves. The noise from a clamshell dredge is punctuated by its entry into the water, contact with bottom substrate and the closing of the jaws of the clamshell. There are also periods of quiet between the events when the clamshell enters the water. In 2001, the U.S. Army Engineer Research and Development Center prepared an analysis of increased sound pressure level (SPLs) produced by clamshell dredging in Cook Inlet, Alaska (Dickerson et al. 2001). In that analysis, the most extreme SPLs measured in decibels root-mean-square (dB rms) were produced by the dredge bucket striking the channel bottom in mixed coarse sand and/or gravel. The increase in sound measured at a 150 meter distance to the dredge plant source produced peak SPLs of 124.0 dB rms, or 50.8 dB above peak ambient conditions. Ambient noise conditions, in the action area during the proposed work window, are comprised primarily of commercial ship traffic, wind and wave turbulence, and hydrodynamic noise associated with variable tidal flow condition. The ambient noise conditions in the action area are expected to be similar to those of Cook Inlet Alaska. Therefore the SPLs at 150 meters are expected to be higher than ambient.

As discussed, a pneumatic jackhammer (**Figure 8**) mounted to an excavator would be used to remove the small rock outcrop at the downstream end of Pinole Shoal (**Figure 6**). Maximum sound levels of jackhammers and excavator-mounted hoe rams used for rock-breaking activities measure about 90 dBA in air at a distance of 50 feet (Washington State Department of Transportation [WSDOT] 2018). Adding the sound conversion factor of 61.5 dB used by the U.S. Navy (Katz et al. 2010) accounts for both the weighting of the original measurement toward human hearing (i.e., dBA vs. dB), and the higher impedance

of water vs. air (Collins 2018). Subtracting an additional 10 dB provides a conservative estimate of 145.5 dB rms at 50 feet underwater; accounting for noise attenuation can be done by subtracting 4.5 dB per doubling of distance (WSDOT 2018). Therefore, for comparison with the clamshell dredge noise described above, the removal of the rock outcrop would create additional noise of approximately 132 dB rms at 400 feet for a short period of time (i.e., for up to 20 hours spanning 1-2 days). Note that noise from multiple sources is not expected to greatly impact results because decibels are measured on a logarithmic scale. The overall noise output would be that of the loudest noise source plus the addition of a maximum of 3 dB (WSDOT 2018).

To quantify the level of sound expected to cause harassment and harm, the Fisheries Hydroacoustic Working Group has established interim criteria for evaluating underwater noise impacts from pile driving on fish. These criteria are defined in the document entitled *Agreement in Principal for Interim Criteria for Injury to Fish from Pile Driving Activities* (Fisheries Hydroacoustic Working Group 2008). This agreement identifies a peak SPL of 206 decibels (dB) and an accumulated sound exposure level of 187 dB as thresholds for injury to fish ≥ 2 grams. For fish less than 2 grams, the accumulated sound exposure level threshold is reduced to 183 dB. Although there has been no formal agreement on a behavioral threshold, NMFS uses 150 dB rms as the threshold for adverse behavioral effects (ICF Jones & Stokes and Illingworth and Rodkin, Inc. 2009). The proposed project is expected to produce SPLs of 124.0 dB rms from clamshell dredging as determined in the Cook Inlet study, and 132 dB rms from removal of the rock outcrop. These noise values are below all of the thresholds described above. Therefore, the noise from the proposed project is not expected to adversely affect listed species greater than 150 m from the clamshell dredge plant. Effects on fish closer than 150 m are unclear, but likely to involve behavioral avoidance of the area.

5.5 San Francisco Bay-Delta Climate Change

The effects of climate change, particularly sea level rise and increased water temperatures, are anticipated to exacerbate existing threats to special status fishes. This biological assessment considered the potential effects of climate change based on projections derived from various modeling scenarios. Temperature increases are likely to lead to a continued rise in sea level, further increasing salinity intrusion (Feyrer et al. 2011; Cloern et al. 2011; Brown et al. 2013). Higher air temperatures will reduce snowpack, melt snow earlier in the winter or spring, and increase water temperatures. These changes will likely alter freshwater flows, possibly shifting and condensing the timing of various life histories of special status fishes (Brown et al. 2013).

Projections indicate that temperature and precipitation changes will diminish snowpack, changing the availability of natural water supplies (USBR 2016). Warming may result in more precipitation falling as rain and less storage as snow. This would result in increased rain on snow events and increase winter runoff with an associated decrease in runoff for the remainder of the year (USBR 2016). Sacramento Valley Ecoregion projections include a 27 percent decrease in annual freshwater flows and earlier snowmelts, with increased freshwater flows in January and February but reduced throughout the rest of the year (PRBO Conservation Science 2011). Earlier seasonal warming increases the likelihood of rain-on-snow events, which are associated with mid-winter floods. Smaller snowpack that melt earlier in the year may result in increased drought frequency and severity (Rieman and Isaak 2010). Thus overall, these changes may lead to increased frequency of flood and drought cycles during the 21st century (USBR 2016).

Sea level rise is likely to increase the frequency and range of saltwater intrusion. Salinity within the northern San Francisco Bay is projected to rise by 4.5 by the end of the century (Cloern et al. 2011). Elevated salinity levels could push the position of X2 farther up the estuary if outflows were not increased to compensate for it. Fall X2 mean values are projected to increase by a mean of about 7 km to the area of Antioch for a distance of approximately 90 km from the golden gate bridge by 2100 (Brown et al. 2013). This increase in the position of X2 in the fall is expected to result in a decrease in suitable physical habitat for fishes (Brown et al. 2013) if current levees and channel structures are maintained. A decrease in spring habitat due to the movement of X2 upstream due to sea level rise is also expected to result from climate change.

It is expected that warmer estuary temperatures to be yet another significant conservation challenge based on climate change models. Mean annual water temperatures within the upper Sacramento River portion of the Bay-Delta estuary are expected to approach or exceed 14 °C during the second half of this century (Cloern et al. 2011).

5.6 Future Foreseeable Projects and Cumulative Effects

Cumulative effects considered in this BA/EFH assessment include the effects of future state, Tribal, local, or private actions that are reasonably certain to occur in the area. Projects that may result in cumulative effects include:

- Future foreseeable changes in operations of the CVP and SWP which are not currently implemented (see USBR's 2008 Operations Criteria and Plan (OCAP) BA, USFWS' 2008 OCAP BO, and NOAA Fisheries 2009 OCAP BO). Cumulative effects could result could result hydraulics and salinity intrusion alterations in the action area.
- The current project would be interrelated with the potential deepening of the shipping channel all the way to the Port of Stockton, should it occur. Cumulative effects could result in additional salinity intrusion within the action area.
- Future habitat restoration associated with the CVP and SWP. Cumulative effects could include adverse effects during construction and beneficial effects upon completion.
- Other restoration efforts not yet completed (e.g., Montezuma Wetlands) or planned in the future. Cumulative effects could include adverse effects during construction and beneficial effects upon completion.
- Projects which would increase concentrations of constituents of concern or clean up areas or sources of contamination. These contaminants include, but are not limited to ammonia and free ammonium ion, numerous pesticides and herbicides from agricultural activities, and oil and gasoline product discharges.
- Projects that alter riparian habitat along sloughs, channels, and other aquatic habitat. Reduction of riparian habitat could result in reduced shading of migratory corridors, increased water temperatures, and increased predation. Whereas, projects that increase and improve riparian habitat could have the opposite effect.

Together with the proposed project, these projects may result in lethal, sub-lethal, or beneficial impacts to special status species, critical habitat, and EFH. For example, projects that increase salinity intrusion could result in reducing the quality and quantity of LSZ habitat in the Suisun Bay and Delta, which could result in decreased prey resources, increased completion affecting critical habitat. Projects that restore

wetland and other aquatic habitat with a hydrological connection to the Bay and Delta could offset or increase salinity intrusion into the Delta (though, most restoration projects are designed to reduce the salinity wedge intruding into the Delta). Additional restoration projects could provide additional spawning, rearing, foraging, and resting habitat for sensitive species.

6.0 USFWS-Managed ESA Species and Effects Determinations

This section presents the impact assessment for threatened and endangered species, as well as critical habitat managed by the USFWS. The most recent official USFWS-species list was generated from the USFWS's IPaC website on November 27, 2017 (**Appendix A**). This species list will be updated prior to submitting this biological assessment to the USFWS requesting consultation. The species list identified 46 threatened and endangered species, including three mammals, seven birds, three reptiles, two amphibians, two fishes, seven insects, four crustaceans, and seventeen plants. Two critical habitats were also identified. Of the species and critical habitats identified, only one fish, delta smelt and delta smelt critical habitat are likely to occur in the proposed project area. In addition, this analysis considers the potential effects of the proposed project on the candidate species longfin smelt (*Spirinchus thaleichthys*). Should longfin smelt be proposed for listing prior to or during construction of the proposed project, USACE will request a conference opinion, pursuant to 50 C.F.R § 402.10.

All species identified in the official list are provided in **Appendix A**, along with a brief analysis of whether the species or critical habitat is in the action area and could be affected by the proposed action. A detailed analysis of the potential effects on the project's effects on threatened and endangered species and critical habitat that has the potential to be affected by the proposed action is also provided below.

6.1 USFWS-Managed Special Status Species Descriptions

This section discusses the listing status, distribution, life history and biology, habitat, stressors, and status of special status species in the action area. This section focuses only on USFWS-managed special status species and critical habitat that may be affected by the proposed action.

The impacts on delta smelt and longfin smelt are expected to be similar; with some differences being that within the action area, longfin smelt inhabit a larger range of the San Francisco Bay, including San Pablo Bay, and delta smelt are generally confined to the areas Suisun Bay and Napa River/Mare Island Strait. As such, the effects of the action on both species are discussed together in **Section 6.2**. Where impacts are different, they are discussed separately.

6.1.1 Delta Smelt (*Hypomesus transpacificus*) (FT) (CH) (SE)

The delta smelt is a euryhaline species endemic to the San Francisco Bay and Sacramento-San Joaquin River Delta. It is a small, slender fish that reaches approximately 2 to 3 inches in length (**Figure 14**). It is a relatively short-lived species that is nearly translucent with a blue sheen on the sides of the body. It is one of seven species of smelt native to California. Its range generally is confined to the fresh and low salinity waters of the Delta and Suisun Bay, but periods of high outflow may move fish westward into San Pablo Bay. Critical habitat is designated for delta smelt, which is discussed in **Section 6.3**.

6.1.1.1 Listing Status and Range

The USFWS listed the delta smelt as threatened on March 5, 1993 (58 FR 12854), and designated critical habitat for this species on December 19, 1994 (59 FR 65256). On April 7, 2010, the USFWS submitted a 12-month petition finding to reclassify the delta smelt as endangered. They found that reclassification is warranted, but precluded by other higher priority listing actions (75 FR 17667).

Delta smelt are endemic to the Sacramento–San Joaquin Delta and utilize areas as far upstream as Verona in the Sacramento River, and Mossdale in the San Joaquin River. They occur downstream to San Pablo Bay, in Contra Costa, Sacramento, San Joaquin, Solano, and Yolo Counties, California (73 FR 74674). Moyle (2002) notes that ‘spawning has...been recorded in Montezuma Slough near Suisun Bay...and may occur in Suisun Slough in Suisun Marsh in some years or in the Napa River “estuary.”’

6.1.1.2 Life Cycle and Habitat Use

Delta smelt are pelagic fish that are weakly anadromous. They complete most of their 1-year life cycle in the LSZ—salinities ranging from about 0.5 to 6 parts per thousand (ppt; which is equivalent to psu) (Kimmerer et al. 1998; Moyle 2002), but can inhabit a range of salinities from completely fresh water to 14 ppt. They migrate to fresher water to spawn in the late winter through early spring.

Generally, delta smelt are found along the freshwater edge of the salinity mixing zone (The Bay Institute 2007). Other than delta smelt eggs, all life stages are pelagic—found in the water column—and are not associated with the shoreline.

In early winter, between December and April, adults migrate to freshwater to spawn. It is thought that upstream migration is triggered by abrupt changes in flow and turbidity associated with the first flush of freshwater. Spawning occurs during the late winter and spring in waters with temperatures ranging from 12 to 18 °Celsius (°C); however, spawning may occur in temperatures up to 22 °C. Although not documented in the wild, it is assumed that spawning takes place in shallow sloughs and channel edge waters over sand and cobble. Females produce approximately 1,200 to 2,600 eggs. Most delta smelt die after spawning; however, some individuals live to spawn one more year (59 FR 65256; 75 FR 17667; 73 FR 74674).

Eggs are negatively buoyant and adhesive, sinking to the bottom and attaching to hard substrates, such as sand particles, cobble, rocks, tree roots, and submerged branches. Eggs incubate for 10 to 14 days before hatching in water temperatures ranging from 15 to 17 °C (75 FR 17667; 73 FR 74674). Generally, hatching success is low in higher temperatures.

Larvae are most abundant between April and May. Recently hatched larvae are buoyant and swim actively near the surface of the water. As larvae continue to develop, they become semi-buoyant and sink in the water column (75 FR 17667). Studies indicate that larvae exhibit reverse vertical migration, i.e., they use the upper portions of the water column during the day and randomly disperse at night (Lenny Grimaldo (ICF), et al. unpublished data) or move to deeper water (Bennett et. al. 2002 and Hobbs et al. 2006). Larvae gradually move to rearing grounds downstream in the LSZ, near X2. They reside in shallow, open waters ranging from 2 to 7 ppt. Swim bladders begin to form 60 to 70 days post-hatch and at around 70 days most delta smelt are no longer larvae (73 FR 74674).

Young delta smelt rear in the LSZ from late spring through early fall, sexually maturing and reaching adult size by about September through October. They begin gradually migrating upstream to spawning grounds in early winter.

Larval delta smelt begin to feed 5 to 6 days post-hatch. Feeding may be triggered by turbidity, in areas with high densities of prey. Larvae are visual feeders that may feed during the day in the upper portion of the water column (Lenny Grimaldo (ICF), et al. unpublished data). Larvae generally feed on larval stages of copepods, including *Eurytemora affinis*, *Pseudodiaptomus forbesi*, and members of the Cyclopidae family (58 FR 12854). To a lesser extent, larvae also feed on the introduced copepods, *Limnithona tetraspina* and *Acartiella sinensis* (75 FR 17667).

Juvenile delta smelt feed on copepods (*Pseudodiaptomus forbesi* and *E. affinis*), cladocerans, amphipods, and insect larvae. Historically, the main prey included larval stages of *E. affinis* and the mysid *Neomysis mercedis*. Adults also consume opossum shrimp (*Neomysis mercedis*), *Daphnia spp.*, and *Bosmina spp.* seasonally (58 FR 12854).

6.1.1.3 Threats

Delta smelt populations are threatened by several factors, many of which are compounding, and some that are not fully understood. Threats include entrainment in water diversions, habitat degradation, changes in abundance and composition of prey, contamination, and, to a lesser degree, predation and competition (59 FR 65256).

One of the biggest threats to delta smelt are the large SWP and CVP water export facilities (i.e., pumping facilities located in Banks and Jones) located in the south Delta near Tracy (73 FR 74674; 75 FR 17667). The Jones facility is part of the CVP, operated by the United States Bureau of Reclamation, and the Banks facility is part of the Department of Water Resources' SWP. The pumping facilities convey water from the northern portion of the state to farms and municipalities in the southern parts of the state. Water exports can directly entrain delta smelt in the Central and South Delta by creating reverse flows—changing the flow of rivers and sloughs from towards the San Francisco Bay to the pumping facilities—and also have affected Delta hydrology and ecology in several ways. Smelt are at higher risk when the flows in the Old and Middle Rivers become more negative (73 FR 74674).

Entrainment of adult delta smelt in the pumping facilities predominantly occurs during their upstream migration to spawning grounds between December and April in the central and south Delta (73 FR 74674). It appears that adults are more susceptible to entrainment during drier years or when exports are higher (73 FR 74674). Hydraulic dredging has also been shown to entrain and take delta smelt, albeit in much smaller numbers.

Alteration of habitat, including loss of shallow water habitat, loss of spawning habitat, and salinity intrusion, is another threat to delta smelt (Nobriga et al. 2008; Sommer and Mejia 2013). They utilize LSZ

habitat from spring through early winter. Factors that alter the position of the LSZ, moving it farther east into the delta, may adversely affect delta smelt habitat. Water diversions in the Delta, especially at the pumping facilities, and reduced upstream water releases have reduced delta outflow significantly, which has resulted in salinity intrusion into the fresher waters of the Delta. Salinity intrusion has moved the LSZ habitat further into the Delta, which is thought to constrict habitat, concentrating delta smelt in a smaller area (75 FR 17667). When the LSZ is further west, especially when in Suisun Bay, juvenile and adult delta smelt are more widely dispersed and have access to shallow water and marsh habitat, which may have higher zooplankton productivity than when shifted east (59 FR 65256; 73 FR 74674).

Loss of and changes to delta smelt prey community has also stressed this species. Historically, the predominant prey of delta smelt included the copepod *Eurytemora affinis* and the mysid *Neomysis mercedis* (Moyle et al. 1992). These prey resources were replaced by *Pseudodiaptomus forbesi* and *Limnoithona tetraspina*, which are now the major prey of delta smelt (Baxter et al. 2008; Bouley and Kimmerer 2006). It is believed that these species provide inferior nutritional value to delta smelt, compared to the historically preferred species.

Non-native submerged aquatic vegetation may also alter habitat components required for delta smelt to complete their life cycle. Introduced *Egeria densa*, among other non-native aquatic vegetation, grows rapidly in many parts of the Delta, reduces turbidity, and could reduce spawning habitat in intertidal shoals and beaches (73 FR 74674).

6.1.1.4 Status in the Action Area

Delta smelt juveniles and adults typically are present in the action area in April through December. Juveniles and adults utilize the action area during the existing delta smelt work windows (August 1 – November 30). Juveniles begin their downstream migration to rear in the Suisun Bay region where they mature. Adults slowly begin their upstream migration to spawning grounds in late fall/early winter. Over the past 15 years, the delta smelt population has declined rapidly and reached record low numbers in the last few years.

The 2017 population estimate was extremely low (48,000 individuals; USFWS 2018), despite being 200 percent higher than 2016 (16,000 individuals). The 2017 estimate is 92 percent lower than the highest recorded abundance (i.e., 48,000 compared to 600,000).

Only two delta smelt were collected during the 4 months of fall mid-water trawl surveys (September–December 2017), the lowest number ever recorded (Hobbs and Moyle 2018). The 2018 population estimate based on spring Kodiak trawl surveys in January and February 2018 is just 18,000 individuals, the second lowest (following 2016) since these surveys began in 2002 (Kim Squires, USFWS, personal communication, May 16, 2018).

Because delta smelt no longer can be reliably detected using the survey methods above (Wilcox 2017), the Enhanced Delta Smelt Monitoring (EDSM) program recently began. The most recent USFWS Enhanced Delta Smelt Monitoring data abundance estimate is the lowest on record, at just 2,721 Delta Smelt estimated to be in the Bay as of February 8, 2019 (Kim Squires, USFWS, personal communication, February 12, 2019).

6.1.2 Longfin Smelt (*Spirinchus thaleichthys*) (FC) (SE)

Longfin smelt is a short-lived, estuarine-anadromous, euryhaline, nektonic, small (90 to 110 mm standard length) osmerid fish that inhabit estuaries and coastal waters along the Pacific Coast, with San Francisco Estuary being the southern extent of its range (Moyle 2002).

6.1.2.1 Listing Status and Range

On April 2, 2012, the USFWS determined that the San Francisco Bay-Delta Distinct Population Segment (DPS) of longfin smelt warrants consideration for protection under the federal ESA, but was precluded from formally listing longfin smelt due to the need to address other higher priority species (77 FR 19755). Longfin smelt remains a federal candidate for listing and is included in this biological assessment with the understanding that if they were to be listed before or during construction of this project, a conference opinion would be requested.

Historically, longfin smelt populations were found in the Klamath, Eel, and San Francisco estuaries, and in Humboldt Bay. Current sampling indicates that populations reside at the mouth of the Klamath River and the Russian River estuary. Scattered populations also occur in estuaries and bays from Oregon to Alaska. In the Central Valley, longfin smelt are rarely found upstream of Rio Vista or Medford Island in the Delta. Adults concentrate in Suisun, San Pablo, and North San Francisco bays (Moyle 2002).

6.1.2.2 Life Cycle and Habitat Use

Longfin smelt largely exhibit a 2-year life cycle and generally die after spawning. However, some individuals delay spawning until age 3, and repeat spawning may be possible (Baxter 2018).

Adult longfin smelt inhabit bays, estuaries, and near shore coastal habitats; including Suisun, San Pablo, Central, and South San Francisco bays (CDFW 2009). During the late fall, adults migrate from these areas to the LSZ of the lower estuary where they congregate prior to spawning. Adults become sexually mature towards the end of their second year. Sexually mature adults migrate upstream to freshwater—ranging from 0.5 to 2 psu—in Suisun Bay and the western Delta. Spawning may start as early as November and extend through July (Baxter 1999); peaking in February through April (Moyle 2002) in freshwater less than 16 °C (CDFW 2009). Fecundity depends on the size of the fish; with smaller fish producing about 1,900 eggs and larger fish producing 18,000 eggs. Longfin smelt eggs are negatively buoyant and adhesive and attach to sand or cobble particles. Eggs take approximately 30 to 40 days to incubate.

Embryos hatch between January through March and are buoyant (CDFW 2009). They move into the upper part of the water column and are transported to Suisun, San Pablo, Central, and South San Francisco bays with high spring and winter flows to waters with salinities ranging from 15 to 30 psu. In low outflow years, larvae move into Suisun Bay and the western Delta, up to the Cache Slough Complex. As larvae grow, they migrate to the lower two-thirds of the water column and continue to vertically migrate over tidal cycles (CDFW 2009).

Juvenile longfin smelt rear in brackish waters with salinities ranging from 2 to 8 psu in waters less than 20 °C, and are rarely found in waters greater than 22 °C. They are generally found farther downstream than larvae, depending on Delta outflow. During years of low flow, juveniles are also found in the Delta (CDFW 2009). Rosenfield and Baxter (2007) indicate that post-larval longfin smelt display a depth-stratified distribution and seem to aggregate in deep-water habitats (catch per unit effort was consistently,

although not significantly, higher at channel stations versus shoal stations). Juveniles generally disperse to more saline and deeper water habitats. High winter/spring outflow appears to improve recruitment success (Baxter 2018). Eggs and larvae tend to be more widely distributed and occur farther downstream under such conditions, and juveniles tend to disperse farther downstream and may enter the ocean earlier (Baxter 2018). In addition, feeding success may be greater and freshwater predators such as largemouth bass would be avoided.

Longfin smelt larvae begin feeding on copepods and cladocerans, and as they grow; they also feed on mysids and amphipods (CDFW 2009). Juveniles predominately feed on mysids, amphipods, copepods and daphnia, with fish making up a smaller portion. Adult longfin smelt feed primarily on opossum shrimp, *Acanthomysis* spp. and *Neomysis mercedis*, when available. Longfin smelt feed throughout the day and into the night, which suggests that turbidity may not hamper feeding success. They have well developed olfactory organs that aid in finding prey (CDFW 2009).

6.1.2.3 Threats

Similar to delta smelt, threats to longfin smelt include entrainment in state and federal water projects, spawning habitat loss, contaminants, predation by birds and fish, bycatch in fisheries, scientific collections, and food limitation. A longfin smelt Management and Synthesis Team was formed in 2017 to assess the species biology and status in a more focused manner, including the development of a conceptual model of the longfin smelt life cycle (Baxter 2018; Hobbs 2018; Tobias 2018).

6.1.2.4 Status in the Action Area

Longfin smelt juveniles and adults typically are present in the action area from April through December. Larval and juvenile fish move downstream and rear in Suisun and San Pablo bays or farther west where they mature and then slowly begin their upstream migration to spawning grounds as adults in late fall/early winter. Since about 2000, the abundance of longfin smelt in the San Francisco Bay-Delta has steadily declined (Hobbs et al. 2017; Baxter 2018).

6.2 Delta Smelt and Longfin Smelt Effects Determinations

A detailed discussion of the general direct, indirect, interrelated, and cumulative impact mechanisms are provided in **Section 5.0**. This section focuses on how these mechanisms would specifically affect delta smelt and longfin smelt. The proposed action has the potential to directly and indirectly affect delta and longfin smelt through crushing or hitting individuals with dredge equipment; entrainment in dredging equipment; exposure to increased hydroacoustic noise, suspended sediment, constituents of concern; changes to physical habitat (e.g., changing shallow water habitat to deeper water habitat), and salinity intrusion (i.e., movement of the LSZ and X2 farther upstream). Most effects would be related to construction of the project, which would be short-lived (i.e., up to 1 month in Bulls Head Reach and approximately 6 months in Pinole Shoal) impacts that occur during or shortly after active dredging. The impacts would be similar to those that occur during maintenance dredging, with the exception of the relatively minor bathymetry alterations, including converting shallower water habitat (-35 feet to -38 feet in Pinole and Bulls Head Reach, with addition of the sediment trap to -42 feet in Bulls Head Reach) to deeper water habitat, and salinity intrusion caused by deepening the channel.

Dredging Bulls Head Reach would be conducted during the existing delta smelt work windows. Longfin smelt are present in the action area year round. However, working within the delta smelt work windows in Bulls Head Reach (Suisun Bay), would limit exposure of longfin smelt to dredging activities and be protective of sensitive life stages, such as spawning adults and larvae.

To the extent practicable, dredging Pinole Shoal would also occur during the work windows. However, should deepening not be completed within one dredging season, the project proposes to expand the work windows in compliance with the NMFS LTMS maintenance dredging biological opinion (i.e., expanded work windows which are allowed for maintenance dredging if dredging is conducted with a clamshell dredge and sediment is beneficially reused for aquatic habitat restoration). In addition, the project proposes to use a clamshell dredge for all work, which would minimize entrainment and physical injury to delta smelt and longfin smelt. The project proposes to use all dredged material for beneficial reuse which would contribute to restoration of smelt habitat.

6.2.1 Direct Contact with Dredging Equipment and Entrainment

The presence of both delta smelt and longfin smelt in the Pinole Shoal Channel and Bulls Head Reach during the environmental work windows is documented. Therefore, there is a potential for smelt to be directly injured or killed by dredging equipment. The most likely cause of injury would be from the clamshell bucket falling through the water column until reaching the substrate. However, as mechanical equipment travels through the water column, it generates a pressure wave that would likely force small fish away from the falling bucket. General disturbance from barges, dredging crew and tugs is expected to disturb any delta or longfin smelt in the surrounding area and likely cause the fish to exhibit a startled response, followed by escapement from the area.

Very limited data exist regarding potential entrainment effects of clamshell dredging on small fish such as delta or longfin smelt (see Reine and Clarke 1998). The entrainment of aquatic organisms may be possible with a mechanical clamshell dredge. As the bucket of a mechanical clamshell dredge collects material from the bottom, aquatic organisms can be physically collected within the water and sediment material. However, mechanical clamshell dredging is considered to have a very low risk of fish entrainment, and for large fish typically the lowest of all dredge types (Reine and Clarke 1998).

As mentioned previously, general disturbance from barges, dredging crew and tugs is expected to cause delta smelt and longfin smelt to avoid the areas where active dredging is occurring. It is expected that direct contact with dredge equipment or entrainment will be minimal because delta and longfin smelt would likely avoid dredging activities. Overall, the potential to entrain or physically injure or kill delta smelt or longfin smelt is very low.

6.2.2 Exposure to Increased Suspended Sediment and Turbidity

Dredging and scow overflow would result in increased concentrations of sediment. The increased concentrations would be continuous during active dredging, with the highest concentrations within a 200-foot radius of dredging and overflow (USACE 2014). As discussed in **Section 5.3.1**, sediment proposed for dredging in the Pinole Shoal Channel ranges from fine-grained at the western and eastern portions of the

channel and sand in the center. Sediment proposed for dredging in Bulls Head Reach is predominately sand with small pockets of fine-grained material. Dredging would result in increased turbidity plumes, which would be greatest in areas of fine-grained sediment (e.g., eastern and western portions of the Pinole Shoal Channel). Dredging in areas of sand would result in plumes with less concentration of suspended sediment because sand would fall out of the water column rather quickly and settle to the bottom of the channel. The range of temporary turbidity increases is expected to be within a 200-foot radius from dredging operations and disposal area, and is expected to persist during active and settle within 20 minutes following active dredging (USACE 2014).

Dredging activities are generally centered within the navigation channel, outside of the intertidal areas associated with the delta smelt's shallow water habitat minimizing the potential for adverse effects. Longfin smelt, on the other hand, are believed to congregate in deeper waters and would be exposed to increased suspended sediment concentrations.

Elevated concentrations of turbidity could expose delta smelt and longfin smelt to the turbidity plumes. It is expected that the harm would be sub-lethal effects to fish anatomy (e.g., damage to gills), or behavioral (avoidance of plumes). The behavioral avoidance response of delta smelt and longfin smelt is expected to substantially reduce or eliminate the risk of exposure the farther they are from the plume source.

6.2.3 Salinity Intrusion

Delta smelt spend most of their life cycle in the LSZ, which ranges from 0.5 to 6 psu (Bennett et al. 2002; Kimmerer et al. 2013). Longfin smelt inhabit a range of salinities, from freshwater to seawater. However, longfin smelt juvenile survival also is strongly linked to the location of X2 (Moyle 2002). Modelling indicates that the location of X2 would increase on average by 0.17 km in a critically dry year and 0.27 km in a wet year (see section 5.3.2. for a detailed discussion).

The maximum salinity intrusion impacts would be the synergistic effects of the proposed project with sea level rise. When sea level rise is included in the model, the baseline conditions for salinity and location of X2 increase. Specifically, the location of X2 would increase by 4.31 km if no increased outflow occurs (Anchor QEA, LLC 2019). The effects of the proposed project in year 50 would be expected to be, on average, 0.17 km divided by 4.31 km, or less than 4 percent of the total upstream change in the location of X2. Since this predicted shift in X2 is on the same order of magnitude as the accuracy to which X2 can be measured operationally, it is not expected that deepening the existing channel would result in a significant shift in the timing or magnitude of exports in order to maintain water quality conditions.

The maximum impact (i.e., including sea level rise) of the proposed project on salinity estimated for five D-1641 sampling locations near water diversions was 6.4 ppm (Anchor QEA, LLC 2019), which is very small given that the psu used to describe delta smelt habitat are approximated by measurements in ppt. Swanson et al. (2000) investigated salinity tolerances in delta smelt; in that study, salinity values were measured to the nearest 0.1 ppt, and salinity challenges were conducted using 2 ppt step increases. The results indicate that delta smelt could not detect small salinity changes. Presumably it would be difficult to detect the impacts of 6.4 ppm maximum increase on delta smelt; $6.4 \text{ ppm} = 0.0064 \text{ ppt}$.

While delta smelt and longfin smelt may not be able to detect the minor changes in salinity resulting from the proposed project, LSZ habitat could be affected. Low salinity zone habitat alteration resulting from a shift in X2 is discussed in **Section 6.2.4**.

6.2.4 Habitat Loss

The proposed project could result in impacts to two key components of delta smelt and longfin smelt habitat, alterations to the LSZ resulting from salinity intrusion and bathymetry changes resulting from conversion of shallow water to deeper water. The key modeled impact of the proposed project on X2 is the upstream shift by 0.17 km in a critically dry year, when delta and longfin smelt would be most intensely subjected to other stressors related to their habitat both contracting and shifting upstream (e.g., increased predation, reduced quantity and quality habitat, etc.). The California Data Exchange Center shows that critically dry years in the Sacramento Valley occurred 16 times during 112 years (i.e., 14 percent of years) from 1906 to 2017 (<http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST>; see Anchor QEA, LLC 2019 for a discussion). The modeled X2 shifted upstream 0.27 km during a wet year scenario, but because the baseline X2 was located down-bay, the impact to delta and longfin smelt habitat would be less severe. Limited additional modeling showed that other water year types (i.e., below normal and dry) would be intermediate in the upstream shift of X2, and that the overall monthly average area of the LSZ for a below normal year would range from 13,966 to 26,807 acres with the project versus 14,083 acres to 26,705 acres without the project (Anchor QEA, LLC 2019). Overall the modelling suggests that these small changes in habitat location and area may not be detectable and hence would be insignificant.

The USFWS defines delta smelt shallow water habitat as “all waters between the mean high water and 3 meters below the mean high water mark. All waters with depths less than 3 meters (9.84 feet) at any given time are within the photic zone and are highly productive. These areas are considered suitable habitat for delta smelt and are both vegetated and un-vegetated, including where riprap rock may have been once applied. Critical habitat for delta smelt encompasses this definition but is not exclusive of shallow water habitat” (USFWS 2004b).

An analysis was conducted to determine the extent the proposed action would convert waters shallower than 3 meters to deeper water. The analysis indicated that all direct impacts resulting from dredging excavation of sediment would occur at waters deeper than 3 meters and that the conversion of shallow water habitat, as defined by the USFWS, would not occur.

As discussed, the project proposes to reuse dredged sediment at Montezuma Wetlands and Cullinan Ranch, thereby contributing to wetland restoration which would increase the quantity and quality of delta smelt and longfin smelt habitat in Suisun Bay, Mare Island Strait/Napa River, and San Pablo Bay. Specifically, the dredged material from this project is expected to result in the creation or restoration of 160 acres of tidal wetland habitat that would benefit delta and longfin smelt, helping to offset temporary impacts to habitat resulting from increased turbidity and changes to the LSZ.

6.2.5 Exposure to Noise

As discussed in **Section 5.4**, noise from the proposed project would be generated primarily from clamshell dredging, tugs working in the vicinity of the dredge and along the dredged material transport corridor, and for a short period from a pneumatic jackhammer required to remove a small rock outcrop. The project

is expected to produce peak SPLs at a distance of approximately 150 meters of 124 dB rms from clamshell dredging and 132 dB rms from removal of the rock outcrop. These noise values are below all of the thresholds that would result in direct injury to most fish, including delta smelt and longfin smelt. However, fish could experience minor temporary behavior disturbances, such as decreased foraging or avoidance of areas with increased noise.

6.2.6 San Francisco Bay-Delta Climate Change

A series of publications (Feyrer et al. 2011; Cloern et al. 2011; Brown et al. 2013) have modeled future impacts of climate change in the delta and projected how this will affect delta smelt. These models used the B1 and A2 scenarios from the 2007 Intergovernmental Panel on Climate Change (IPCC) report. Each scenario included both a warmer-wetter and warmer-drier sub scenario. Modeled predictions presented in these publications are based on current baseline conditions (no increased outflow, no breaching of levees) which may or may not change in the future. Temperature increases are likely to lead to a continued rise in sea level, further increasing salinity which will increasingly restrict delta smelt's already limited geographic range (Feyrer et al. 2011; Cloern et al. 2011; Brown et al. 2013). These changes will likely alter freshwater flows, possibly shifting and condensing the timing and location of delta smelt reproduction (Brown et al. 2013).

Warmer water temperatures could reduce delta smelt growth, increase delta smelt mortality and constrict suitable habitat within the estuary during the summer months. Due to warming temperatures, delta smelt are projected to spawn an average of 25 days earlier in the season depending on the location (Brown et al. 2013). Also due to expected temperature increases, total number of high mortality days is expected to increase for all IPCC climate change scenarios (Brown et al. 2013). The number of stress days is expected to be stable or decrease partly because many stress days will become high mortality days. This could lead to delta smelt being forced to grow under highly stressful conditions during summer and fall with less time to mature because of advanced spawning (Brown et al. 2013). Growth rates have been shown to slow as water temperatures increase therefore requiring delta smelt to consume more food to reach growth rates that are normal at lower water temperatures (Rose et al. 2013a). Delta smelt are already often smaller than they used to be (Sweetnam 1999; Bennett 2005) and expected temperature increases due to climate change will likely further slow growth rates.

At the same time, warmer water will tend to move the spawning season earlier in the year (Brown et al. 2013). That means the smelt will have to grow faster still to compensate for that shorter growing season to produce even as many eggs as they do now, and that may already be a serious limitation on their population fecundity (Rose et al. 2013b). Higher temperatures may restrict delta smelt distribution into the fall, limiting their presence in Suisun Bay for more than just salinity reasons and force greater inhabitation of cooler high salinity waters (Brown et al. 2013). Water temperatures are already presently above 20°C for most of the summer in core habitat areas, sometimes even exceeding 25 °C for short periods. The delta smelt is currently at the southern limit of the inland distribution of the family *Osmeridae* along the eastern Pacific coast. That indicates that this region is already about as warm as that fish family can handle. Increased temperatures associated with climate change may result in a habitat in the Bay-Delta that is outside of the species ecological tolerance limits.

6.2.7 Cumulative Effects

Section 5.6 provides an overview of the types of foreseeable future projects and resulting cumulative impacts on special status fishes and habitat. These impacts range from adverse effects from additional delta exports or potential increases in contaminants in Bay/Delta waters, and beneficial effects from habitat restoration. These projects can either enhance or reduce prey quality and quantity; the quality and area of LSZ habitat, including spawning and rearing habitat; and/or directly injure or kill delta smelt and longfin smelt. While nebulous and difficult to predict, both species are in peril, especially delta smelt, as evidenced by the Bay Study. While difficult to tease out and beyond the scope of this analysis, the baseline conditions and anticipated future conditions of the Bay/Delta may include synergistic effects that cannot be accurately known, regardless of habitat restoration efforts.

6.2.8 Delta Smelt Critical Habitat and Potential Effects of the Proposed Action on Primary Constituent Elements

Delta smelt critical habitat was designated on December 19, 1994 (59 FR 65256). Critical habitat for this species includes: all water and submerged lands below the ordinary high water and the entire water column bounded by and including the Suisun Bay (including Grizzly and Honker Bays); Good Year, Suisun, Cutoff, First Mallard, and Montezuma Sloughs; and the water contained within the Sacramento–San Joaquin Delta in Contra Costa, Sacramento, San Joaquin, Solano, and Yolo counties, California.

The location of the X2 and resulting LSZ habitat is identified as one of the most important features of delta smelt habitat, including critical habitat. Depending on the water-year type (i.e., wet, above normal, normal, below normal, dry, critically dry), each of the habitat conditions specified below requires fluctuation (within-year and between-year) in the placement of the X2 at three historical reference points. These three historical reference points are the Sacramento-San Joaquin River confluence, the upstream limit of Suisun Bay at Chipps Island, and in the middle of Suisun Bay at Roe Island. The actual number of days that the X2 is maintained at the three points varies according to water-year type (discussed in **Section 5.3.3**). As previously discussed, the location of the X2 at or west of the confluence of the Sacramento and San Joaquin rivers results in increased quality and quantity of the LSZ habitat important for delta smelt populations. Further, the naturally-occurring spatial variability of the X2 and resulting LSZ habitat is typically found in healthy estuarine ecosystems, resulting in an effective deterrent to further invasion of newly introduced species and continued competition by those that are already established; produces higher densities of phytoplankton and zooplankton characteristic of healthy estuarine ecosystems; and simulates natural processes and historical conditions present when delta smelt thrived.

Primary constituent elements (PCEs) essential to the conservation of delta smelt include physical habitat, water, river flow, and salinity concentrations that are required to maintain delta smelt habitat for spawning, larval and juvenile transport, rearing, and adult migration (59 FR 65256). Details of delta smelt critical habitat PCEs and the potential effects of the proposed action on these PCEs are further discussed below.

PCE 1—Physical habitat for spawning: Adult delta smelt seek shallow, fresh, or slightly brackish backwater sloughs and edge-waters for spawning. These areas must have clean water and substrates that allow the attachment of eggs. Delta smelt broadcast spawn over sandy or cobble substrate; eggs are negatively buoyant and sink to the bottom where they attach to the substrate. The rest of the delta smelt's life cycle is spent in open pelagic waters. Areas identified as important spawning habitat include Barker,

Lindsey, Cache, Prospect, Georgiana, Beaver, Hog, and Sycamore Sloughs and the Sacramento River in the Delta, and the Suisun Marsh.

Effects of the proposed action on PCE 1: Clamshell dredging would occur in the open, deep water areas of San Pablo Bay or Suisun Bay and would not adversely affect physical habitat for spawning. However, it is the project could increase spawning habitat by beneficially reusing dredged material for creation of wetland habitat at Montezuma Wetlands and Cullinan Ranch. Montezuma Wetlands will have direct intertidal connections with Montezuma Slough (i.e., Suisun Marsh) as early as 2019 (Jim Levine, Montezuma Wetlands, pers. comm., July 23, 2018) and thus could increase the physical habitat for spawning. Cullinan Ranch would have direct intertidal connections with Mare Island Strait/Napa River and could also provide spawning habitat for delta smelt. In addition, both Montezuma Wetlands and Cullinan Ranch are expected to be productive wetland habitats and thus will increase the food supply for delta smelt.

PCE 2—Suitable water quality for all life stages: Adult delta smelt migrating to spawning grounds require low-salinity and freshwater water quality, with spawning typically occurring in freshwater with sandy substrate for spawning (USFWS 2008). Eggs require water with low concentrations of constituents of concerns and temperatures ranging from 14 to 17 °C to ensure successful hatching (59 FR 65256). Newly hatched larvae require intertidal freshwater in the upper parts of the LSZ, approximately 5 to 20 kilometers upstream of the X2 (see PCE 4, salinity) with temperatures ranging between 10 to 20 °C to develop. As larvae grow, they move to open pelagic waters and move farther towards the X2 in areas with higher salinities. Larvae also require high turbidities to elicit feeding responses and adequate prey. Juveniles require open pelagic waters with temperatures less than 24 °C and a preference for waters with high turbidities (Secchi disk depths < 0.5 meters) (USFWS 2008) and adequate prey (59 FR 65256).

Effects of the proposed action on PCE 2: Clamshell dredging is expected to increase suspended sediment in the water column in the immediate area surrounding the equipment. However, the sediment plumes caused by these activities are expected to be temporary and localized, with most sediment settling out of the water column within the mixing zone. Specifically, they are expected to dissipate over several hours and be relatively small compared to the over size of Suisun Bay.

As previously discussed and shown on **Table 2**, the deepening of the channel is expected to increase salinity intrusion only by a small amount as X2 is predicted to move upstream by 0.17 during critically dry years to 0.27 km during wet years. When X2 is greater than 64 km, this would result in X2 shifting up to 0.23 km, which may require additional water releases. This could slightly shift the LSZ habitat upstream, which in turn could affect the rearing habitat of juvenile delta smelt and result in slight increase in competition for resources of both juveniles and adults. However, the predicted shifts in X2 are on the same order of magnitude as the accuracy to which X2 can be measured operationally, and hence are not expected to be measureable. Although it is unknown if the additional 160 acres of wetland habitat generated at Montezuma Wetlands and Cullinan Ranch would offset the salinity intrusion, it would increase habitat available for spawning and larval development. It would also result in increased nutrient production that could be exported to the Napa River/Mare Island Strait and Suisun Bays, habitat used by juvenile and adult delta smelt. It is expected that these habitat benefits would offset the impacts on PCE 2.

PCE 3—River flow: Adequate river flow, both inflow and outflow from the Delta, influence the movement of migrating adults, larvae and juveniles. Adequate flow required to elicit upstream adult spawning migration, as adults are attracted to pulses of freshwater that are cooler and more turbid (USFWS 2008). River flows also transport larvae and juveniles downstream to LSZ rearing habitats (59 FR 65256). In addition, river flow greatly influences the extent and location of X2 and the LSZ, which is the primary habitat for delta smelt, and the vulnerability of delta smelt entrainment into pumping facilities (59 FR 65256; USFWS 2008).

Effects of the proposed action on PCE 3: An important aspect of PCE 3 is suitable river flow to ensure high quality and increased quantity of suitable LSZ rearing habitat. Suitable river outflow pushes the X2 (and LSZ) farther west, which improves habitat quality. This PCE is closely linked to the position of the X2; therefore, when X2 is located in or near Suisun Bay, the LSZ includes the shallow water estuarine habitat in areas of Suisun Bay, and at times, portions of San Pablo Bay.

The proposed project is expected to increase salinity intrusion only by a small amount; X2 is predicted to move upstream by 0.17 to 0.27 km. As discussed above, the shift in X2 is not expected to be measureable, and the beneficial reuse of dredged material should restore or create approximately 160 acres of wetland habitat, which would increase delta smelt access to shallow water habitat and may increase the food supply for rearing delta smelt. It is expected that these habitat benefits would offset the impacts on PCE 3.

PCE 4—Salinity for rearing: This PCE primarily is related to the position of X2 and the protection of the LSZ. Delta smelt spend most of their life cycle in the LSZ; as such, the salinity PCE for delta smelt is defined as the LSZ, which ranges from 0.5 to 6 psu. As discussed, as river outflow increases, the X2 shifts towards the west which is thought to increase the quantity and quality of the LSZ habitat (USFWS 2008). Due to the importance of the location of X2 for delta smelt habitat, flows in the Old and Middle Rivers are managed during certain times of the year to keep X2 from moving too far east towards the Delta.

When X2 is farther west in the Suisun Bay region, it is thought that the habitat quality increases because delta smelt have access to shallow waters and wetlands in Suisun and Grizzly bays, which could provide additional food resources. It is believed that when delta smelt habitat includes Suisun Bay, food resources increase, thereby decreasing competition for prey; individuals are less prone to predation, are less constricted; and able to disperse farther. As previously mentioned, they are also less prone to entrainment in pumping facilities as they are not affected by reverse flows in the south Delta.

Effects of the proposed action on PCE 4: Deepening of the channel is expected to affect the location of X2 by a small amount, which may shift the LSZ slightly upstream. However, this shift is not expected to be measureable. As discussed, it is expected that the beneficial reuse of the dredge material should restore or create 160 acres of wetland habitat would offset these minor shifts in the LSZ by creating additional spawning and rearing habitat adjacent to Suisun Bay and Mare Island Strait/Napa River, and also increasing the food supply for delta smelt. Dredged material would be placed on one of two beneficial reuse sites that will contribute to the construction of several different types of wetland habitats adjacent to Suisun and San Pablo Bays. Specifically, beneficially reusing dredged material would result in the

creation of 160 of wetland habitat that could provide shallow freshwater spawning habitat, larval and juvenile rearing habitat, and increase the quantity and quality of prey resources both at the restoration sites and exported into the bay.

6.2.9 Delta and Longfin Smelt Effect Determinations and Conclusions

The USACE acknowledges the probable existence of federally-listed threatened or endangered species within the action area. This biological assessment was prepared with the best available scientific and commercial information to determine potential effects on listed species.

This biological assessment analyzes the effects of deepening the Pinole Shoal Channel and portions of Bulls Head Reach from 35 foot MLLW to 38 feet MLLW (plus 2 feet of overdepth). The project also includes creating a sediment trap in Bulls Head Reach by deepening from 35 feet MLLW to 42 feet MLLW (plus 2 feet of overdepth) to decrease shoaling events that have resulted in emergency dredging in this area, outside of the regular yearly maintenance dredging. The rock outcrop that will be removed is relatively small and currently does not protrude above the bottom sediment. Its removal is not expected to produce noises above levels known to adversely impact fish or other organisms.

The project would occur within the existing delta smelt work windows for Suisun Bay and, to the extent practicable, the salmonid work windows in Suisun Bay. Although adherence to work windows in the Bulls Head Reach would occur, delta smelt are known to be present in this channel during the work windows albeit to a lesser extent. Longfin smelt may be present year-round, with numbers decreasing later in the work windows. Regardless, the work windows are protective of the most sensitive life stages of delta and longfin smelt, including spawning adults, eggs, larvae, and juveniles.

Injury or death could result from direct contact with dredging equipment, particularly from entrainment. This project proposes to use clamshell dredging in lieu of hopper dredging to minimize known effects, which would greatly reduce the risk of entrainment. Sub-lethal physiological or behavioral effects could result from exposure to increased concentrations of suspended sediment, contaminants released from suspended particles, and noise. However, these impacts would be temporary, only persisting during active dredging, and generally avoided due to the use of appropriate work windows.

No shallow water habitat important to delta and longfin smelt (i.e., habitat less than 3 m in depth at MLLW) will be altered due to the deepening of the navigation channels. Additionally, alterations of habitat due to the location of the X2 are expected to be minor, with a maximum projected upstream shift of 0.17 km likely to affect the important habitat in Suisun Bay only during critically dry years. Modeling indicates that upstream movement of X2 caused by the project may actually result in LSZ area being either gained or lost due to the large variance in the shoreline primarily in Suisun Bay (i.e., average monthly change for a below normal year from -556 to 446 acres; Anchor QEA, LLC 2019). Furthermore, the modeling showed that the overall monthly average area of the LSZ would range from 13,966 to 26,807 acres with the project versus 14,083 acres to 26,705 acres without the project. The small changes to habitat area are not expected to be detectable and hence insignificant. Also, the alterations and potential loss of shallow water and LSZ habitat should be offset by beneficially reusing dredged sediment for wetland restoration, thereby contributing to the creation or restoration of approximately 160 acres of wetland habitat, including tidal and intertidal wetland habitat. This habitat could be used by smelt for spawning and rearing, and would contribute to their prey base; consequently beneficial reuse

of dredging material would be a beneficial impact. The Cullinan Ranch and Montezuma Wetlands Environmental Impact Statements and Biological Opinions provide information on the amount of habitat each species would likely benefit from based on the respective restoration projects. The habitat restoration would occur approximately 2 years earlier than expected due to the contributions of sediment from this project.

Based on the analysis herein, the proposed project ***may affect, but is not likely to adversely affect*** threatened delta smelt and its critical habitat and candidate longfin smelt primarily due to the use of both appropriate work windows and clamshell dredging instead of hopper dredging. Turbidity and noise effects would be temporary and localized. Deepening the shipping channels would not remove shallow water habitat, and the upstream shift of X2 and the LSZ is expected to be minor and often within measurement error. The beneficial reuse of sediment is expected to accelerate the creation of approximately 160 acres of tidal and intertidal wetland habitat by approximately 2 years.

7.0 NMFS-Managed ESA Species and Effects Determinations

This section presents the impacts assessment for the threatened and endangered species and their respective critical habitats managed by NMFS. Species identified in the official list are provided in **Table 3**, along with a brief analysis of whether the species or critical habitat is in the action area and could be affected by the proposed action. A detailed analysis of the potential effects on the project's effects on threatened and endangered species and critical habitat that has the potential to be affected is also provided herein.

Table 3: Special Status Species and Critical Habitat Included on the NMFS Official Species List (February 20, 2018)

Common Name	Scientific Name	Status	Designated Critical Habitat	Critical Habitat in the Action Area	Potential to be in the Action Area	Effects Determination
California Central Valley steelhead	<i>Oncorhynchus mykiss</i>	FT	Yes	Yes	Yes	Not Likely to Adversely Affect
Central California Coast steelhead	<i>O. mykiss</i>	FT	Yes	Yes	Yes	Not Likely to Adversely Affect
Sacramento River winter-run Chinook salmon	<i>O. tshawytscha</i>	FE	Yes	Yes	Yes	Not Likely to Adversely Affect
Central Valley spring-run Chinook salmon	<i>O. tshawytscha</i>	FT	Yes	Yes	Yes	Not Likely to Adversely Affect
North American green sturgeon	<i>Acipenser medirostris</i>	FT	Yes	Yes	Yes	Not Likely to Adversely Affect

7.1 NMFS-managed ESA Species Descriptions

Five special status fishes managed by the NMFS inhabit the action area, including four salmonid species and green sturgeon. These species, along with the effects of the proposed action on these species, are discussed below.

7.1.1 Central Valley Spring-run ESU Chinook Salmon (*Oncorhynchus tshawytscha*) (FT) (CH) (ST) and Sacramento River Winter-run ESU Chinook Salmon (*Oncorhynchus tshawytscha*) (FE) (CH) (SE)

7.1.1.1 Listing Status and Range

The Central Valley spring-run Chinook salmon ESU was initially listed as threatened by NOAA Fisheries on September 16, 1999 (64 FR 50394) and re-listed as threatened on June 28, 2005 (70 FR 37160). The CDFW designated the Central Valley spring-run Chinook salmon as threatened on February 5, 1999 (CDFW 2009b).

The Sacramento River winter-run Chinook salmon was initially listed as endangered on January 4, 1994 (59 FR 440); this listing was reaffirmed on June 28, 2005 (70 FR 37160). The CDFW listed the Sacramento River winter-run Chinook salmon as endangered on September 22, 1989 (CDFW 2009b).

Historically, Chinook salmon ranged from Ventura River, California to Point Hope, Alaska, and in northeastern Asia from Hokkaido, Japan to the Anadyr River in Russia. Central Valley spring-run Chinook salmon once were widely distributed and spawned in larger tributaries to both the Sacramento and San Joaquin rivers (Moyle 2002). Currently, only three naturally spawning populations remain and occur in Deer, Mill, and Butte creeks, which are all tributaries to the Sacramento River (NMFS 2016a). Sacramento River winter-run Chinook salmon originally spawned in the Pit, McCloud, and upper Sacramento rivers but now consists of a single spawning population in the Sacramento River downstream of Keswick Dam (Moyle 2002). A captive broodstock conservation hatchery program was initiated in 2015 to supplement the population, and reintroduction of winter-run Chinook salmon to newly accessible habitat in Battle Creek is planned for 2020 (NMFS 2016b).

7.1.1.2 Life Cycle and Habitat Use

Chinook salmon are the largest of the Pacific salmon species. They are anadromous and migrate to natal grounds where they spawn and die. They exhibit two separate reproductive life histories, stream-type and ocean-type. Stream-type juveniles reside in freshwater for a year or more before migrating to marine environment, whereas ocean-type migrate within their first year of life (Healey 1991). Spring-run Chinook salmon juveniles primarily are stream-type, whereas winter-run Chinook salmon exhibit a mix of stream- and ocean-type characteristics (Moyle 2002). Both winter- and spring-run Chinook salmon utilize high spring flows to access spawning grounds (Fisher 1994). However, the migration and spawning timing for each species differs, as discussed below.

Spring-run Chinook salmon: Adult spring-run Chinook salmon migrate upstream between late January and early February. They hold in freshwaters over the summer, spawning in the fall. Spawning typically occurs between September and October, depending on water temperature. Larvae emerge from the gravel as fry from November to March, and juveniles typically spend 3 to 15 months rearing in freshwater before migrating toward the ocean. Juveniles outmigrate from mid-March through mid-May. It is unlikely that

adult or juvenile spring-run Chinook would be present in the action area during dredging. *Winter-run Chinook salmon*: Adult winter-run adults migrate to spawning grounds between November and June (Hallock and Fisher 1985). Adults begin upstream migration sexually immature and typically hold in freshwater over the summer and fall, delaying spawning until spring or early summer. Spawning typically occurs from mid-April to mid-August, peaking in May and June. Fry emerge from the gravel in late June through early July, with juveniles spending 4 to 7 months rearing in freshwater prior to migrating to the ocean as smolts. Juveniles outmigrate from October through early May. Adult winter-run Chinook salmon may be present in the action area if they migrate to spawning grounds in June. Outmigrating juveniles may be present in the action area starting in October; but, are likely to be absent in June.

The results of the 2007 *San Francisco Bay Juvenile Outmigration Study* (conducted by the USACE, NOAA-Fisheries, University of California Davis, East Bay Municipal Utilities District, and San Francisco Bay Area Planning Coalition) indicate that juveniles spent from approximately 1-17 days transiting from the Benicia Bridge to the Golden Gate Bridge (Chapman et al. 2009). MacFarlane and Norton (2002) found that outmigrating juvenile salmon required up to 40 days to pass through the San Francisco Bay to the ocean. Hearn et al. (2013) found that smolts generally transited the Bay rapidly in 2 to 4 days, yet also made repeated upstream movements, coinciding with incoming tidal flows, and that smolts utilize habitat located over deep, channelized portions of the Bay. Smolts detected at nearshore, shallow sites such as marinas, or up tributaries generally returned to the main channel to finish their migration.

During the course of their downstream migration, juveniles may utilize the estuary for seasonal rearing, but available information suggests that fish are actively migrating and currently they do not reside in the San Francisco Bay estuary (Hearn et al. 2013). MacFarlane and Norton (2002) found that fall-run Chinook experienced little growth, depleted condition, and no accumulation of lipid energy reserves during the relatively limited time the fish spent transiting the 40-mile length of the estuary.

The diet of outmigrating Chinook salmon varies geographically and seasonally and feeding appears to be opportunistic. Aquatic insect larvae and adults, such as *Daphnia*, amphipods (*Eogammarus* and *Corophium spp.*), and *Neomysis* are common Chinook food species. Other species that make up Chinook salmon diet include anchovies and herring.

7.1.1.3 Threats

The biggest threat to Chinook salmon is the existence of numerous migratory barriers including dams which impede access to historical habitat, and diversions of water from rivers and streams which degrade the quality of existing habitat. Other threats include juvenile entrainment in state and federal water projects, exploitation, predation, invasive species, and competition with hatchery-reared salmon, disease, pollution, siltation, and loss of riparian habitat that provides essential cover (Moyle 2002).

7.1.1.4 Status in the Action Area

Adult spring-run Chinook salmon migrate upstream between March and September. Winter-run adults migrate upstream between December and July. Consequently, adults may be in the action area during these months. Juveniles outmigrate to the ocean and may be present in the action area during the late fall, winter, and spring, typically October through June. Central Valley Spring-run ESU Chinook salmon and Sacramento River Winter-run ESU Chinook Salmon Critical Habitat

Critical habitat for Central Valley spring-run Chinook salmon includes 162,560 acres of estuarine habitat, all located in the San Francisco-San Pablo-Suisun Bay estuarine complex, and 2,308 miles of riverine habitat; located in Tehama, Butte, Glenn, Shasta, Yolo, Sacramento, Solano, Colusa, Yuba, Sutter, Trinity, Alameda, San Joaquin, and Contra Costa Counties (70 FR 52488). Critical habitat for Sacramento River winter-run Chinook salmon includes the Sacramento River from Keswick Dam (RM 302) to Chipps Island (RM 0) and all waters in the San Francisco-San Pablo-Suisun Bay estuarine complex (50 FR 33212). The action area is within critical habitat for both the spring-run DPS and winter-run ESU.

7.1.2 Central Valley Steelhead DPS (*Oncorhynchus mykiss*) (FT) (CH) and Central California Coast Steelhead DPS (*Oncorhynchus mykiss*) (FT) (CH)

7.1.2.1 Listing Status and Range

The Central Valley steelhead was initially listed as threatened by NOAA-Fisheries on March 19, 1998 (63 FR 13,347); this listing was reaffirmed on January 5, 2006 (71 FR 834) and revised on April 14, 2014 (79 FR 20802).

The Central California Coast steelhead was initially listed as threatened by NOAA-Fisheries on August 18, 1997 (62 FR 43937); this listing was reaffirmed on January 5, 2006 (71 FR 834) and revised on April 14, 2014 (79 FR 20802).

O. mykiss (rainbow trout/steelhead) are distributed worldwide in cold waters (Moyle 2002). In North America, *O. mykiss* historically was distributed from Alaska to Baja California. Central Valley steelhead presently occur in the Sacramento and San Joaquin river drainages (71 FR 834). However, except for the Stanislaus River, they may no longer occur in the San Joaquin River watershed (Moyle 2002). Central California Coast steelhead occur in coastal streams from the Russian River south to Aptos Creek, and in the San Francisco, San Pablo, and Suisun Bay drainages west of Chipps Island (71 FR 834).

7.1.2.2 Life Cycle and Habitat Use in the Action Area

Steelhead are the anadromous form of rainbow trout; however, because of their ecological requirements, their life history more closely resembles Pacific salmon. Unlike Chinook salmon, steelhead are iteroparous, meaning they are capable of spawning more than once before they die; however, it is highly unlikely that they spawn more than twice in a lifetime (65 FR 36074). After spending approximately 2 years rearing in freshwater, steelhead migrate to marine waters where they reside for 2 or 3 more years until sexually mature.

Biologically, steelhead can be separated into two reproductive ecotypes, based on their state of sexual maturity at the time they enter their natal water body. These two ecotypes are referred to as stream maturing and ocean maturing. Stream maturing steelhead enter freshwater sexually immature and require several months to become sexually mature before spawning. Ocean maturing steelhead enter natal streams with well-developed sexual organs and spawn shortly after river entry. These two reproductive ecotypes are more commonly referred to by the season of freshwater entry. Summer river maturing enters between May and October and winter ocean maturing enters between November and April. The Central Valley steelhead is predominately ocean maturing (65 FR 36075; NMFS 2014).

Once sexually mature, adult steelhead return to their natal stream to spawn, usually at the age four or five. Generally, the Central Valley and CCC steelhead migrate to spawning grounds between December and April, peaking in January and February (Fukushima and Lesh 1998). Spawning typically occurs from early March through July, peaking in May through June (NMFS 2014). Depending on water temperature, steelhead eggs may incubate in redds for 1.5 to 4 months before hatching as alevins. Following absorption of the yolk sack, fry emerge from the gravel and begin actively feeding. Juveniles migrate to marine waters as smolts from January through May, peaking in April and May (Fukushima and Lesh 1998). Studies indicate that steelhead move through the Bay rather quickly, spending only 2 to 4 days outmigrating (Hearn et al. 2013 and Sandstrom et al. 2013).

7.1.2.3 Threats

The biggest threat to these species is habitat destruction. Logging, agriculture and mining activities, urbanization, stream channelization, dams, wetland loss, and water diversions also threaten steelhead. Depletion and storage of natural flows have altered natural hydrological cycles in several California rivers and streams, altering important water quality parameters, such as temperature, dissolved oxygen and nutrient loads, resulting in injury or mortality of some individuals. Reduced flows also degrade and diminish viable fish habitat by increasing deposition of fine sediments in spawning gravels, which decreases recruitment of new spawning gravels and promotes encroachment of riparian vegetation into spawning and rearing areas (65 FR 36075).

7.1.2.4 Status in the Action Area

Adult steelhead would be expected to migrate through the action area between December and March (Moyle 2002). Juveniles rear in the action area and adjacent estuary and may be present year-round.

7.1.3 Southern DPS Green Sturgeon (*Acipenser medirostris*) (FT) (CH)

7.1.3.1 Listing Status and Range

April 7, 2006, the Southern DPS of the North American green sturgeon (*Acipenser medirostris*) was listed as threatened by NMFS (71 FR 17757). The listing was updated on April 14, 2014 (79 FR 20802). Green sturgeon is also considered a species of special concern by the CDFW (see Moyle et al. 2015).

Green sturgeon are found in nearshore marine waters ranging from Mexico to the Bering Sea and are common in bays and estuaries along the west coast of the Americas. The North American green sturgeon are composed of two genetically distinct population structures (DPS), the Northern DPS (Klamath and Rogue River spawning populations) and Southern DPS (Sacramento River spawning populations) (68 FR 4433; Adams et al. 2002). The range of Southern DPS green sturgeon was thought to be within the coastal waters south of the Eel River through Mexico; however, adults travel as far north as Canada (Lindley et al. 2008, Huff et al. 2012). San Francisco Bay and its tributaries are thought to contain a majority of the Southern DPS green sturgeon population.

7.1.3.2 Life Cycle and Habitat Use in the Action Area

Green sturgeon are long-lived, slow growing and iteroparous. Mature males range from 139 to 199 centimeters fork length at 15 to 30 years of age; mature females, on the other hand, range from 157 to 233 centimeters fork length at 17 to 40 years of age. Generally, spawning occurs at 160 to 170 centimeters

fork length for males (17 to 18 years old) and 182 to 192 centimeters fork length for females (27 to 28 years old) (68 FR 4433). Females produce approximately 60,000 to 140,000 eggs that are spawned over cobble substrate where they settle in the spaces between cobbles. Water temperatures must be less than 60 °F (20° C) for the eggs to be viable.

Green sturgeon spawn every 3 to 5 years. Adults typically migrate to freshwater in the upper Sacramento River, beginning in late February through early May (Heublein et al. 2009). Spawning occurs from March through July, with peak spawning occurring from mid-April through mid-June in freshwater. Green sturgeon generally spawn in their natal stream and appear to have high homing capabilities for spawning grounds. Historically, spawning occurred in areas above Shasta Dam and in the Feather River; however, following the construction of Shasta and Oroville Dams, green sturgeon were not able to migrate farther upstream (Adams et al. 2002). Spawning occurs in deep pools with large cobble substrate; however, spawning also occurs on clean sand and bedrock substrate.

After spawning, adults may hold between June and November in deep pools near spawning grounds and outmigrate in the late fall to early winter, or they may directly outmigrate in the late spring to early summer after spawning. Preliminary results from tagged adult sturgeon suggest travel time through the Bay, from the Golden Gate to Rio Vista is generally 1 to 2 weeks. Post-spawning adults display two outmigration strategies; outmigrating from Sacramento River prior to September 1 and outmigration during the onset of fall/winter stream flow increases. The transit time for post-spawning adults is similar to upstream migration, spending approximately 1 to 2 weeks in the Bay before entering the ocean (Heublein et al. 2009). During the summer and fall, some non-spawning adults and subadults enter the Bay from the ocean for periods ranging from a few days to 6 months (Lindley et al. 2011). Some fish are detected only near the Golden Gate, while others move as far inland as Rio Vista in the Delta. Therefore, it is likely that post-spawning adults could be present in the action area during construction; however, adults migrating to spawning grounds are not likely to be present. Additionally, non-spawning adults may enter the estuary and be present in the action area during construction.

Green sturgeon larvae begin feeding approximately 10 to 15 days after hatching, and approximately 35 days later metamorphose into juveniles. Juveniles spend their first few years Bay-Delta waters before migrating to the ocean as subadults, with juveniles spending their first several months to a year in Delta freshwaters before migrating to the Bay (Adams et al. 2002). Although juveniles are present in the Bay year-round, Kelly et al. (2007) found that sub-adults typically remain in shallower depths (less than 30 feet) and show no preference for temperature, salinity, dissolved oxygen, or light levels. Therefore, juveniles are likely to be present in the action area year-round; however, it is likely that they are present over the shallower depths adjacent to the ship channel.

Juvenile green sturgeon forage primarily in soft-bottom intertidal areas (Dumbauld et al. 2008), feeding on opossum shrimp and amphipods (68 FR 4433). Adult green sturgeon feed on benthic invertebrates including shrimp, mollusks, amphipods, and small fish (68 FR 4433).

7.1.3.3 Threats

The biggest threat to green sturgeon is loss of spawning habitat in the upper Sacramento River. Insufficient freshwater flows in spawning areas, contaminants, bycatch in fisheries, poaching, entrainment in water

projects, exotic species, impassable barriers at other locations, and elevated water temperatures may also pose a threat to green sturgeon.

7.1.3.4 Status in the Action Area

The action area is within green sturgeon critical habitat. Green sturgeon juveniles (age 1-3 years) outmigrate to the ocean to continue rearing and growing, and may return after spending up to 13 years in the ocean (Moyle 2002). They may be expected to occur in the action area during the summer and fall.

7.2 NMFS-managed Special Status Fishes Effects Determinations

This section provides the effects determination of the proposed action on listed salmonids and green sturgeon. Section 5 provides a detailed discussion of the impact mechanisms of the proposed action. The potential impacts to listed salmonids and green sturgeon from the proposed project include: impacts from dredging including potential entrainment and temporary degradation of water quality; physical disturbance of habitat, and noise or disturbance of fish and habitat. However, the action area is used primarily as a migration corridor by the listed Chinook salmon, steelhead, and green sturgeon as described above, as well as rearing habitat for juvenile salmonids and green sturgeon.

Adult and juvenile spring-run Chinook are not likely to be present in the action area during dredging. Adult winter-run Chinook salmon may be present in the action area if they migrate to spawning grounds in June. Outmigrating juveniles may be present in the action area in October through January and, therefore, could be affected by dredging activities in October and also in December and January, should dredging be conducted outside the salmonid work window.

During construction of the proposed action, it is unlikely that adult or juvenile Central Valley or CCC steelhead would be present in the action area. However, should construction of Pinole Shoal extend into December (outside of the salmonid work windows), adults migrating to spawning grounds could be present.

Green sturgeon may be more likely than juvenile salmonids to use the action area for foraging and rearing habitat. As discussed, it is likely that post-spawning adults could be present in the action area during construction; however, adults migrating to spawning grounds are not likely to be present. Non-spawning adults may enter the estuary and be present in the action area during construction. Juveniles are likely to be present in the action area year-round.

To the extent practicable, dredging Pinole Shoal would also occur during the work windows. However, should deepening not be completed within one dredging season, the project proposes to expand the work windows into December and possibly January, in compliance with the NMFS LTMS maintenance dredging biological opinion (i.e., expanding work windows are allowed for maintenance dredging if dredging is conducted with a clamshell dredge and sediment is beneficially reused for aquatic habitat restoration). In addition, the project proposes to use a clamshell dredge, which would avoid or minimize entrainment and physical injury to salmonids and green sturgeon.

7.2.1 Direct Contact with Dredging Equipment and Entrainment

As discussed, adult and juvenile winter run Chinook salmon, juvenile spring-run Chinook salmon, non-spawning adult green sturgeon, and juvenile green sturgeon may be present in the action area during dredging. The presence of these species in the navigation channel during dredging results in a potential for individuals to be directly injured or killed. The most likely cause of injury would be from the clamshell bucket falling through the water column until reaching the substrate. However, as mechanical equipment travels through the water column, it generates a pressure wave that would likely force fish away from the falling bucket.

Very limited data exist regarding potential entrainment effects of clamshell dredging on fishes (Reine and Clarke 1998). The entrainment of aquatic organisms may be possible with a mechanical clamshell dredge. As the bucket of a mechanical clamshell dredge collects material from the bottom, aquatic organisms can be physically collected within the water and sediment material. However, mechanical clamshell dredging is considered to have a very low risk of fish entrainment, and for large fish typically the lowest of all dredge types (Reine and Clarke 1998).

As mentioned previously, general disturbance from barges, dredging crew and tugs is expected to cause salmonids and green sturgeon to avoid the areas where active dredging is occurring. Overall, the potential to entrain or physically injure or kill salmonids or green sturgeon is very low.

7.2.2 Exposure to Increased Suspended Sediment and Turbidity

Dredging and scow overflow, should overflow be permitted, would result in increased concentrations of sediment. The increased concentrations would be continuous during active dredging, with the highest concentrations within a 200-foot radius of dredging and overflow (USACE 2014). As discussed in Section 5.3.1, sediment proposed for dredging in the Pinole Shoal Channel ranges from fine-grained at the western and eastern portions of the channel and sand in the center. Sediment proposed for dredging in Bulls Head Reach is predominately sand with small pockets of fine-grained material. Dredging would result in increased turbidity plumes, which would be greatest in areas of fine-grained sediment (e.g., eastern and western portions of the Pinole Shoal Channel). Dredging in areas of sand would result in plumes with less concentration of suspended sediment because sand would fall out of the water column rather quickly and settle to the bottom of the channel. The range of temporary turbidity increases is expected to be within a 200-foot radius from dredging operations and disposal area, and is expected to persist during active and settle within 20 minutes following active dredging (USACE 2014).

Elevated concentrations of turbidity could affect salmonids and green sturgeon if they are in the vicinity of dredging and exposed to the turbidity plumes. It is expected that the harm could include sub-lethal effects to fish anatomy (e.g., damage to gills), or behavioral (avoidance of plumes). Adult and juvenile salmonids are expected to generally avoid sediment plumes, utilizing clearer open waters adjacent to the plumes (NMFS 2015b). Green sturgeon are benthic fish that can tolerate high levels of suspended sediment and are less likely to be disturbed by the sediment plumes; however, green sturgeon may not alter their direction of travel or other behaviors to avoid turbidity plumes (NMFS 2015b).

7.2.3 Salinity Intrusion

Salmonids and green sturgeon are anadromous fishes, inhabiting both saltwater and freshwater during various points of their life histories. Both species osmoregulate to adjust to salinity gradients as they begin their upstream and downstream migrations. It is important that salinity gradients support the physiological transition of juveniles and adults as they transition between fresh- and saltwater. Laboratory studies conducted by Allen and Cech (2007) indicated juveniles approximately 6-months old were tolerant of saltwater, but approximately 1.5-year old green sturgeon appeared more capable of successful osmoregulation in salt water. The minor movement of salinity into the delta could shift salinity gradients slightly farther east compared to baseline conditions; however, these small shifts are not expected to affect migrating adult and juvenile salmonids and green sturgeon.

7.2.4 Habitat Loss

The proposed project would cause some loss of LSZ and shallow water habitat due to physical loss to the steepened side slopes of the project, and an anticipated 0.17 km upstream shift in X2 in critically dry years. However, adult salmonids and green sturgeon do not rely on shallow water or low salinity habitat. Although shallow floodplain rearing habitat is critical for juvenile salmonids especially in rivers, the action area is used by juveniles primarily as a migratory corridor, and their time there is expected to be brief.

Salmonids are pelagic fish and forage in the water column. Green sturgeon, on the other hand, are benthic fish and forage on the benthos. Dredging the side slopes would result in removal of approximately 298 acres of benthic habitat between the toes of the navigation channels and 21 acres of benthic habitat along the side slopes, which would directly remove foraging habitat for green sturgeon. Sediment removed between the toes of the channel bottom are disturbed regularly through maintenance dredging and deep-draft navigation and would continue to be disturbed similar to the baseline disturbance following deepening the channels. Therefore, it is expected that the channel bottom would provide limited food resources, compared to the side slopes, which are typically not disturbed. Removal of benthic prey resources could adversely affect green sturgeon, particularly juveniles, which rear in the action area year-round. However, the expected creation or restoration of 160 acres of tidal wetland habitat from beneficially reusing material dredged from the channels could result in a net export of nutrients to the surrounding bay waters, thereby improving the quality and quantity of benthic prey resources. Additionally, the benthic resources along the side slopes are expected to recovery shortly, within months to a year.

7.2.5 Exposure to Noise

As discussed in **Section 5.4.**, noise from the proposed project would be generated primarily from clamshell dredging, tugs working in the vicinity of the dredge and along the dredged material transport corridor, and for a short period from a pneumatic jackhammer required to remove a small rock outcrop. The project is expected to produce peak SPLs at a distance of approximately 150 meters of 124 dB rms from clamshell dredging and 132 dB rms from removal of the rock outcrop. These noise values are below all of the thresholds that would result in direct injury to most fish, including salmonids and green sturgeon. However, fish could experience temporary behavior disturbances, such as decreased foraging or avoidance of areas with increased noise.

7.2.6 San Francisco Bay-Delta Climate Change

As discussed, climate change is expected to result in mean annual water temperatures within the upper Sacramento River portion of the Bay-Delta to approach or exceed 14 °C during the second half of this century (Cloern et al. 2011). Higher air temperatures will reduce snowpack, melt snow earlier in the winter or spring, and increase water temperatures. Additionally, elevated salinity levels could push the position of X2 farther up the estuary if outflows were not increased to compensate for it.

Higher water temperatures are likely to severely affect salmonids, which depend on cool water for successful spawning and rearing. Higher temperatures could result in delayed migrations to spawning grounds, reduced spawning success, and other sub-lethal and lethal effects from elevated temperature. Green sturgeon may experience similar impacts. In general, increased temperatures associated with climate change may result in a habitat in the Bay-Delta that is outside of the species ecological tolerance limits.

7.2.7 Cumulative Effects

Section 5.6 provides an overview of the types of foreseeable future projects and resulting cumulative impacts on special status fishes and habitat. These impacts range from adverse effects from additional delta exports or potential increases in contaminants in Bay/Delta waters, and beneficial effects from habitat restoration. While nebulous and difficult to predict, cumulative effects on listed salmonids and green sturgeon could be significant, particularly with the inclusion of climate change. While difficult to tease out and beyond the scope of this analysis, the baseline conditions and anticipated future conditions of the Bay/Delta may include synergistic effects that cannot be accurately known, regardless of habitat restoration efforts.

7.2.8 Salmonid and Green Sturgeon Critical Habitat and Potential Effects of the Proposed Action on Primary Constituent Elements

7.2.8.1 Central Valley Winter-Run Chinook and Central California Coast Steelhead Critical Habitat

Critical habitat for Central Valley winter-run Chinook salmon and CCC steelhead was designated on September 2, 2005 (70 FR 52488). Critical habitat includes stream channels within the designated stream reaches and the lateral extent of the ordinary high water mark or, where not defined, by bankfull elevations in Tehama, Butte, Glenn, Shasta, Yolo, Sacramento, Solano, Yuba, Sutter, Placer, Calaveras, San Joaquin, Stanislaus, Tuolumne, Merced, Alameda, and Contra Costa Counties, California. The action area is located within the Marin Coastal Hydrologic Unit, Bay Bridges Hydrologic Unit, and San Pablo Hydrologic Unit. Approximately 247,040 acres of critical habitat exist in San Francisco and San Pablo Bays (NOAA Fisheries 2007c). Critical habitat for Central California Coast steelhead includes several coastal watersheds and approximately 282,880 acres in San Francisco and San Pablo bays; the waters of the Carquinez Strait and Suisun Bay are not designated critical habitat.

Primary constituent elements for these both include:

- Freshwater spawning sites with water quality and substrate conditions that can support spawning, incubation, and larval development.
- Freshwater rearing sites with water quality and floodplain connectivity to support juvenile growth, mobility, foraging, and development.

- Aquatic habitat with natural cover, such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
- Freshwater migration corridors free of obstruction and excessive predation with water quality conditions and natural cover to support juvenile and adult mobility and survival.
- Estuarine areas free of obstruction and excessive predation.
- Water-quality conditions that support juvenile and adult physiological transitions between fresh- and saltwater, natural cover, and foraging.

The action area is partially within Central Valley steelhead and Central California Coast steelhead critical habitat.

Effects of the Proposed Action on Salmonid PCEs: With the exception of estuarine habitat and water quality conditions that support salmonid physiological transitions between freshwater and saltwater, the proposed action occurs outside of freshwater PCEs and, therefore, would not affect these PCEs. As previously discussed, the extent of salinity intrusion into the Delta are not expected to affect aquatic habitat where migration and rearing habitat where adults and juveniles would be transitioning between fresh and saltwater. The minor increase of salinity gradients in the Delta would likely not be perceptible to transitioning salmonids.

Construction would temporarily affect estuarine habitat, resulting in temporary obstructions in the navigation channel from dredging equipment, increased turbidity, and possibly noise. However, during construction, adult and juvenile salmonids are expected to generally avoid sediment plumes, utilizing clearer open waters adjacent to the plumes (NMFS 2015b). Following construction, these obstructions would be eliminated.

7.2.8.2 Southern DPS of North American Green Sturgeon Critical Habitat

Critical habitat for green sturgeon was designated on October 9, 2009 (74 FR 52300). Critical habitat includes freshwater riverine systems, including the stream channels and the lateral extent defined by the ordinary high-water line (33 C.F.R § 329.11) or bankfull elevation, where the ordinary high water mark is not defined and all United States coastal marine waters out to the 60 fathom depth boundary line (relative to MLLW), from Monterey Bay, California north and east, including the Straits of Juan de Fuca, Washington. Riverine stream systems include the Sacramento River, from the Sacramento I-Street Bridge upstream to Keswick Dam, including waters encompassed by the Yolo Bypass and Sutter Bypass areas, and the lower American River from the confluence with the mainstem Sacramento River upstream to Fish Barrier Dam on the Feather River; and portions of the Lower Yuba River and Lower Feather River; the Sacramento–San Joaquin Delta waterways up to the elevation of mean higher high water, San Francisco Bay, San Pablo Bay, Suisun Bay, and Humboldt Bay, California; Coos Bay, Winchester Bay, Yaquina Bay, Nehalem Bay, and the Lower Columbia River Estuary, Oregon; and Willapa Bay and Grays Harbor, Washington.

Green sturgeon PCEs include various components of freshwater, estuarine, and nearshore marine habitats. Components include food resources, substrate for spawning, water flow, water and sediment quality, water depth, and migratory corridor. Green sturgeon PCEs are described below.

Freshwater Systems: The lower Sacramento River, from I Street Bridge to the downstream side of the Red Bluff Diversion Dam gates, is considered a PCE because this area supports egg incubation, larval and juvenile rearing, feeding and migration, and adult and subadult holding and migration. This PCE does not occur in the action area and, therefore, would not be affected by the proposed action.

Nearshore Coastal Marine Areas: Green sturgeon require nearshore coastal marine areas with adequate migratory corridors, water quality, and food resources. This PCE does not occur in the action area and, therefore, would not be affected by the proposed action.

Estuarine Habitats: Estuarine habitat provides food resources, migratory corridors, juvenile rearing, and adult and subadult holding habitat for green sturgeon. Of the various habitat types that comprise green sturgeon PCEs, estuarine habitat is the only habitat type that occurs within the action area and could be affected by the proposed action. Components of the PCE include:

- Food resources. Green sturgeon require abundant prey items within estuarine habitats and benthic substrate for juvenile, adult, and subadult life stages. Adult and subadults prey on ghost shrimp, amphipods, clams, juvenile Dungeness crab, anchovies, sand lances, ling cod, and other unidentified fish. Juveniles feed on shrimp, amphipods, isopods, clams, annelid worms, and unidentified crabs and fishes.
- Water flow. Sufficient water flow into the San Francisco Bay and Delta is required to allow adults to successfully orient to the incoming flow and migrate upstream to spawning grounds.
- Water quality. Water quality includes temperature, salinity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages. Adults and subadults occur across the entire temperature (11.9–21.9 °C) and salinity range (8.8–32.1 parts per thousand) and a wide range of dissolved oxygen (6.54–8.89 milligrams per liter).
- Migratory corridor. The migratory corridor should allow for safe and timely passage of sturgeon within estuarine habitats and between estuarine and riverine or marine habitats. Adults enter the Estuary in late February and quickly migrate to spawning grounds. After spawning, they either reside over the summer in deep holding pools deeper than 5 meters (16.4 feet), or they migrate downstream. Tagged green sturgeon were present in holding pools in the Sacramento River through November and December before migrating downstream. They appear to migrate in shallow waters, swimming near the surface, but foraging on the bottom.
- Depth. Green sturgeon require a diversity of depths for shelter, foraging, and migrating. Juveniles are present year round in the Bay and Delta in shallow depths ranging from 1 to 3 meters (3.3–9.8 feet). Tagged adults and subadults appear to stay in shallow depths less than 10 meters (32.8 feet).
- Sediment quality. Sediment quality is necessary for normal behavior, growth, and viability of all life stages.

The proposed action may affect green sturgeon estuarine PCE. Specifically, food resources and water quality. Removal of approximately 320 acres of benthic foraging habitat, of which 21 acres along the side slope is considered undisturbed habitat, could reduce prey resources important for green sturgeon. It is expected that the removal of approximately 298 acres of benthic habitat within channel toes would have limited benthic foraging value as these areas are dredged regularly and are exposed to propeller wash from the deep draft navigation. Beneficial reuse of the dredged material from the proposed project would

contribute to 160 acres of wetland habitat, which would offset effects to removal of the habitat from -35 feet to -38 feet in the channel toes.

Water quality would be temporarily affected by dredging activities. Water quality surrounding dredging activities would experience increased concentrations of turbidity resulting from re-suspension of sediments. Additionally, there is a potential for constituents of concern to be released from sediment particles during resuspension. These impacts would be temporary, persisting only during dredging operations. It is expected that these impacts would be offset by the creation/enhancement of approximately 160 acres of wetland habitat adjacent to green sturgeon estuarine habitat. The wetlands would indirectly support green sturgeon foraging by exporting nutrients to the Bay.

7.2.9 Effects Analysis and Conclusions

As discussed above, adverse effects from this project to all listed species would largely be avoided or minimized due to the use of both appropriate work windows and clamshell dredging instead of hopper dredging. Turbidity and noise effects would be temporary and localized. Adult and juvenile Central Valley spring-run Chinook salmon are not expected to be present in the action area during dredging. However, though unlikely, there is a slight chance that late outmigrating juveniles may be present. Minor alterations to salmonid habitat could occur; however, any resulting impacts would be insignificant. Therefore, the proposed action ***may affect, but is not likely to adversely affect***, Central Valley spring-run Chinook salmon.

Adult winter-run Chinook salmon may be present in the action area if they migrate to spawning grounds in June. Outmigrating juveniles may be present in the action area starting in October, and could be affected by the proposed action. Additionally, should the work windows be extended into December and January, the likelihood of juveniles being present in the action area would increase. As a result of limited presence in the action area, it is expected that proposed action ***may affect, but is not likely to adversely affect***, Central Valley winter-run Chinook salmon.

Should construction of the proposed project be contained to the existing salmonid work windows, it is unlikely that adult or juvenile Central Valley or CCC steelhead would be present in the action area. However, should deepening the Pinole Shoal Channel extend into December (outside of the salmonid work windows), adults migrating to spawning grounds could be present. Because the likelihood of steelhead being present in the action area during construction is minimal, it is expected that construction of the project ***may affect, but not likely to adversely affect***, listed steelhead.

As discussed, juvenile green sturgeon are present in the action area year-round, and forage in the shallow waters adjacent to the navigation channels. Although work windows are not established for green sturgeon, the use of work windows will reduce the exposure of sturgeon to dredging activities. Further, the use of clamshell dredges would reduce the risk of entrainment. The loss of benthic foraging habitat could temporarily reduce prey resources. However, it is expected that restoration of wetland habitat adjacent to the Bay would increase the quality and quantity of sturgeon prey resources in the Bay. The beneficial reuse of sediment from this project is expected to accelerate the creation of approximately 160 acres of tidal and intertidal wetland habitat at Montezuma Wetlands and Cullinan Ranch by approximately 2 years. Based on this analysis, it is expected that the proposed action ***may affect, but is not likely to adversely affect*** threatened green sturgeon. Similarly, while temporary impacts to green sturgeon and

salmonid estuarine PCEs of critical habitat are expected, these impacts would be temporary and offset in part by restoration of 160 acres of wetland habitat adjacent to the Bay, which would increase food supply.

8.0 Essential Fish Habitat Assessment

The Magnuson-Stevens Act protects the essential fish habitat of species managed under federal Fishery Management Plans (FMPs). EFH is defined as “...those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity...” (16 U.S.C. 1802(10)).

In addition to preparing FMPs, the Magnuson-Stevens Act requires NOAA Fisheries to designate a Habitat Area of Particular Concern (HAPC) for each species. HAPCs are “subsets of EFH, which are rare, particularly susceptible to human-induced degradation, ecologically important, or are located in an environmentally stressed area” (NMFS 2010b). HAPCs do not qualify for additional protection beyond that provided for EFH in general; however, project impacts on HAPCs will be carefully considered during the consultation process.

The proposed project occurs within areas identified as EFH for fish species managed as part of three FMPs:

- Pacific Groundfish FMP – various rockfish, sole and sharks
- Pacific Salmon FMP – Chinook salmon
- Coastal Pelagic FMP – northern anchovy, Pacific sardine, mackerel, squid

8.1 Potential Effects of the Proposed Action on Essential Fish Habitat

The HAPCs described in the 2010 LTMS programmatic EFH consultation for maintenance dredging in San Francisco Bay (NMFS 2010b) as potentially affected by LTMS activities include San Francisco Bay and seagrass habitats. The proposed project falls within the LTMS area, but neither of these HAPCs occur within the proposed project footprint. In accordance with the habitat categorizations provided by NMFS (2010b), the proposed project dredging activities would disturb a total of 318 acres of soft bottom habitat (**Table 1**) which may be considered either sand or fine-grained habitat. Dredged sediment is to be placed at beneficial reuse wetland restoration sites, so no additional area of adverse impacts is anticipated from in-bay disposal. No wetland or eelgrass habitat would be affected. Sandy and some fine-grained benthic habitat, is expected to comprise most of the dredge area of Pinole Shoal Channel, which is considered to have reduced value as foraging habitat for fish due to reduced productivity and invertebrate species diversity, although it can be used for reproduction and rearing (NMFS 2010b).

Dredged sediment from the proposed project would be used for beneficial reuse, specifically wetland creation. The project proposes to utilize dredged material at Cullinan Ranch and Montezuma Wetlands, thereby creating approximately 160 acres of aquatic habitat that would benefit EFH. Cullinan Ranch is expected to accept 2.8 million cy to restore 290 acres of the 1,575-acre site to elevations suitable for marsh plain establishment. Additionally, the Cullinan Ranch project will provide food and nutrients for aquatic species in the adjacent Napa River Estuary and San Pablo Bay (USFWS 2010b). Once completed, Montezuma Wetlands is expected to restore 1,820 acres of tidal, seasonal, and managed wetlands. Approximately 17.5 million cubic yards of dredged material are needed to raise site elevations. As of August 2017, approximately 4 million cy of dredged material had been placed at Montezuma Wetlands, contributing to the restoration of over 350 acres of wetlands (https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/dredging.html).

Based on the above information for Cullinan Ranch and Montezuma Wetlands, 9000 to 11,429 cy of dredged sediment is required to create 1 acre of wetland habitat at the above locations. Using an

intermediate value of 10,000 cy per acre of habitat, the approximately 1.6 million cy of dredged sediment resulting from the proposed project is expected to create 160 acres of wetland habitat due to its beneficial reuse. This habitat would be accessible to species managed under FMPs.

In addition to disturbance of habitat through dredging and creation of habitat through beneficial reuse, the proposed action has the potential to cause a subset of the adverse impacts on EFH described by NMFS (2010b) for the LTMS program. These include:

- Removal of food organisms through entrainment or burial
- Increased suspended sediment and release of contaminants
- Noise

As stated above, the proposed action would remove approximately 1.6 million cy of sediment covering 318 acres from the project area. Consequently, benthic organisms which could serve as food especially for species managed under the Pacific Groundfish FMP would be removed from the channel during dredging and likely buried in the wetlands of Cullinan Ranch and Montezuma Wetlands where they will die. Benthic recolonization rates are expected to be months or years (see NMFS 2010b for a review).

Sediment proposed for dredging in the Pinole Shoal and Bulls Head Reach channels is anticipated to classify as clay, silt, and sand. The alternating layers of silty clay, clayey silt, sandy silt, silty sand, sand, and inter-bedded clay and sand are discontinuous and of varying thickness. Shells, wood debris (e.g., branches, twigs, and rootlets), and organic soils grading to peat also are expected to be encountered. In Pinole Shoal Channel, the content of fine-grained material is anticipated to range from 9 to 94 percent and clay fraction ranges from 5 to 50 percent. In the Bulls Head Reach Channel, the content of fine-grained material ranges from 1 to 97 percent, and clay ranges from 1 to 54 percent. Still, the majority of the sediment in the Pinole Shoal Channel is expected to be greater than 80 percent sand where benthic organisms would be relatively less abundant. Overall, the area of benthic habitat affected by the proposed project would be very small compared to the total size of San Pablo Bay and Suisun Bay which have surface areas of approximately 58,000 and 40,000 acres, respectively.

The adverse effects of suspended sediment, potential release of toxins, and noise are discussed extensively in section 5.3. Effects specifically on listed Pacific salmon are discussed in section 7.2.

Background turbidity in the estuary is naturally high, with total suspended solids (TSS) levels varying from 10 mg/L to more than 100 mg/L (Rich 2010). However, turbidity plumes generated by dredging activities typically have an increased suspended sediment concentration. Monitoring of turbidity plumes during clamshell dredging indicates that exceedances of the water quality turbidity standards occur periodically, especially in locations where sediment is very fine-grained. These effects would be temporary, and exposed fish would be expected to avoid the area if necessary. More sessile organisms such as benthic invertebrates would be unable to flee; food intake by filter feeders could be reduced if increased sediment is taken in instead.

Sampled sediment from the Pinole Shoal and Bulls Head Reach channels underwent physical, chemical, and bioaccumulation analyses, as well as studies to determine if the sediment is was suitable for wetland creation (see section 5.3.4). In all studies, sediment was sampled to a depth of 45 feet MLLW, plus 2 feet of overdepth, for a total sampled depth of 47 feet MLLW. Results were somewhat variable, but in general toxins were similar to control sites, and the survival of exposed invertebrates was affected in only a few

cases. Use of Pinole Shoal sediments for wetland creation would produce wetlands comparable to existing wetlands in the Bay area.

The proposed project is expected to produce peak SPLs of 124.0 dB measured 150 m distant from the clamshell dredge plant and 132 dB rms from removal of the small rock outcrop (which currently does not protrude above the bottom sediment), both of which are below the sound thresholds described by Fisheries Hydroacoustic Working Group (2008) and ICF Jones & Stokes and Illingworth and Rodkin, Inc. (2009). Therefore, the noise from the proposed project is not expected to adversely affect listed species greater than 150 m from dredge plant or rock outcrop. Effects on fish closer than 150 m are unclear, but likely would involve behavioral avoidance of the area.

8.1.1 Future Maintenance Dredging

On January 22, 2019, the USACE issued new guidance regarding compliance with EFH requirements of the MSFCMA for maintenance dredging projects. This guidance requires that new work projects (i.e., deepening) include analysis of future maintenance dredging such that future EFH consultation is not required, in the absence of substantially new information requiring a revised EFH consultation. Currently, all federal navigation channel maintenance dredging in San Francisco Bay, including the Pinole Shoal Channel and Bulls Head Reach, are covered under the LTMS programmatic EFH consultation and conservation recommendations (NMFS 2010b). The LTMS programmatic EFH consultation provides the following language allowing for future maintenance dredging to be included in the programmatic consultation following deepening”

"Program activities are described in detail below, with certain limitations and restrictions. Specifically, this programmatic consultation will not cover the following: (1) any new or previously unauthorized dredging...maintenance dredging of new or deepened areas following completion of initial work may be considered part of this consultation pending NMFS approval."

Based on this language, it is expected that future maintenance dredging will be included in the programmatic EFH consultation once the new work deepening is completed.

8.1.2 Conclusions and Determination of Effects

Pacific Groundfish EFH: *Adverse effect* under the Magnuson-Stevens Act “means any impact that reduces quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH” (50 CFR § 600.810). The proposed action is *likely to adversely affect EFH for Pacific Groundfish*. This would occur due to the removal of sediment and benthic organisms with a clamshell dredge, which is unavoidable. Although essentially all of the effects of the proposed project may be considered temporary, the recolonization of disturbed areas by benthic invertebrates is thought to require several months at a minimum, and may take years. Other effects such as the creation of noise or turbidity plumes would cease immediately or within minutes or hours of when active dredging stops, and may be avoided or minimized by fish (including prey fishes) exhibiting avoidance behavior.

The disturbance of 318 acres soft-bottom habitat and removal of sediment containing benthic invertebrates from dredging may be partially offset through the beneficial reuse of the dredged sediment, which is expected to be used to create 160 acres of wetland habitat and would increase food production in adjacent Bay waters.

Pacific Salmonid EFH: Potential effects to pacific salmonid EFH are expected to be similar to those discussed under the ESA impacts to listed salmonid habitat and critical habitat (Sections 7.2.5 and 7.3.1). As discussed in those sections, the proposed action would temporarily affect estuarine habitat and water quality during dredging. Additionally, salinity intrusion may slightly increase the salt content of water near the eastern portion of the salinity wedge; however, this is not likely to be perceptible to migrating and rearing salmonids transitioning between freshwater and saltwater. Therefore, the proposed action is *not likely to adversely affect Pacific Salmonid EFH*.

Coastal Pelagic EFH: Northern anchovy is one of the most abundant fishes in the San Francisco Bay and an important commercial fish and prey resource other commercial fisheries. During construction, the proposed action has the potential to temporarily increase noise and suspended sediment in the surrounding water column. However, these impacts would be localized and not permanently affect coastal pelagic EFH. Restoration of wetland habitat resulting from beneficial reuse of dredged material would ultimately benefit coastal pelagic EFH by improving the quality and quantity of food resources. Because of the localized and temporary impacts, it is expected that the proposed action is *not likely to adversely affect Coastal Pelagic EFH*.

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Appendix A. Species Lists

Appendix B. Summary of Sediment Sampling and Analysis

1.0 Introduction

Sediment sampling and analysis studies conducted during the project's early planning phases are described below. Studies conducted include:

- Chemical Evaluations of John F. Baldwin Ship Channel Ship Channel Sediment. September 1990. Prepared by Battelle/Marine Sciences.
- Ecological Evaluation of Proposed Dredged Material from the John F. Baldwin Ship Channel Ship Channel (Phase III – Biological Testing). October 1993. Prepared by Battelle/Marine Sciences.
- Ecological Evaluation of Proposed Dredged Material from Bulls Head Channel (Lower Suisun Bay). July 1994. Prepared by USACE Engineer Research and Development Center.
- *Evaluation of Wetland Creation with John F. Baldwin Ship Channel Sediment*. November 2000. Prepared by USACE Engineer Research and Development Center.

2.0 San Pablo Bay Sediments

Sediments were evaluated for proposed deepening along a 28-mile long portion of the John F. Baldwin Channel in 1990 (physical and chemical analyses), 1993 (full Tier III physical, chemical, toxicity, and bioaccumulation analyses), and 2000 (wetland creation analyses). The channels sampled included the West Richmond Channel, located downstream of the Pinole Shoal Channel; Pinole Shoal Channel; and Carquinez Strait. The study did not include Bulls Head Reach. The objectives of these studies was to identify and quantify sediment contamination in the channels, whether identified contamination would result in acute toxicity or bioaccumulation in organisms during dredging and aquatic dredged material placement, and whether the sediment was suitable for wetland creation. The results of the analysis were compared to similar analysis conducted with sediment from reference sites. The references sites used in this study include the Bay Farm site in the South Bay and a deep ocean site approximately 50 miles west of the Golden Gate.

Physical and chemical properties were analyzed for sediment grain size, total organic compounds, total volatile solids, oil and grease, total petroleum hydrocarbons, percentage of petroleum, polynuclear aromatic hydrocarbons, chlorinated pesticides and polychlorinated biphenyls, and ten metals (Battelle 1990, 1993). Full Tier III testing, including suspended-particulate-phase (SPP) toxicity test, solid-phase toxicity tests, and bioaccumulation tests, as well as grain and chemistry analyses (Battelle 1993). Suspended-particulate-phase (SPP) toxicity tests evaluates the effects of dissolved contaminants and contaminates associated with particles suspended in the water column during dredging and aquatic placement. Solid-phase toxicity tests are benthic toxicity and bioaccumulation tests that examine the effects of dredged sediment on sensitive benthic organism. The results are compared to similar tests conducted with sediment from a reference site and proposed dredged material placement sites.

2.1 Pinole Shoal Channel Sediments

During the 1990 sampling and analysis study, 37 sediment cores were collected from Pinole Shoal Channel sediment. Sediment collected in the samples represented only young bay mud. In general, sediment sampled showed little contamination. Sediment in the northeast portion of Pinole Shoal had elevated levels of aluminum, arsenic, and mercury that were not correlated to the concentration of total organic carbon or grain size. During the 1993 Tier III testing, 26 sediment cores were sampled to depths of 47 feet MLLW (45 feet MLLW plus 2 feet of overdepth). Four composite samples were generated from the 26 samples and used in the analyses. The first composite was from the western-most 16,000 feet of the channel and included three separate samples. The second composite was from the next approximate 15,000 feet and included ten separate samples. The third composite was from the next 13,000 feet and contained five samples. The final composite was from the final 10,700 feet and included eight samples.

2.1.1 Pinole Shoal Channel Physical and Chemical Sediment Sampling and Analyses

The results of the physical and chemical analysis are summarized in Table 1 through Table 5, with the exception of chlorinated pesticides and polychlorinated biphenyls. Chlorinated pesticides and polychlorinated biphenyls were either undetected or below the method detection limits for all samples, and therefore, are not reported herein. In addition, results of butyltin analyses showed that tri-, di-, and monobutyltin were undetected in all but one sample. Tributyltin was detected at a level of 4.1 µg/kg at one station at the eastern most border of composite PS-3.

Table 1: Conventional Parameters Measured in Pinole Shoal Channel Sediments									
Composite	Gravel (> 2000 µm)	Sand (62.5- 2000 µm)	Silt (3.9 – 63 µm)	Clay (<3.9 µm)	TOC (% dry weight)	TVS (% dry weight)	Oil and Grease (mg/kg)	TPH (mg/kg)	Petroleum Fraction (%)
PS-1	1	24	42	33	0.90	5.50	24.1	20.4	85
PS-2	0	53	26	21	0.62	4.18	37.0	29.3	79
PS-3	0	85	7	8	0.20	2.26	16.7	13.5	<81
PS-4	0	42	29	29	0.48	5.58	43.2	24.0	56
<i>In-bay RS</i>	0	4	54	42	1.10	7.60	155.8	119.4	77
<i>Ocean RS</i>	0	50	29	21	0.75	3.59	29.2	17.2	<59
TOC: Total organic compounds									
TVS: Total volatile solids									
TPH: Total petroleum hydrocarbons									

Table 2 summarizes the sediment composition, as well as the total organic compounds, total volatile solids, and petroleum products found in the sediment composites. Pinole Shoal Channel exhibited a trend of predominately fine-grained sediments (>70 percent silt and clay) at the west end of the channel, with sediment decreasing in fine grain through section PS-3, where sediment were predominately coarse-grained (>70 percent sand and gravel). Continuing east, the sediment composition increased to between 25 and 90 percent fine-grained. Total organic compounds were generally high in the western portion of Pinole Shoal, and decreased moving eastward. Total volatile solids was ranged from 25 percent dry weight in PS-1 to 85 percent in PS-3. Total organic compounds and total volatile solids were well correlated with sediment size; the fine-grained sediment contained higher total organic compounds. Oil and grease and

total petroleum hydrocarbons were generally low throughout the channel, except near the eastern edge of PS-4, where two samples within the composite both exceed 100 mg/kg oil and grease.

Ten metals were measured in the Pinole Shoal Channel; Table 2 summarizes the concentration of metals measured. All composite samples exceeded the ocean reference site for arsenic and two (PS-2 and PS-3) exceeded the in-bay reference site. PS-2, PS-3, and PS-4 all exceeded the in-bay and ocean reference sites for chromium by approximately 20 to 35 mg/kg. All composites exceeded the ocean reference site for copper; however, the in-bay site was not exceeded. PS-2 and PS-4 exceeded the ocean reference site for mercury. All composites exceeded the ocean reference site for nickel; however, only PS-1 exceeded the in-bay reference site. All composites exceeded the ocean reference site for lead. PS-4 exceeded the in-bay reference site for selenium. Finally, PS-1, PS-2, and PS-4 exceeded the reference site for Zinc.

Table 2: Concentrations of Metals Measured in Pinole Shoal Composite Samples (mg/kg dry weight)										
Composite	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
PS-1	0.11	7.57	0.20	184.0	37.8	0.050	109.7	12.4	0.16	93.9
PS-2	0.15	10.43	0.21	227.0	39.8	0.089	99.5	11.7	0.37	97.6
PS-3	0.05	7.97	0.12	235.0	23.1	0.032	90.0	11.3	0.16	73.0
PS-4	0.11	15.00	0.24	216.0	48.0	0.270	93.0	20.4	0.46	89.6
<i>In-bay RS</i>	<i>0.52</i>	<i>10.40</i>	<i>0.21</i>	<i>198.0</i>	<i>54.5</i>	<i>0.345</i>	<i>104.9</i>	<i>34.1</i>	<i>0.37</i>	<i>142</i>
<i>Ocean RS</i>	<i>0.42</i>	<i>3.86</i>	<i>0.52</i>	<i>198.0</i>	<i>21.9</i>	<i>0.055</i>	<i>67.4</i>	<i>8.8</i>	<i>1.23</i>	<i>76.1</i>
Ag: Silver Cu: Copper Se: Selenium As: Arsenic Hg: Mercury Zn: Zinc Cd: Cadmium Ni: Nickel RS: reference site Cr: Chromium Pb: Lead										

Table 3 provides the range of measured PAH for the samples that comprise each composite, as well as the concentration measured in each composite. In the Pinole Shoal Channel, composites PS-1 and PS-3 were low in PAH; however, PS-2 samples ranged between 100 and 300 µg/kg. Composite PS-4 had low PAH; with higher concentrations in the eastern most edge of the channel, near Carquinez Strait. PS-2 and PS-4 composites exceeded the concentrations of the ocean reference site for low molecular PAH and PS-2, PS-3, and PS-4 composites exceeded the ocean reference site for high molecular PAH and total PAH. The in-bay site concentrations were not exceeded.

Table 3: Polynuclear Aromatic Hydrocarbons in Pinole Shoal Channel Sediments (µg/kg dry weight)							
Composite	Low Molecular PAH		High Molecular PAH		Total PAH		Percent High Molecular PAH
	Range	Composite	Range	Composite	Range	Composite	Composite
PS-1	18.0 – 20.5	14.6	28.2 – 38.5	28.5	46 – 59	41	64.4
PS-2	14.7 – 36.6	17.0	64.5 – 247.5	159.1	79 – 337	176	90.4
PS-3	2.5 – 12.1	6.8	8.7 – 74.7	100.6	11 – 87	107	93.7
PS-4	4.5 – 36.4	16.3	29.6 – 296.5	106.7	30 – 338	123	86.8

Table 3: Polynuclear Aromatic Hydrocarbons in Pinole Shoal Channel Sediments (µg/kg dry weight)							
Composite	Low Molecular PAH		High Molecular PAH		Total PAH		Percent High Molecular PAH
	Range	Composite	Range	Composite	Range	Composite	Composite
<i>In-bay RS</i>	--	255.7	--	2,345.7	--	2,610	90.2
<i>Ocean RS</i>	--	14.9	--	44.9	--	60	75.1

2.1.2 Pinole Shoal Channel Sediment Toxicity and Bioaccumulation

Suspended-particulate-phase toxicity and solid-phase toxicity tests were conducted on all four composite samples. Three separate tests were conducted using three different species: the mysid, *Holmesimysis sculpta*; sanddab, *Citharichthys stigmaeus*; and echinoderm, *Dendraster excentricus*. In addition, three concentrations of SPP were used, 10, 50, and 100 percent, along with a seawater control, 0 percent SPP.

Estimates of toxicity in the water column were evaluated by exposing three sensitive marine species (*H. sculpta*, *C. stigmaeus*, and *D. excentricus*) to three concentrations of SPP and a dilution seawater control. Results showed that there was no acute toxicity to *H. sculpta* and *C. stigmaeus*; but, that 100 percent of the four composites was acutely toxic to *D. excentricus* larvae. Despite those instances of significant toxicity, no LC50s could be calculated because mortality did not exceed 50 percent of the population relative to control. In addition, some sediment composites from the Pinole Shoal Channel did result in significant increased abnormal growth and development of the *D. excentricus*. The results of each test are described below and data is summarized in Table 4.

The 96-hour mysid (*H. sculpta*) test showed no reduction in survival when exposed to various concentrations of SPP prepared from sediment composites. In fact, some survival was higher with SPP, compared to controls. The 96-hour sanddab (*C. stigmaeus*) test showed survival rates ranging from 92.5 to 100 percent and, in PS-1, SPP had no effect on survival at any concentration. For both *H. sculpta* and *C. stigmaeus*, LC50 concentrations (percent SPP expected to cause 50 percent reduction in survival) were determined to be greater than 100 percent SPP.

Table 4: Results of the Suspended-Particulate Phase Test for Pinole Shoal Composite Sediments

Composite	Concentration (percent SPP)	96-hour <i>H. Sculpita</i>		96-hour <i>C. stigmaeus</i>		72-hour <i>D. excentricus</i>			
		Mysid Survival		Sanddab Survival		Embryo Development		Embryo Survival	
		Mean Percent Surviving (10 mysids)	96-hour LC50 (percent SPP)	Mean Percent Surviving (10 sanddabs)	96-hour LC50 (percent SPP)	Proportion Normal Development (252 embryos)	EC50 (percent SPP)	Proportion Survival	LC50 (percent SPP)
PS-1	0 (control)	95.0	>100	100.0	>100	0.84	22.5	0.88	>100
	10	77.5		100.0		0.85		0.88	
	50	92.5		100.0		0.00		0.96	
	100	95.0		100.0		0.00		0.49	
PS-2	0 (control)	92.5	>100	100.0	>100	0.84	29.0	0.88	>100
	10	92.5		97.5		0.84		0.87	
	50	97.5		100.0		0.19		0.89	
	100	95.0		100.0		0.00		0.50	
PS-3	0 (control)	82.5	>100	97.5	>100	0.89	>100	0.92	>100
	10	95.0		97.5		0.88		0.91	
	50	97.5		100.0		0.85		0.91	
	100	95.0		97.5		0.56		0.80	
PS-4	0 (control)	87.5	>100	100.0	>100	0.88	71.6	0.90	>100
	10	97.5		100.0		0.89		0.92	
	50	97.5		100.0		0.81		0.84	
	100	90.0		92.5		0.09		0.80	

The 72-hour SPP test with larval *Dendraster excentricus* indicated that embryo survival and development in 100 percent SPP treatment showed statistically different survival rates in PS-1, PS-2, and PS-3, compared to controls (0 percent SPP). However, LC50 could not be calculated, as there was never a 50 percent reduction in embryo survival. Therefore, the LC50s for all treatments were determined to be greater than 100 percent. The SPP treatments did affect normal embryo development more than embryo survival. The normal development endpoint is more indicative of the organisms that are likely to survive into adulthood; therefore, this metric is more useful for assessing environmental impacts. All 100 percent SPP treatments resulted in significant differences in normal development, relative to controls. PS-1, PS-2, and PS-4 all had more than a 50 percent reduction in normal development and the following median effective concentrations (EC50s), or concentrations effecting a 50 percent decrease in normal development relative to a control, were calculated: PS-1, 22.5 percent SPP; PS-2, 29.0 percent SPP; and PS-4, 71.6 percent SPP.

Ten-day tests of the acute toxicity of 11 solid-phase sediment treatments were conducted on the amphipod *Rhepoxynius abronius*. 28-day bioaccumulation toxicity of solid-phase treatments were conducted the polychaete *Nephtys caecoides* and the bentnose clam *Macoma nasuta*. The results of the solid-phase toxicity tests are summarized in Table 5. Mean survival for all tests were generally high. Statistical analysis of the 10-day *R. abronius* acute toxicity test indicate that no statistically significant differences in response and increase in mortality occurred between the four test composites and the ocean reference site. While statistical analysis of the 28-day bioaccumulation tests were not conducted; survival rates for each of the composite treatments are all greater than 90 percent, and close to the survival rates for both reference sites.

Table 5: 10-day and 28-day Solid-phase Test for Composite Sediments From Pinole Shoal Channel			
Composite	10-day <i>R. abronius</i> Mean Percent Survival (n = 20)	28-day <i>M. nasuta</i> Mean Percent Survival (n = 25)	28-day <i>N. caecoides</i> Mean Percent Survival (n = 40)
PS-1	82.0	90.0	95.0
PS-2	88.0	98.0	95.0
PS-3	96.0	93.0	95.0
PS-4	94.0	97.0	94.0
<i>In-bay RS</i>	92.0	96.0	94.0
<i>Ocean RS</i>	87.0	99.0	95.0

Contaminants of concern were measured in tissues of *M. nasuta* and *N. caecoides* after the 28-day solid-phase exposure tests in composite, reference, and control sediments. Contaminants measured include PAHs, chlorinated pesticides, PCBs, metals, and butyltins. Each category of contaminants is discussed below. *M. nasuta* and *N. caecoides* tissue contaminant concentrations were orders of magnitude below the Food and Drug Administration action limits after exposure to Pinole Shoal Channel sediments. However, although the majority of the contaminants were not bioaccumulated by either species, statistically significant elevations of several contaminants were detected, compared to the ocean reference site. The contaminants which showed a statistically significant higher concentration in tissue exposed to Pinole Shoal Channel composite samples are discussed.

Polynuclear Aromatic Hydrocarbons: Two PAHs showed statistically significant *M. nasuta* concentrations in composite sediments, compared to the ocean reference site, pyrene and fluoranthene, as discussed below. The magnitude and significance of elevated concentrations of both these contaminants was relatively low, with test treatment concentrations two to four times the ocean reference concentration. In general, the in-bay reference site had higher concentrations of sediment PAH levels.

- Pyrene in *M. nasuta*: tissue concentrations of pyrene were significantly greater in composite sediments from PS-2 (19.5 µg/kg), PS-3 (10.0 µg/kg), and PS-4 (24.2 µg/kg), compared to the ocean reference site (6.0 µg/kg).
- Pyrene in *N. caecoides*: tissue concentrations of pyrene were significantly greater in composite sediments from PS-2 (14.9 µg/kg) and PS-4 (16.2 µg/kg), compared to the ocean reference site (4.6 µg/kg).
- Fluoranthene in *M. nasuta*: tissue concentrations of fluoranthene were significantly greater in composite sediments from PS-2 (15.0 µg/kg) and PS-4 (23.4 µg/kg), compared to the ocean reference site (9.9 µg/kg).
- Fluoranthene in *N. caecoides*: tissue concentrations of fluoranthene were significantly greater in composite sediments from PS-4 (7.3 µg/kg), compared to the ocean reference site (4.4 µg/kg).

Chlorinated Pesticide and Polychlorinated Biphenyl: 4,4'-DDD was found to be significantly greater in *M. nasuta* and *N. caecoides* exposed to sediments from the Pinole Shoal Channel. Concentrations in *M. nasuta* was statistically greater in composites PS-2 (12.5 µg/kg), PS-3 (7.2 µg/kg), PS-4 (15.8 µg/kg); with mean concentrations 3 to 7 times higher than the ocean reference site (2.3 µg/kg) and in-bay reference site (4.8 µg/kg). However, the actual contaminant concentrations were very low. All were below the in-bay reference site.

Bioaccumulation of 4,4'-DDD in *N. caecoides* was found statistically significant for composites PS-2 (8.9 µg/kg) and PS-4 (10.0 µg/kg), compared to the ocean reference site (2.1 µg/kg) and in-bay reference site (3.1 µg/kg). Trans-chlordane was also statistically different for PS-1 (9.4 µg/kg), compared to the ocean reference site (6.2 µg/kg).

Metals: Lead in composite sediment PS-4 (3.39 µg/kg) was the only compound found at higher concentrations in *M. nasuta* tissue at statistically greater concentrations compared to the ocean reference site (1.18 µg/kg), and was also higher than the in-bay reference site (2.62 µg/kg). It appeared that the significance was due to only one sediment sample in the composite being elevated, at 10.0 µg/kg.

Butyltins: Tributyltin in composite sediment PS-3 (88.7 µg/kg), compared to the ocean reference site (11.4 µg/kg) and the in-bay reference site (13.6 µg/kg). *M. nasuta* exposed to composite PS-3 had consistently higher Tributyltin concentrations (79.1 to 108.8 µg/kg dry weight in individual replicates) than any of the other treatments, suggesting that any tributyltin in PS-3 sediment is readily bioavailable.

2.1.3 Pinole Shoal Channel Wetland Creation Suitability

In 2000, USACE Engineer Research and Development Center (ERDC) conducted sediment sampling and analyses to determine if sediments from the Pinole Shoal Channel would result in toxicity or contamination to wetland plants and animals. Laboratory tests included two coastal saltmarsh grasses, smooth cordgrass (*Spartina alterniflora*) and salt couch grass (*Sporobolus virginicus*), and three sediment

compositions. Three animals were used, including nassa mud snails (*Nassarius* spp.), annelids (*Nephtys* spp.), and ribbed mussels (*Modiolus*). Three local plant species were used California cordgrass (*Spartina foliosa*), Parish's pickleweed (*Salicornia subterminalis*), and chairmaker's bulrush (*Scirpus olvenyi*). A field survey of plants, animals and sediments from existing naturally occurring wetland around the San Francisco Bay area was conducted to provide a reference data base with which results of the Pinole Shoal Channel sediment testing could be compared.

In general, the study found that sediment in the Pinole Shoal Channel had concentrations of PAHs, butyltin, arsenic, cadmium, chromium, copper, mercury, nickel, lead, selenium, and zinc similar to those found naturally occurring in Bay Area wetlands. Plant bioassays indicated that leaf tissue concentrations of heavy metals were equal to or below those found naturally occurring in wetlands. However, data suggests a potential for migration of lead from plant tissues into food webs.

Wetland animal bioassays showed a mixed result when both plants and animals were grown in mesocosms with channel sediment. *Salicornia* grew well in sediments, whereas *S. foliosa* and *S. olvenyi* grew poorly. This could be because the plants were collected during the fall dormant stage for *S. foliosa* and *S. olvenyi*. The mud snails and mussels grew well and survived in the mesocosms; however, all annelids died, likely a result of a thick algae mat forming on sediment surfaces, which suffocated the annelids.

Overall, the wetland mesocosms tests indicated that creating wetlands with Pinole Shoal Channel sediments will produce plants or animals with tissue metal concentrations in the range of those found in existing San Francisco Bay area wetlands; PAH concentrations were negligible; PCBs and butyltins were not detected in mesocosms organisms. Use of Pinole Shoal sediments for wetland creation would produce wetlands comparable to existing wetlands in the Bay area.

With the most recent 2009 sediment testing data from -37 to -39 feet, Chromium concentrations range from 51 to 61. The threshold criteria for wetland placement at surface is 112 mg/kg. Therefore, the material would be suitable for cover or wetland placement at the beneficial reuse sites. Confirmatory testing will be completed prior to placement at the reuse sites.

3.0 Bulls Head Reach Sediments

Bulls Head Reach sediments were sampled and analyzed in 1994. Sediment from this reach was analyzed to determine if the sediment was suitable for placement at SF-DODS, in-bay disposal aquatic disposal sites, and for beneficial use. Core samples were taken from 38 location (28 within the channel, 8 outside of the channel, and 2 from reference sites) to depths of 47 feet MLLW (45 feet MLLW plus 2 feet of overdepth); in addition, 8 composite samples were used. Sediment analyses included physical, chemical, toxicity, and bioaccumulation tests. Reference sites included the SF-11 Alcatraz in-bay disposal site and Bay Farms in-bay site in the South Bay.

Similar to Pinole Shoal Channel, the depths proposed for dredging would only penetrate young bay mud. Bulls Head Reach sediments are characterized as mostly sandy, or as silt and clay with varying amounts of sand. Chemical analysis showed that the sediments were relatively uncontaminated. Organic compounds were present in low concentrations, including PAHs, butyltins, and 4'-DDD. Overall, the analysis indicates that the material is suitable for in-bay and ocean disposal, as well as beneficial use.

3.1 Bulls Head Reach Sediments Conventional Parameters and Metals

Conventional parameters measures include grain size, total organic compounds, total petroleum hydrocarbons, total volatile solids, and total and water soluble sulfides (Table 6). Sediment total organic compounds, total volatile solids, total petroleum hydrocarbons, and sulfides were well correlated with grain size; smaller grains tended to have higher concentrations of the afore-mentioned compounds.

Composite	Gravel (> 2000 µm)	Sand (62.5- 2000 µm)	Silt (3.9 – 63 µm)	Clay (<3.9 µm)	TOC (% dry weight)	TVS (% dry weight)	TPH (mg/kg)	Total Sulfide (mg/kg)	Water Soluble Sulfide (mg/kg)
BHR-A (upper)	1	97	0	2	0.17	01.40	12 U	1.41 U	0.16 U
BHC-A (lower)	0	46	31	23	0.76	3.18	22	1.18 U	0.20 U
BHC-B	0	21	48	31	2.02	3.97	20	1.96 U	0.20 U
TB-C	0	97	1	2	0.18	1.30	14	1.36 U	0.14 U
TB-D (upper)	0	80	12	8	0.29	1.95	13 U	1.50 U	0.18 U
TB-D (lower)	0	79	16	5	0.35	1.69	13 U	1.50 U	0.15 U
TB-E (upper)	0	87	9	4	0.11	1.82	14	1.46 U	0.17 U
TB-E (lower)	0	19	54	27	1.42	3.39	16	9.50	0.19 U
<i>Alcatraz RS</i>	<i>0</i>	<i>97</i>	<i>1</i>	<i>2</i>	<i>0.04</i>	<i>0.69</i>	<i>20</i>	<i>1.31 U</i>	<i>0.15 U</i>
<i>Bay Farm RS</i>	<i>0</i>	<i>7</i>	<i>39</i>	<i>54</i>	<i>1.28</i>	<i>2.11</i>	<i>54</i>	<i>91.9</i>	<i>0.39 U</i>
TOC: Total organic compounds TVS: Total volatile solids TPH: Total petroleum hydrocarbons U: Analyte undetected above given concentration.									

Ten metals were measured in the Bulls Head Reach sediment samples and reference samples (Table 7). Silver concentrations ranged from 0.024 to 0.059 mg/kg in sandy sediments and 0.048 to 0.132 mg/kg in finer-grained sediments. Concentrations in the silt/clay composites exceeded concentrations at the Alcatraz reference site; but not the Bay Farm site. Copper values ranged from 11.7 to 68.4 mg/kg, which is similar to concentrations found in Pinole Shoal Channel sediments. Copper was lower in sandy samples, compared to finer-grained concentrations; but, copper in all composite samples were higher than the Alcatraz reference site (11.0 mg/kg). Arsenic, cadmium, chromium, nickel, lead and zinc concentrations were similar to those of the Pinole Shoal Channel; however, in silt/clay samples, concentrations often exceeded both reference site samples, but not by more than a factor of two to three.

Mercury concentrations were generally low, except for in composite BHC-A lower, which included sampling sites closest to the Benicia-Martinez Bridge. Mercury was strongly associated with fine-grained sediments and mercury in the silt/clay composites generally exceeded the Alcatraz reference site by up

to two times. Selenium concentrations were similar to those of the Pinole Shoal Channels, and was also positively associated with silt/clay sediments.

Table 7: Concentration of Metals Measured in Bulls Head Reach Samples (mg/kg dry weight)										
Composite	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
BHR-A (upper)	0.035	7.6	0.084	258	17.0	0.031	83.3	12.1	0.10 U	74.1
BHC-A (lower)	0.079	11.0	0.167	204	46.3	0.138	106	11.9	0.18	91.1
BHC-B	0.099	10.1	0.171	171	64.3	0.051	122	12.3	0.24	102
TB-C	0.027	8.8	0.084 U	230	19.2	0.015	83.5	9.1	0.10 U	71.7
TB-D (upper)	0.045	7.3	0.086	304	23.7	0.021	94.9	7.8	0.18	74.2
TB-D (lower)	0.054	6.5	0.089	210	30.6	0.021	101	8.3	0.10 U	77.6
TB-E (upper)	0.042	6.2	0.093	334	29.4	0.018	106	7.3	0.10 U	76.6
TB-E (lower)	0.104	11.6	0.179	181	60.2	0.048	116	8.4	0.24	102
<i>Alcatraz RS</i>	<i>0.048</i>	<i>8.0</i>	<i>0.084 U</i>	<i>386</i>	<i>11.0</i>	<i>0.026</i>	<i>42.8</i>	<i>14.3</i>	<i>0.10 U</i>	<i>43.7</i>
<i>Bay Farm RS</i>	<i>0.423</i>	<i>10.8</i>	<i>0.146</i>	<i>164</i>	<i>56.0</i>	<i>0.368</i>	<i>103</i>	<i>34.1</i>	<i>0.29</i>	<i>146</i>
Ag: Silver Cu: Copper Se: Selenium As: Arsenic Hg: Mercury Zn: Zinc Cd: Cadmium Ni: Nickel RS: reference site Cr: Chromium Pb: Lead U: Analyte undetectable above given limit										

3.2 Bulls Head Reach Sediments Organic Compounds

Organic compounds measured in Bulls Head Reach Channel included polynuclear aromatic hydrocarbons, phthalates, chlorinated pesticides, polychlorinated biphenyls, and butyltins (Table 8). As shown, Bulls Head Reach sediments are relatively uncontaminated with organic pollutants. Phthalates were not detected in any of the sediment samples. Polynuclear aromatic hydrocarbon concentrations are very low, and in all cases, lower than both reference sites. The pesticide 4,4'-DDD was detected in a few Bulls Head Reach samples, but also in reference samples. Polychlorinated biphenyls were not detected in any Bulls Head Reach or reference samples.

Table 8: Polynuclear Aromatic Hydrocarbons, Pesticides, and Butyltins in Bulls Head Reach Sediments (µg/kg dry weight)										
Composite	Low Molecular PAH		High Molecular PAH		Total PAH		4,4-DDD	Tributyltin	Dibutyltin	Monobutyltin
	Range	Composite	Range	Composite	Range	Composite	Composite	Composite	Composite	Composite
BHR-A (upper)	20 – 167	20	27 – 275	27	47 – 442	47	0.13 U	0.25 U	0.41 U	0.43 U
BHC-A (lower)	4 – 93	26	6 – 400	79	10 – 493	105	0.14 U	0.25 U	0.41 U	0.43 U
BHC-B	4 – 93	18	6 – 21	12	11 – 58	30	0.16 U	0.25 U	1.96	1.88
TB-C	5 – 19	10	5 – 38	9	10 – 57	19	0.12 U	0.25 U	0.41 U	0.43 U
TB-D (upper)	6 – 12	5	8 – 11	6	16 – 20	11	0.13 U	0.25 U	0.41 U	0.43 U
TB-D (lower)	11	3	10	5	21	8	0.12 U	0.25 U	0.41 U	0.43 U
TB-E (upper)	6 – 8	1	6	3	12 – 14	4	0.12 U	0.25 U	0.41 U	0.43 U
TB-E (lower)	12 – 30	23	11 – 26	13	23 – 53	36	0.14 U	0.25 U	0.41 U	0.43 U
<i>Alcatraz RS</i>	--	<i>574</i>	--	<i>1039</i>	--	<i>1613</i>	<i>0.53</i>	<i>0.25 U</i>	<i>0.41 U</i>	<i>0.71</i>
<i>Bay Farm RS</i>	--	<i>217</i>	--	<i>1444</i>	--	<i>1661</i>	<i>1.63</i>	<i>3.63</i>	<i>11.5</i>	<i>3.00</i>
U: Analyte undetectable above given limit										

3.3 Bulls Head Reach Toxicity and Bioaccumulation

Solid phase sediment toxicity tests were conducted with eight Bulls Head Reach sediment composites, two reference sediment samples, and once control. The tests measured survival rates of two amphipods, *Rhepoxynius abronius* and *Echaustorius estuaries*, as well as the effective survival rate of *R. abronius* (Table 9). The effective survival of *R. abronius* was assessed by counting the number of survivors that were able to rebury in clean sediment. Three sediment composites had had relatively high preliminary porewater ammonia levels (BCH-A lower, 70 mg/l; BCH-B, 100 mg/l; and TB-E lower, 110 mg/l). These samples were aerated for 1 to 2 days and overlying water was replaced to reduce porewater ammonia to acceptable levels (<30 mg/l for *R. abronius*). *R. abronius* survival ranged from 81 to 97 percent for all test composites; with the exception of the low survival of TB-E lower. TB-E lower porewater ammonia was not manipulated. Both sediment composites TB-E lower and BHC-B had statistically significant reduced survival relative to the Alcatraz reference site; but, not by more than 20 percent.

The effective survival of *R. abronius* was used to assess the sublethal endpoint of the solid-phase test. Most individuals that survived exposure to Bulls Head Reach composite samples were able to rebury in clean sediment.

E. estuarius survival ranged from 74 to 98 percent, and was lower than 68 percent in the un-manipulated TB-E lower composite. In composites BHC-B and TB-E lower (both with reduced porewater ammonia), *E. estuaries* survival was statistically significant and more than 20 percent lower, compared to the Alcatraz reference site. This suggests that either this species is sensitive to something other than ammonia (e.g., grain size).

Table 9: 10-Day Solid Phase Test for Composite Sediment Samples from Bulls Head Reach

Composite	10-day <i>R. abronius</i> Mean ($\pm$ SD) Percent Survival (n = 20)	10-day <i>R. abronius</i> Mean ($\pm$ SD) Percent Effective Survival (n = 20)	10-day <i>E. estuarius</i> Mean ($\pm$ SD) Percent Survival (n = 20)
BHR-A (upper)	94 $\pm$ 5	94 $\pm$ 5	94 $\pm$ 4
BHC-A (lower) ^(a)	94 $\pm$ 4	94 $\pm$ 4	81 $\pm$ 34 / 96 $\pm$ 3 ^(f)
BHC-B ^(a)	81 $\pm$ 9 ^(b)	77 $\pm$ 12 ^(b)	74 $\pm$ 7 ^{(b) (c)}
TB-C	97 $\pm$ 4	97 $\pm$ 4	98 $\pm$ 3
TB-D (upper)	97 $\pm$ 3	92 $\pm$ 6	95 $\pm$ 4
TB-D (lower)	91 $\pm$ 5	88 $\pm$ 10	94 $\pm$ 5
TB-E (upper)	94 $\pm$ 4	77 $\pm$ 10	97 $\pm$ 4
TB-E (lower) ^(a)	83 $\pm$ 8 ^(b)	77 $\pm$ 10 ^(b)	77 $\pm$ 18 ^{(b) (c)}
TB-E (lower)	12 $\pm$ 8 ^{(b) (c) (d) (e)}	11 $\pm$ 8 ^{(b) (c) (d) (e)}	68 $\pm$ 9 ^{(b) (c)}
Alcatraz RS	96 $\pm$ 4	94 $\pm$ 9	98 $\pm$ 3
Bay Farm RS	85 $\pm$ 7	85 $\pm$ 12	74 $\pm$ 13
Control	98 $\pm$ 12	98 $\pm$ 4	99 $\pm$ 2

Table 9: 10-Day Solid Phase Test for Composite Sediment Samples from Bulls Head Reach			
Composite	10-day R. abronius Mean ($\pm$ SD) Percent Survival (n = 20)	10-day R. abronius Mean ($\pm$ SD) Percent Effective Survival (n = 20)	10-day E. estuarius Mean ($\pm$ SD) Percent Survival (n = 20)
Notes: (a) Samples were manipulated to reduce porewater ammonia before adding animals. (b) Survival significantly lower than lower than Alcatraz reference site. (c) Survival > 20 percent lower than Alcatraz reference site. (d) Survival significantly lower than Bay Farm reference site. (e) Survival > 20 percent lower than Bay Farm reference site.			

Forty-eight-hour suspended-particulate-phase tests were conducted with larvae of the bivalve *Mytilus galloprovincialis*. Larvae were exposed to five concentrations of ten treatments (eight composites, two reference); results are presented in Table 10. A statistically significant difference in survival between the 0 percent and 100 percent SPP was observed in composite TB-E lower. The LC50 for composite TB-E was estimated to be 85.3 percent SPP. All other treatments had LC50s greater than 100 percent SPP.

EC50s, which is considered a more sensitive indicator of water column toxicity, are based on the normal development of larvae. A statistically significant difference in mean normal development between the 0 and 100 percent SPP was calculated for six of the eight composite samples. The other four compositions (TB-C, BHC-A Upper, and the two reference sites) showed no significant difference in normal development between the 0 and 100 percent SPP, thus EC50s are considered > than 100 percent SPP. EC50s for the other six composites ranged between 18.8 and 22.4 percent SPP.

The level of response for both survival and normal development corresponded well with measured ammonia levels in the SPP treatments. The highest ammonia concentration (23.7 mg/l total ammonia) was measured in SPP from composite TB-E lower, the treatment to which larvae were the most sensitive. It is likely that the toxicity and reduced development was due to ammonia, rather than suspended sediment contaminants. Many advances were made regarding reducing ammonia input from sources in the San Francisco Bay area and tributaries. However, confirmatory sediment sampling and analyses during the pre-construction, engineering, and design phase will provide further investigation as to the source of toxicity.

Table 4: Results of the 48-Hour Suspended-Particulate-Phase Test for Bulls Head Reach Composite Samples

Composite	Concentration (percent SPP)	48-hour <i>M. Galloprovinciatis</i>		Normal Development <i>M. Galloprovinciatis</i>	
		Larval Survival		Embryo Development	
		Mean Percent Surviving	96-hour LC50 (percent SPP)	Proportion Normal Development	EC50 (percent SPP)
BHR-A (upper)	0 (control)	94	>100	0.91	22.5
	1	92		0.85	
	10	98		0.94	
	50	94		0.89	
	100	97		0.00	
BHC-A (lower)	0 (control)	100	>100	1.00	22.3
	1	98		0.97	
	10	100		1.00	
	50	90		0.00	
	100	84		0.00	
BHC-B	0 (control)	100	>100	1.00	22.4
	1	100		1.00	
	10	100		1.00	
	50	100		0.00	
	100	63		0.00	
TB-C	0 (control)	97	>100	0.96	>100
	1	94		0.93	
	10	98		0.97	
	50	99		0.98	
	100	100		1.00	
TB-D (upper)	0 (control)	96	>100	0.92	22.3
	1	99		0.96	
	10	94		0.90	
	50	97		0.03	
	100	96		0.00	
TB-D (lower)	0 (control)	97	>100	0.97	20.0
	1	98		0.97	
	10	93		0.92	
	50	94		0.00	
	100	86		0.00	
TB-E (upper)	0 (control)	98	>100	0.97	40.7
	1	98		0.98	
	10	100		0.99	
	50	91		0.50	
	100	85		0.00	

Table 4: Results of the 48-Hour Suspended-Particulate-Phase Test for Bulls Head Reach Composite Samples					
Composite	Concentration (percent SPP)	48-hour <i>M. Galloprovinciatis</i>		Normal Development <i>M. Galloprovinciatis</i>	
		Larval Survival		Embryo Development	
		Mean Percent Surviving	96-hour LC50 (percent SPP)	Proportion Normal Development	EC50 (percent SPP)
TB-E (lower)	0 (control)	99	>100	0.98	18.8
	1	98		0.97	
	10	97		0.89	
	50	92		0.00	
	100	37		0.00	
<i>Alcatraz RS</i>	0 (control)	99	>100	0.99	>100
	1	96		0.95	
	10	99		0.99	
	50	99		0.99	
	100	98		0.96	
<i>Bay Farm RS Control</i>	0 (control)	95	>100	0.92	>100
	1	98		0.96	
	10	93		0.88	
	50	94		0.88	
	100	97		0.95	

3.4 Bull's Head Reach Wetland Creation Suitability

The 2009 sampling at Suisun (Suisun Bay Channel_New York Slough SAR 2009 Jul.pdf) included some overdepth sampling at Bulls head Shoal (37 to 39 ft). The samples were not analyzed for total solids content of metals. Instead, they were tested for elutriate concentrations which are reported in ug/L (dissolved metals in solution) instead of mg/Kg for comparison with drinking water standards, leaching standards, and RWQCB standards to determine suitability for inwater placement and upland placement instead of wetland placement.

Based on the 2009 sampling results, it appears the material would be acceptable for inwater placement and upland placement. However, the 1990 upper samples in Suisun Bay showed chromium concentrations that exceeded 250 mg/Kg and hence the wetland placement criteria. This suggests that sediment from 38-40 feet may be suitable for cover material on the beneficial reuse placement sites, whereas sediment depths below that may only be suitable for foundation material. The Bulls Head Reach portion of the project would generate 0.28 acres of material, which could easily be accommodated as foundation material over the 160 total acres of wetlands created by this project. Confirmatory testing will occur prior to placement.

Appendix C: Special Status Species and Critical Habitat Included on the USFWS Official Species List (November 27, 2017)

Common Name	Scientific Name	Status	Designated Critical Habitat	Critical Habitat in the Action Area	Habitat Requirements	Effects Determination
Mammals						
Saltmarsh harvest mouse ^(a)	Reithrodontomys raveiventris	FE, SE	No	na	Endemic to salt and brackish marshes of the San Francisco Bay area. They predominately utilize areas of dense pickleweed stands; however, to a lesser extent, they are known to forage and find shelter in saltgrass and other vegetated areas found in salt and brackish marshes.	ESA consultation for upland beneficial use sites is already completed.
San Joaquin kit fox	Vulpes macrotis mutica	FE, ST	No	na	San Joaquin kit fox requires dens for shelter, protection, and reproduction. It prefers annual grasslands with scrub and shrub vegetation. Its current range southern and western San Joaquin Valley and foothills (USFWS 1998).	No effect. The proposed project is outside of kit fox range.
Southern sea otter ^(b)	Enhydra lutris nerensis	FT	No	na	The southern sea otter utilizes nearshore habitat ranging from San Mateo County to Santa Barbara County and San Nicolas Island, Ventura County (USFWS 2015).	No effect. The proposed project is outside of southern sea otter range.
Birds						
California clapper rail ^(a)	Rallus longirostris obsoletus	FE, SE	No	na	Prefers intertidal zones and sloughs of salt and brackish marshes dominated by pickleweed, Pacific cord grass, gumplant, saltgrass (<i>Distichlis spicata</i>), jaumea and adjacent upland refugia.	ESA consultation for upland beneficial use sites is already completed.

Appendix C: Special Status Species and Critical Habitat Included on the USFWS Official Species List (November 27, 2017)

Common Name	Scientific Name	Status	Designated Critical Habitat	Critical Habitat in the Action Area	Habitat Requirements	Effects Determination
California least tern ^(a)	<i>Sterna antillarum browni</i>	FE, SE	No	na	California least tern inhabit coastal areas from the San Francisco Bay area south to Baja, California. They nest on open beach free of vegetation and migrate south in the fall (USFWS 2006). In the Bay Area, the LTMS has developed work windows from the Berkeley Marina to south of the Highway Bridge; however, these areas are outside of the project area.	No effect. Habitat not present in the action area; therefore, individuals will not be present.
Marbled murrelet	<i>Brachyramphus marmoratus</i>	FT, SE	Yes	No	Marbled murrelet spend a majority of their lives foraging in near-shore marine environments. Breeding occurs in near-shore environments in large, old-growth forests with limited edge habitat and fragmentation, and close proximity to the marine environment (76 FR 61599).	No effect. Habitat not present in the action area; therefore, individuals will not be present.
Northern spotted owl	<i>Strix occidentalis caurina</i>	FT, ST	Yes	No	The northern spotted owl inhabits structurally complex older-growth forests, with large trees and snags for nesting. This species nests, roosts and forages in forested habitat with high canopy cover and multilayered understory with limited fragmentation (77 FR 71,885).	No effect. Habitat not present in the action area; therefore, individuals will not be present.
Short-tailed albatross	<i>Phoebastria albatrus</i>	FE	No	na	Albatross nesting occurs on flat or sloped coastal area, with sparse or full vegetation, on isolated windswept offshore islands. They utilize marine	No effect.

Appendix C: Special Status Species and Critical Habitat Included on the USFWS Official Species List (November 27, 2017)

Common Name	Scientific Name	Status	Designated Critical Habitat	Critical Habitat in the Action Area	Habitat Requirements	Effects Determination
					and coastal waters adjacent to nesting areas (65 FR 46,645) Vol. 65, No. 147 / Monday, July 31, 2000)	Habitat not present in the action area; therefore, individuals will not be present.
Western snowy plover	Charadrius alexandrius nivosus	FT	Yes	No	Western snowy plover breeds above the high tide line on flat, sandy substrates on coastal beaches, sand spits, dunes, beaches at creeks and river mouths adjacent to coastal beaches, and salt pans at lagoons and estuaries. Coastal populations can either be year-round or migrants, with migrants arriving in California as early as January, but typically nesting occurs between early March and mid-June. Migrating plovers typically migrate either north or south during the winter between June and October (USFWS 2007).	No effect. Habitat not present in the action area; therefore, individuals will not be present.
Western yellow-billed cuckoo	Coccyzus americanus	FT, SE	Proposed	No	Yellow-billed cuckoos are migratory birds that breed in large, relatively un-fragmented blocks of riparian woodland habitat, primarily consisting of cottonwoods and willows with dense understory. Nesting pairs typically require about 25 acres or more of riparian habitat. It is believed that the Sacramento Valley is the northern limit of this species breeding range (66 FR 38,611).	No effect. Suitable habitat not present in the action area.

Appendix C: Special Status Species and Critical Habitat Included on the USFWS Official Species List (November 27, 2017)

Common Name	Scientific Name	Status	Designated Critical Habitat	Critical Habitat in the Action Area	Habitat Requirements	Effects Determination
Reptiles						
Alameda whipsnake	Masticophis lateralis euryxanthus	FT, ST	Yes	No	Alameda whipsnake typically inhabit chaparral and coastal sage scrub communities. Rock outcrops, rock crevices and mammal burrows are important habitat features. Its current range includes the inner coast range of California, primarily in most of them in Contra Costa and Alameda counties.	No effect. Habitat not present in the action area; therefore, individuals will not be present.
Giant garter snake	Thamophis gigas	FT, ST	No	N/A	The giant garter snake is endemic to wetlands of the Sacramento-San Joaquin Valley. Specifically, they inhabit marshes, sloughs, ponds, small lakes, low gradient streams, and other waterways (e.g., drainage ditches, rice fields, agricultural canals; 58 FR 54053).	No effect. Habitat not present in the action area; therefore, individuals will not be present.
Green sea turtle	Chelonia mydas	FT	No	N/A	Habitat includes waters off the coast of California.	No effect. Habitat not present in the action area; therefore, individuals will not be present.
Amphibians						
California red-legged frog	Rana draytonii	FT	Yes	No	California red-legged frogs inhabit aquatic, riparian, and upland habitat for forage, shelter,	No effect.

Appendix C: Special Status Species and Critical Habitat Included on the USFWS Official Species List (November 27, 2017)

Common Name	Scientific Name	Status	Designated Critical Habitat	Critical Habitat in the Action Area	Habitat Requirements	Effects Determination
					cover, and non-dispersal movements (75 FR 12,816).	Habitat not present in the action area; therefore, individuals will not be present.
California tiger salamander	Ambystoma californiense	FT, CH, ST	Yes	No	They inhabit subterranean refugia, especially burrows of ground squirrels, and breed in shallow wetlands or ponds. Migrations between breeding grounds and upland habitats generally occur at night during periods of sustained rainfall. During breeding migrations, individuals can be found under rocks, logs, or other objects (69 FR 47,212).	No effect. Habitat not present in the action area; therefore, individuals will not be present.
Fishes						
Delta smelt	Hypomesus transpacificus	FT, SE	Yes	Yes	Inhabits estuarine and delta waters	Likely to adversely affect; see additional analysis in narrative below
Tidewater goby	Eucyclogobius newberryi	FE	Yes	No	This species is considered extirpated from San Francisco Bay.	No effect.
Longfin smelt	Spirinchus thaleichthys	FC, SE	No	N/A		Likely to adversely affect; see additional analysis in narrative below
Insects						

Appendix C: Special Status Species and Critical Habitat Included on the USFWS Official Species List (November 27, 2017)

Common Name	Scientific Name	Status	Designated Critical Habitat	Critical Habitat in the Action Area	Habitat Requirements	Effects Determination
Bay checkerspot butterfly	<i>Euphydryas editha bayensis</i>	FT	Yes	No	Habitat not present in the action area.	No effect.
Callippe silverspot butterfly	<i>Speyeria callippe</i>	FE	Proposed	No	Habitat not present in the action area.	No effect.
Delta green ground beetle	<i>Elaphurs viridis</i>	FT	Yes	No	Habitat not present in the action area.	No effect.
Lange's metalmark butterfly	<i>Apodemia mormo langei</i>	FE	Proposed	No	Habitat not present in the action area.	No effect.
Mission blue butterfly	<i>Icaricia icarioides missionensis</i>	FE	Proposed	No	Habitat not present in the action area.	No effect.
San Bruno elfin butterfly	<i>Callophrys mossii bayensis</i>	FE	Proposed	No	Habitat not present in the action area.	No effect.
Valley elderberry longhorn beetle	<i>Desmocerus californicus dimorphus</i>	FT	Yes	No	Valley elderberry longhorn beetle is associated with the valley elderberry (<i>Sambucus</i>) bush during its entire life cycle; the beetles feed on <i>Sambucus</i> leaves and use the plant stems that are	No effect. Habitat not present in the action area; therefore, individuals will not be present.

Appendix C: Special Status Species and Critical Habitat Included on the USFWS Official Species List (November 27, 2017)

Common Name	Scientific Name	Status	Designated Critical Habitat	Critical Habitat in the Action Area	Habitat Requirements	Effects Determination
					greater than or equal to one inch in diameter for larval development and pupation.	
Crustaceans						
California freshwater shrimp	<i>Syncaris pacifica</i>	FE, SE	No	N/A	Habitat not present in the action area.	No effect.
Conservancy fairy shrimp	<i>Branchinecta conservatio</i>	FE	Yes	No	Habitat not present in the action area.	No effect.
Vernal pool fairy shrimp	<i>Branchinecta lynchi</i>	FT	Yes	No	Habitat not present in the action area.	No effect.
Vernal pool tadpole shrimp	<i>Lepidurus packardii</i>	FE	Yes	No	Habitat not present in the action area.	No effect.
Plants						
Antioch Dunes evening-primrose	<i>Oenothera deltoides</i> ssp. <i>howellii</i>	FE	Yes	No	Habitat not present in the action area.	No effect.
Colusa grass	<i>Neostapfia colusana</i>	FT	Yes	No	Habitat not present in the action area.	No effect.

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Common Name	Scientific Name	Status	Designated Critical Habitat	Critical Habitat in the Action Area	Habitat Requirements	Effects Determination
Contra Costa Goldfields	<i>Lasthenia conjugens</i>	FE	Yes	No	Habitat not present in the action area.	No effect.
Contra Costa Wallflower	<i>Erysimum capitatum</i> var. <i>angustatum</i>	FE	Yes	No	Habitat not present in the action area.	No effect.
Franciscan Manzanita	<i>Arctostaphylos franciscana</i>	FE	Yes	No	Habitat not present in the action area.	No effect.
Keck's Checker-mallow	<i>Sidalcea keckii</i>	FE	Yes	No	Habitat not present in the action area.	No effect.
Marin Dwarf-flax	<i>Hesperolinon congestum</i>	FT	No	N/A	Habitat not present in the action area.	No effect.
Marsh Sandwort	<i>Arenaria paludicola</i>	FE	No	N/A	Habitat not present in the action area.	No effect.
Presidio Clarkia	<i>Clarkia franciscana</i>	FE	No	N/A	Habitat not present in the action area.	No effect.
Presidio Manzanita	<i>Arctostaphylos hookeri</i> var. <i>ravenii</i>	FE	No	N/A	Habitat not present in the action area.	No effect.

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Common Name	Scientific Name	Status	Designated Critical Habitat	Critical Habitat in the Action Area	Habitat Requirements	Effects Determination
San Francisco Lessingia	<i>Lessingia germanorum</i>	FE	No	N/A	Habitat not present in the action area.	No effect.
Showy Indian Clover	<i>Trifolium amoenum</i>	FE	No	N/A	Habitat not present in the action area.	No effect.
Soft Bird's-beak	<i>Cordylanthus mollis</i> ssp. <i>mollis</i>	FE	No	N/A	Habitat not present in the action area.	No effect.
Tiburon Jewelflower	<i>Streptanthus niger</i>	FE	No	N/A	Habitat not present in the action area.	No effect.
Tiburon Mariposa Lily	<i>Calochortus tiburonensis</i>	FT	No	N/A	Habitat not present in the action area.	No effect.
Tiburon Paintbrush	<i>Castilleja affinis</i> ssp. <i>neglecta</i>	FE	No	N/A	Habitat not present in the action area.	No effect.
White-rayed Pentachaeta	<i>Pentachaeta bellidiflora</i>	FE	No	N/A	Habitat not present in the action area.	No effect.

Appendix C: Special Status Species and Critical Habitat Included on the USFWS Official Species List (November 27, 2017)

Common Name	Scientific Name	Status	Designated Critical Habitat	Critical Habitat in the Action Area	Habitat Requirements	Effects Determination
FT: Federal threatened FE: Federal endangered FC: Federal candidate SE: State endangered ST: State threatened (a) Species may be present in the upland beneficial use sites. Placing dredged material at these sites may affect, and is likely to adversely affect these species, should individuals stray from protected areas into dredged material placement cells. However, the projects have already undergone ESA consultation and have biological opinions and incidental take statements. Therefore, this project does not analyze the potential impacts of placing material at the permitted upland beneficial sites. (b) This species is also protected under the Marine Mammal Protection Act.						



United States Department of the Interior



In Reply Refer to:
08-FBDT00-
2019-CPA-0002

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FEB 28 2019

Thomas Kendall
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Dear Sirs:

We have enclosed our draft Fish and Wildlife Coordination Act (FWCA) report on the U.S. Army Corps of Engineers' (Corps) proposed San Francisco Bay to Stockton Navigation Improvement Project. Please provide any comments or concurrence with this report, or otherwise indicate that you will have no comment, by April 30, 2019.

If you have questions on this draft report, please contact Steven Schoenberg of my staff at (916) 930-5672, or at Steven_Schoenberg@fws.gov.

Sincerely,


for Kaylee Allen
Field Supervisor

Enclosure

cc:
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Michael MacWilliams, Anchor QEA, San Francisco, California
Ryan Hernandez, Contra Costa County Water District, Martinez, California

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

DRAFT FISH AND WILDLIFE COORDINATION ACT REPORT FOR THE
SAN FRANCISCO BAY TO STOCKTON NAVIGATION IMPROVEMENT PROJECT

PREPARED BY:

Steven Schoenberg, Senior Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
Habitat Conservation Division
Bay Delta Fish and Wildlife Office
Sacramento, California

PREPARED FOR

U.S. Army Corps of Engineers
Wilmington District
Wilmington, North Carolina

February 2019

SUMMARY

The Corps of Engineer's preferred alternative for the San Francisco Bay to Stockton Navigation Improvement Project involves deepening the Pinole Shoal, Suisun Bay, and Bulls Head channels to -38 feet below Mean Lower Low Water (MLLW) to improve access by tankers to oil refineries, and conducting advance maintenance dredging in a sediment trap area of the Bulls Head channel to -42 feet MLLW. The 1.72 million cubic yards (mcy) of dredged material from project construction would be beneficially used for tidal habitat restoration at two permitted sites, Cullinan Ranch (1.45 mcy) and Montezuma Wetlands (0.28 mcy). Project construction would cause temporary impacts to about 429 acres of deep subtidal benthic habitat. Due to changes in circulation patterns associated with this increased channel depth, the project is predicted to result in an annual average eastward change in the position of the 2 practical salinity units isohaline near the bed, or X2, of 0.17 and 0.23 km during critical dry and wet years, respectively, for portions of the year in which $X2 > 64$ km. This could result in a modest reduction in the range of the low salinity zone considered important for production and concentration of food organisms that support native fishes, including the listed delta smelt. We conclude that this potential adverse effect on X2 is minimized, while the indirect beneficial effect of accelerating tidal wetland restoration is significant. Accordingly, we recommend the project proceed as designed.

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APPENDIX

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INTRODUCTION

This document represents the United States Fish and Wildlife Service's (Service) Fish and Wildlife Coordination Act (FWCA) report on the U.S. Army Corps of Engineer's (Corps) San Francisco Bay to Stockton Navigation Improvement Project (project). The project study area is within part of the San Francisco Bay to Stockton Ship Channel, also known as the J. F. Baldwin Ship Channel, which spans a distance of about 75 miles from outside the Golden Gate to the Port of Stockton. The ship channel is intended to allow the access and efficient transport of goods by deep draft vessels. It has been partially constructed in increments or phases from 1965 - 1986. Phase III of the project as it was originally designed has an authorized depth of 45 feet below MLLW, and would have included dredging in the West Richmond, Pinole Shoal, and Suisun Bay Channels, and associated maneuvering areas. Increasing the channel depth to this extent has previously raised concerns about salinity intrusion which may affect water quality and certain ecological processes in the estuary. The currently proposed project involves dredging to -38 feet MLLW as its Tentatively Selected Plan (TSP), with additional dredging of a sediment trap, and maximum beneficial re-use of dredged material for tidal restoration (Figure 1). This shallower depth limits the overall volume and spatial extent of dredging to portions of the Pinole Shoal and Bulls Head Reach, because the water of the West Richmond Channel is naturally at least this deep, and also reduces environmental concerns about salinity intrusion. The proposed work would still be sufficient to improve access and efficiency by tankers which service a number of oil refineries in the vicinity of the Carquinez Strait.



Figure 1. Study area and tentatively selected plan element locations for the San Francisco Bay to Stockton Navigation Improvement Project.

Previous coordination activities for this ship channel involved various FWCA reports or Planning Aid Letters on the prior designs of the project, dredging and dredged material disposal impacts, or updates to the project (1963-1986). For the last 20 years or so, dredged material

from channel or harbor projects has been increasingly used beneficially, often to accelerate habitat restoration by raising the elevation of subsided diked baylands and opening them to tidal action. A number of restoration sites that involved accepting dredged material were evaluated by the Service in the 1990s as a part of other Corps projects, such as the Oakland Harbor, Richmond Harbor, and J.F. Baldwin phase III ship channel projects, and more recently for the Corps' South San Francisco Bay Shoreline Study, Redwood City Harbor, and Central Basin CAP 107 Navigation Improvement projects. Our earlier FWCA reports on these projects often included some level of quantification of the benefits of such beneficial re-use for habitat restoration, such as with Habitat Evaluation Procedures accounting models, or the relationship between the volume dredged and the habitat restored. The most recent FWCA report on the channels that are part of the currently proposed project was our 1997 revised draft FWCA report on the phase III channels, in which the Corps examined needs for a ship channel and an alternative involving an oil pipeline and associated facilities for the pipeline (Service 1997). The most recent coordination activities for the project have included regular conference calls with the Corps to discuss information needs and progress on this report, and attendance at a workshop in December 2018 with other Federal agencies and local interests. Information used in the preparation of this report included preliminary project descriptions, bathymetry, draft sections of environmental documents, discussion with experts, and salinity modeling reports.

DREDGING ALTERNATIVES

The Corps has retained 2 alternatives for evaluation in addition to the no-action alternative: (1) deepening to -37 feet MLLW; and (2) deepening to -38 feet MLLW. Both action alternatives would include beneficial use of dredged material at existing permitted sites, and a sediment trap at the Bulls Head Reach. Under the no-action alternative, no deepening of any channels would occur.

The -37-foot MLLW alternative involves deepening the Pinole Shoal, Suisun Bay, and Bulls head channels to that depth. A portion of the Bulls Head Reach would be deepened to -41 feet MLLW as a sediment trap. Dimensions and disposal sites would be the same as the -38-foot MLLW alternative, described in detail below. Dredging would be done in an area of 200 acres (ac) and generate 0.86 million cubic yards (mcy) of dredged material, assuming allowances for 2 feet of overdepth are used.

The -38-foot MLLW alternative is the TSP and involves deepening the same channels to -38 feet MLLW, and the sediment trap area to -42 feet MLLW. Dredging would be done over a larger area of 429 ac, and generate 1.72 mcy of dredged material, assuming 2 feet of overdepth. Dredging would be accomplished with one or more mechanical clamshell dredges, except for a small rock obstruction in the Pinole Shoal - about 40 cubic yards - that will require a pneumatic jackhammer to remove. Some of the work in the Pinole Shoal Channel may be outside of the June 1 through November 30 work window for that reach to protect listed anadromous fish but would be in compliance with terms and conditions of the 2015 Long Term Management Strategy Biological Opinion. Work in the Bulls Head Reach would be within the August 1 through November 30 work window for that reach to avoid impacts to that reach. Dredged materials would be placed in scows and transported to two permitted wetland restoration sites, Cullinan Ranch and Montezuma Wetlands. The material dredged from Pinole Shoal Channel, about 1.44

mcy, would be placed at Cullinan Ranch and the 0.28 mcy dredged from the Bulls Head Reach would be placed at Montezuma Wetlands. It is expected the project would take from 8 months to 2 years to complete, depending on the number and size of scows used, and would commence in the year 2023. Annual maintenance dredging would continue at about a 20% increase in volume compared to existing conditions.

DREDGED MATERIAL PLACEMENT SITES

Cullinan Ranch: Cullinan Ranch is another tidal restoration project site on about 1,500 ac located on the north side of San Pablo Bay just west of the Napa River between State Highway 37 and Dutchman Slough. It is also a subsided former diked bayland intended to be restored to tidal marsh. It is within the San Pablo Bay National Wildlife Refuge and a restoration plan involving restoring it to tidal action which would have general tidal ecosystem benefits in a location that would specifically assist the recovery of the Salt Marsh Harvest Mouse and Ridgway's Rail. The restoration project is permitted and has a capacity to receive at least 3 mcy of dredged material on the easternmost 290 ac of the site, which have been isolated from the rest of the site and subdivided into 5 cells for placement of material when it is available. The current plan is to complete dredged material import before opening this area to tidal action. To date, about 0.86 mcy of material has been placed and filled 2 of the 5 cells. Both cover and non-cover quality sediment can be accepted at this site. Travel distances are 5-16 miles and 11-14 miles from the Pinole Shoal and Bulls Head Channels, respectively. Clamshell dredged material would be barged to a land-based offloader and then pumped onto the site.

Montezuma Wetlands: This site is a privately owned, permitted, and operational wetland restoration project site located on about 2,400 ac of moderately subsided, diked baylands at the eastern edge of Suisun Marsh. The location of this project is such that it would provide benefits to native fishes in the low salinity region of the delta, including longfin smelt and the federally-listed Delta smelt. Dredged material from various projects is transported and used here to raise elevations of the site so it can be opened up to tidal action to restore tidal marshlands, and the owner charges for receipt of this material. The site can accept both wetland cover ("non-foundation") and non-cover ("foundation") quality materials. All offloading and pump facilities are currently in place and fully operational, sufficient to accept full-sized barges (~10,000 cubic yard capacity). The site is divided into four phases, of which the first phase has been under construction since late 2003, is nearly filled, and is expected to be complete and breached in 2019. When complete, phase I will have received roughly 8 mcy of dredged material and restored about 600+ ac of all wetland habitat. Phase II, which could receive material from the proposed project, has an approximate capacity to receive about 4.5 mcy. When complete, phase II will restore about 400 ac of tidal wetland. The Montezuma Wetlands site is 24-34 and 14-17 miles, respectively, from the Pinole Shoal and Bulls Head Channels. Material would be transported by scow to an offloader, which would pump the material onto the site.

BIOLOGICAL RESOURCES

Dredging Locations (Pinole Shoal, Suisun Bay, and Bulls Head Channels): The shipping channels are within an expanse of relatively deep subtidal waters that are all subject to wind and tidal energy and vary somewhat in biological resources with location and hydrologic conditions.

The bottom is mostly sand, with some mud and cobble. Depths vary with location with a range of -30 to -50 feet MLLW. The surrounding lands include developed areas, uplands and hills, as well as some significant seasonal and tidal wetlands, most notably tidal marsh along the northern margin of San Pablo Bay including the National Wildlife Refuge there, and non-tidal and tidal marshes in Suisun Marsh (along Suisun Bay). These wetlands provide important habitat for wildlife, including resident marsh birds and mammals as well as migratory waterfowl and shorebirds.

The biological resources vary with habitat type and location. The dredging location in the Pinole Shoal Channel, in San Pablo Bay, is west and more saline, whereas the dredging location to the east in Suisun Bay and Bulls Head Channels, is less saline. The fish community in San Pablo Bay would include a number of saltwater game species like sturgeon, salmon, halibut and striped bass, as well as other fishes like Pacific herring, English sole, jacksmelt, topsmelt, and others. The brackish waters of Suisun Bay and farther to the east have increasing numbers of freshwater species like silversides, bass, sunfish, delta smelt, juvenile salmon, sturgeon, and bass, and longfin smelt. Invertebrate fauna include planktonic copepods, rotifers, and cladocerans, in the water column, and various worms, crustaceans, and molluscs within or near the benthic interface, appropriate to the local salinity.

At least a portion of the dredging to the east would occur in (or affect, via salinity intrusion due to the channel deepening) open waters with an increased concentration of phytoplankton and associated food organisms, known as the “entrapment zone” or “low salinity zone” (LSZ). The location of the LSZ is typically cited as the distance from the Golden Gate, in km, of the daily averaged near bottom 2 practical salinity unit (psu) isohaline, commonly known as “X2”, because it corresponds to the estuarine turbidity maximum and peak abundance of estuarine organisms (Jassby et al. 1995). The full aerial extent of the LSZ encompasses a region of 0.5-6 psu. This is a zone where fresh and salt waters meet, and particles are concentrated by estuarine circulation patterns that are sensitive to depth, topography, and wind mixing. This region has the most productivity and benefit to resources when X2 is positioned in the shallow waters at the upstream end of Suisun Bay. This productivity and the position of X2 are affected by net delta outflow, becoming less productive and less valuable to fishes when it is moved east into confined channels at times of low net outflow.

The Sacramento San Joaquin Delta through which the ship channel passes, including the LSZ and interconnected marshlands, is considered an extremely important area for natural resources. Not only does it support several rare, endemic species, such as the Federally-listed delta smelt and State-listed longfin smelt, but it is a migratory corridor and juvenile rearing area for important salmon, steelhead, sturgeon, and striped bass. The Delta is affected by water operations that regulate freshwater flows, and other factors such as non-native fish and invertebrate species, contaminants, sea-level rise, and other influences.

Cullinan Ranch: This site, located on the north shore of San Pablo Bay just west of the Napa River, is a former diked bayland, subsided about 6 feet, and until recently had been farmed for oats and hay for the last century. Sometime after it was acquired by the Service in 1991, the pumping used to keep it in this agricultural state ceased, and it became a complex of non-tidal seasonal and perennial wetlands with some open water and a small amount of upland. This type

of habitat mosaic is often used by wading birds. In the last few years there has been considerable disturbance of this site to develop the elements needed to open it up to tidal action. In 2015, most of the site was opened to tidal action, and it is now primarily open water. Post breach surveys show the site is used by many species of waterfowl during fall and spring migration periods, particularly dabbling and diving ducks (Washburn 2018). However, the 280 ac of the site reserved for dredged material placement remains as a combination fallow fields, which provide some residual seasonal and some perennial wetlands value (unfilled cells), together with the areas disturbed by material placement with low value (filled cells). This area has received about 860,000 cy of dredged material thus far, and has about 2 mcy capacity remaining. This capacity may be revised upwards to accelerate revegetation and allow for sea level rise.

Montezuma Wetlands: This site is diked and subsided up to 11 feet. It was formerly characterized as grazing land with some bare areas and wetlands in the form of ditches, saline basins, and seasonally flooded areas (Levine-Fricke 1995). Currently, phase I of the Montezuma Wetlands project is still in development and receiving dredged materials. The rest of the site not yet in development. Within these uplands, seasonally flooded areas probably receive some winter use by wading birds and waterfowl during periods of high precipitation and extreme tides. There is also pickleweed and saltgrass in some areas. Pre-breach surveys have been ongoing from 2000 to the present in accordance with a monitoring plan for the project as part of its permits, which is overseen and updated as necessary by a technical review team (Acta 2018). In phase I, there is considerable interim use during dredged material placement by shorebirds and ducks when ponded water is present, as well as by the listed California least tern. Salt marsh harvest mice have been regularly detected in the pickleweed areas of phases that have not yet been constructed. Vernal pool crustaceans, both listed and common, have been noted in vernal pools created as part of the project. Otherwise, wildlife use of the area would be by common upland species.

MITIGATION POLICY AND COVER TYPES

The Service's Mitigation Policy (Policy) (FR 46:15 January 23, 1981) provides general guidance in making recommendations to conserve fish and wildlife resources. Under the Policy, resources are assigned to one of four Resource Categories, with a mitigation goal consistent with the values provided to fish and wildlife and the rarity of that habitat (cover-type). A mitigation goal is assigned ranging from "no loss of existing habitat value" (Resource Category 1) for the most valuable kinds of habitat to "minimize loss of habitat value" (Resource Category 4) for the less valuable and most common kinds of habitat. Application of the Policy involves designating cover-types which may be affected and assigning evaluation species based on the sensitivity of those species to the project action, their role in the ecosystem, or association with Service-wide resource management issues such as conservation of anadromous fish and migratory birds. We then state the Resource Category, the rationale for that selection, and the corresponding mitigation goal.

For this project area, we have designated seven basic cover-types within the project area and adjacent areas affected by the project. Due to differences in water depth and/or salinity in tidal and non-tidal ponds, there may be several more specific habitats within these cover-types, as noted below.

Open water (bay): This cover type is considered those waters within San Francisco Bay which are permanently inundated, deeper than MLLW and usually more than 18 feet below MLLW. Areas affected by the project include the waters in the channels to be dredged, the region of the low salinity zone affected by this deepening, and the sites of any sediment offloading facilities that might be needed, depending on the disposal/placement option selected. Pelagic plankton, fish, and macroinvertebrates are produced in these waters, which are prey organisms for some seabirds and waterfowl. An appropriate evaluation species would be juvenile fishes. Such open waters are relatively abundant in the planning area and are not expected to be lost or significantly degraded by the proposed action, although there may be some temporary effects of dredging and a small increment of permanent effect on salinity. The planning goal varies with location. Waters west of the Bulls Head Shoal are more abundant, deeper, and of moderate value to the evaluation species; these waters are designated Resource Category 4, with a mitigation planning goal to minimize loss of habitat value. Waters east of the Bulls Head Shoal include shallower areas (i.e., less than 10 feet deep) which would not be dredged but could be affected by salinity. These waters encompass a critical rearing area for juvenile and native fishes; as such, they are designated Resource Category 2, with a goal of no net loss of in-kind habitat value.

Subtidal benthic (bay): This cover type includes permanently inundated, unvegetated bottom substrate deeper than MLLW, such as the channels to be dredged, and any new sediment offloading facilities constructed in deep waters. This cover type supports food organisms like shrimp, benthic fish, and other macroinvertebrates. Bottom dwelling fishes such as sturgeon, flatfishes such as juvenile halibut, and rays, would be appropriate evaluation species. Most such habitat affected by the proposed project is already regularly dredged, although there may be some slightly shallower subtidal benthic habitat on the margin of the channels that would be deepened, and the frequency and/or extent of dredging may slightly increase beyond current levels. With a depth range of -26 to -41 feet MLLW, the areas designated for dredging are deeper than the 10-foot criterion used to assess shallow water habitat effects for species like the delta smelt. This cover type is also relatively abundant. Due to this abundance, regular disturbance, depth, and medium value to the evaluation species, this benthos is designated Resource Category 4, with a mitigation planning goal to minimize loss of habitat value.

Non-tidal pond waters: This cover-type includes permanently inundated, unvegetated waters separated from tidal action, and is represented by any ponds within Montezuma Wetlands or Cullinan Ranch which could receive dredged material from the proposed project. These ponds vary in depth, circulation, and water chemistry depending on management. They support some species of saltwater or freshwater fish, and benthic or pelagic macroinvertebrates that can provide forage. They may be used by waterfowl, or other bird groups, depending on salinity. For the lower salinity ponds, we would select a duck such as the northern shoveler as an evaluation species. For higher salinities, the American avocet would be an appropriate evaluation species. Non-tidal ponds are moderately abundant and are used for foraging and roosting by the evaluation species. We designate these as Resource Category 3, with a mitigation goal of no net loss of habitat value while minimizing loss of in-kind habitat value.

Tidal emergent marsh: This cover-type includes areas which are vegetated, generally between Mean Higher High and Mean Low Water that are subject to unrestricted tidal inundation and

drained by slightly deeper, unvegetated channels. For this project, it includes areas which could become vegetated in the future through placement of dredged material and exposure to tidal action at Montezuma Wetlands or Cullinan Ranch, or vegetated margins of sloughs which may be affected locally by offloading facilities and pipes needed to transport dredged material. Species composition varies with salinity and elevation with respect to mean tide level. It provides habitat for mammals including the listed salt marsh harvest mouse, tidal marsh birds such as the listed Ridgway's Rail, macroinvertebrates, and juvenile fishes. Marshes also produce and export organic matter that support the food web throughout estuaries and bays. Evaluation species would be a marsh specialist like the marsh wren. The unvegetated tidal channel component of tidal marsh is considered to be an important breeding and nursery area for fishes, and foraging area for shorebirds. Most historical tidal marsh in the Bay area has been lost due to industrial salt production or coastal development and fill. Due to this regional scarcity, importance to the ecosystem, and very high value to the evaluation species, we designate tidal emergent marsh as Resource Category 2, with a goal of no net loss of in-kind habitat value.

Mudflat: Mudflats are unvegetated tidal areas between Mean Low Water and MLLW that are exposed during low tide. A limited amount of mudflat could be locally disturbed at least temporarily by construction and operation of an offloader and/or pipeline needed to deliver sediment to Cullinan Ranch. Depending on initial elevation and subsequent revegetation rate, some expanses of mudflat could form initially at either Cullinan Ranch or Montezuma Wetlands. Mudflats produce diatoms, worms, and shellfish, which provide forage for numerous shorebirds, gulls, terns, and larger wading birds. During higher tide stages, fish enter the mudflats and forage. Shorebird species which specialize on exposed mud such as the western sandpiper would be an appropriate evaluation species. Although there has been some loss of mudflat due to development and fill, it remains moderately abundant in the Bay. Due to this abundance and high importance to the evaluation species, mudflat is designated Resource Category 2, with a goal of no net loss of in-kind habitat value.

Seasonal Wetland: Seasonal wetlands include low areas of Cullinan Ranch or Montezuma Wetlands that regularly pond during the winter. The more open wetlands can support vernal pool crustaceans, while the vegetated areas include some pickleweed and saltgrass known to support the listed salt marsh harvest mouse. An evaluation species would be a marsh specialist like the marsh wren. This particular cover-type is largely a consequence of historical diking, and is of low-to-moderate abundance and value to the evaluation species. Restoration actions would result in eventual replacement with tidal emergent marsh that is considered of greater value. Due to the moderate abundance and importance, relative to the restored cover-types, seasonal wetland is designated Resource Category 2, with a goal of no net loss of in-kind habitat value.

Upland: Upland in the project area occurs mostly as non-native annual grassland habitat on dike slopes surrounding several placement sites (Montezuma Wetlands, Cullinan Ranch). Limited portions could be temporarily affected by construction of offloading facilities or pipelines needed to deliver dredged material. Upland supports common small mammals and passerine birds, many of which are non-native. A native species like the California vole would be an appropriate evaluation species. A modest area of upland adjacent to tidal emergent marsh does have value as roosting habitat for birds during high tides, and as refugium for the listed Ridgway's rail and salt marsh harvest mouse during tidal flood events. Considering both the regional abundance as well

as the importance of preserving some uplands near tidal habitats, we designate upland as Resource Category 4, with a mitigation goal to minimize loss of habitat value.

FUTURE WITHOUT THE PROJECT

Without the Project and with shipping channel depths remaining at -35 feet MLLW, petroleum product shipping volume would increase but would be shipped on an increased number of smaller draft vessels. Maintenance dredging would continue at about the same frequency and amounts as in the past. There could be a need for emergency dredging in the Bulls Head reach due to rapid shoaling in some locations. The dredging would result in temporary, localized impacts on the water column during dredge operations manifested by increased turbidity and some loss of benthic organisms within the removed materials, but fish would likely be displaced and not suffer increased mortality.

The placement sites at Cullinan Ranch and Montezuma Wetlands would continue to receive dredged materials when available from projects other than the proposed project.

The distribution and location of the low salinity zone and position of X2 would be variable and predominantly affected by water year type and operations that either release freshwater to or export it from the Delta.

FUTURE WITH THE PROJECT

With the Project and channel depths deepened to -38 feet MLLW, petroleum product shipping volume would also increase but would utilize a reduced number of trips by deeper draft vessels, and with fewer tidal restrictions. Maintenance dredging would continue at about the same frequency, but with a modest increase in the volume of material, and with less of a need for emergency dredging in the Bulls Head reach due to the sediment trap. The dredging activity would cause a somewhat more continuous localized disturbance of the benthic biotic community in the immediate vicinity of the dredge than just maintenance dredging alone. This could result in a temporary reduction in abundance of benthic organisms on the order of several months more or less. The effects on fish would likely be limited to displacement during operations although there may be some adverse effect on fish exposed to either turbidity plumes in the immediate vicinity of the dredge, or sound from the pneumatic jackhammer. Based on bathymetry, only deeper bay waters and benthos would be directly affected by the dredging, although some shallow waters could be indirectly affected by salinity changes related to the deepened channel.

Cullinan Ranch: Placing the proposed 1.44 mcy volume of dredged material here would be roughly sufficient to complete the needs for restoration of this site. This would modestly accelerate completion of the site in terms of dredged material needs by one or more seasons, based on the current rate of receipt of dredged material (860,000 cy since permitting in 2012). This site is located and designed to specifically benefit the listed salt marsh harvest mouse in the near term. Revegetation would likely begin immediately after breaching, and 5-6 seasons of tidal action is expected to provide the veneer of natural sediment needed to optimize high marsh establishment. About 90% of the site is designed for high marsh that would benefit the listed

mouse and Ridgway's rail as well as other high marsh wildlife species, with the other 10% of the area as channels and low marsh providing values to fish and fish-eating wildlife. The current, upland and seasonal wetland habitat would be replaced by tidal marsh and channels. Wading birds may be displaced, however, the current value of the site is likely to be limited owing to recent earthwork in preparation of receipt of dredged material from other projects. Any displaced wading birds would likely relocate to nearby habitat just west of this location.

Montezuma Wetlands: Placement of the proposed 0.28 mcy volume of dredged material here would incrementally contribute to the 4.5 mcy total needed to fill phase II of this project, but would only nominally accelerate the rate of completion of this phase. This restoration would have relatively broad benefits, including to marsh wildlife such as salt marsh harvest mice, and native fish including delta smelt.

Water Quality: For the purposes of this report, we have limited our discussion to those conditions when X2 is greater than 64 kilometers east of the Golden Gate when there is a requirement for freshwater inflow to regulate its position. The effect of the project on X2 is estimated by Corps-provided predictions of a numerical model under representative conditions for a critical dry water year (2014) and a wet water year (2011) (MacWilliams 2018). This model predicts that, with the TSP, the position of X2 would be moved east 0.17 km on average during a critical dry year, with $X2 > 64$ from January to mid-December, and would be moved 0.23 km east during a wet water year, with $X2 > 64$ from late July through December. The numerical model predicts somewhat larger changes in X2 due to the project at other times of the modeled wet year of up to about 0.9 km when X2 is much farther west (40 km), but this is when the salinity gradient is pushed west into San Pablo Bay, and the Pinole Shoal Channel is stratified.

Changes in water quality due to the channel deepening that could adversely affect fisheries would generally be due to the eastward shift in X2 during the driest water years like the modeled 2014 year. The X2 range for the 2014 modeled year is roughly 70-90 km. The amount and quality of the LSZ change as X2 is shifted to the east, with reduced LSZ surface area and greater depth, together with reduced access by fish to optimum food/turbidity conditions, disconnection of the LSZ to adjacent marshes and sloughs, and greater exposure of small fish to predation in the deeper channels. This is a gross relationship more apparent for X2 changes on the order of several kilometers or more than for the small X2 change associated with deepening of the ship channel. Nevertheless, it is reasonable to conclude that the eastward shift due to the ship channel deepening could result in a modest increment of loss of habitat quantity and quality (*see Discussion, below*).

DISCUSSION

For the purposes of this report, we assume only the no-project and Corps-preferred TSP deepening alternatives are under consideration. Deepening will result in reduced shipping traffic because refineries can use larger ships with less of a need for lightering. The improved safety from the deepened channel, and the fewer ships, will lessen the risk of potential oil spills and consequent effects on fish and wildlife resources. The extent of dredging disturbance of benthic habitat needed to deepen the channel to 38 feet is a relatively small 429 ac. This will occur over

one season, mostly in previously-disturbed portions of the channel. Benthic fauna will be temporarily reduced where dredging is recent, but is expected to recover in a matter of months. Placement of the dredged material from the project at two permitted restoration sites, Cullinan Ranch and Montezuma Wetlands, will contribute to meeting the habitat benefit goals of these sites. Prior testing done in the 1990s showed the material to be predominantly sandy and meeting all or nearly all State criteria for use as cover material in wetland restoration¹. The quantity of benefit can be expressed in several ways - the benefit associated with the dredged material volume from the project as a fraction of the total volume needed for restoration, or the benefit associated with the acceleration of the restoration.

The dredged material volume from the proposed project is typically calculated from the target depth plus 2 feet of overdepth, which in this case is about 1.72 mcy. This estimate is unlikely to be achieved. The actual volume dredged will probably be the sum of the authorized depth, to 38 feet MLLW, plus a majority of the paid overdepth (38-39 feet MLLW), and a fraction of the unpaid overdepth (39-40 feet MLLW) (Appendix A, termed “likely” dredged volume). As proposed (Pinole Shoal material to Cullinan; Bulls Head and sediment trap material to Montezuma), we estimate the restored tidal areas attributable to this likely volume to be 96.1 ac and 2.8 ac at Cullinan Ranch and Montezuma Wetlands, respectively. If the full volume including all overdepth (1.72 mcy, termed “high” dredged volume in Appendix A) is dredged and placed as proposed, we estimate the restored tidal areas attributable to this volume to be 136.4 ac and 26.4 ac at Cullinan Ranch and Montezuma Wetlands, respectively.

The availability of the proposed project sediments is expected to accelerate completion of Cullinan and Montezuma Wetlands phase II, which will result in greater average habitat value over the period of analysis. Over an assumed 52 year life of the project, we roughly estimate the effect of accelerated completion to be two years, and an increase in value of about 7 Average Annualized Habitat Units (AAHUs) at Cullinan Ranch (Appendix A). The likely volume intended for disposal at Montezuma Wetlands is relatively small, about 0.03 mcy, so there would be little such accelerating effect there as the project is currently proposed. If for some reason Cullinan Ranch cannot accept the material due to capacity or other reasons at the time of construction, and Montezuma Wetlands were used instead, we estimate the effect of accelerating restoration by putting all of the material at Montezuma to be about 18 AAHUs.

The eastward shift in the salinity distribution as a result of the project could have an adverse effect on the productivity of forage organisms used by native fishes in the Delta, but this effect is believed to be minor. The Corps contracted with regional consultant experts to develop an estimate of this shift using a 3-dimensional numerical model (McWilliams 2018). The 0.17-0.23 km change in X2 due to the project channel deepening which is predicted by the numerical model is a consistent increase for much of the year but is a relatively small change compared to the seasonal fluctuation in X2 of >20 km. Also, this change in X2 assumes all of the material is actually dredged (i.e., to -38 feet MLLW plus 2 feet overdepth). The actual amount of material dredged will likely be less, so the effect will also be reduced. Lastly, creation of the sediment trap will reduce the need for near term emergency dredging in the Bulls Head Reach, thereby reducing the frequency of benthic disturbance in that area.

¹ Some composites showed slight exceedence of wetland criteria for Chromium, which is naturally occurring.

A rough worst case estimate of the effect of the salinity distribution on habitat can be developed from average changes in LSZ as a function of X2. The most rapid changes for X2>64 occur in the X2 region of 74-84 km (e.g., Figure 12 in Herbold and Vendlinski 2012; Figure 12 in MacWilliams et al. 2015). In these cited analyses, the LSZ parameter is restricted to the 1-2 psu region, probably because it is central to the range of the LSZ and represents the highest value habitat. Within this region, LSZ area declines from about 100 to 65 km² (~25,000 to 16,000 ac), or about 9,000 ac over a 10 km distance. A shift in X2 due to the ship channel of 0.17 km is less than 2% of this distance; if it occurred while X2 is within the 74-84 km region, we calculate that it would cause a LSZ area reduction of roughly 153 ac. During many other year types, and portions of critical dry years, X2 would not be within the 74-84 km region, and LSZ differences would be much less. This worst case scenario of habitat reduction appears modest, comparing favorably to the 162.8 ac habitat increase in the form of restored tidal area attributable to placement of the full volume of dredged material at Cullinan Ranch and Montezuma Wetlands.

Although these placement sites are not the same kind of habitat as that which is impacted, Policy exception to the “no net loss of in-kind habitat value” planning goal for Resource Category 2 is permissible when (FR 46 (15) 7658): “(1) different habitats and species available for replacement are determined to be of greater value than those lost, or (2) in-kind replacement is not physically or biologically attainable in the ecoregion section.” In this instance, we believe that the value of the habitat to be created in the proposed placement sites (Cullinan and Montezuma) is of greater value than the LSZ loss. It is difficult to precisely quantify LSZ effects beyond a coarse estimate. Therefore, this finding is based on our best judgement of a comparison of the gains and losses, the range of species affected, and information on the likelihood of benefit. In its ranking of 40 sites based on a variety of likely benefits Corps ranked Montezuma #1 and Cullinan #10, with Montezuma highest based on the benefits to listed species, particularly fishes, in the entrapment zone (Corps 2011). Cullinan will likely have the most benefits to listed marsh wildlife species not specifically recognized in Corps (2011). Further benefits are expected from the production and export of vascular plant and attached algae from restored marsh to bay waters, which we expect to enhance fishery resources.

Placement of material at Cullinan Ranch is currently limited to smaller draft scows that can navigate Dutchman Slough. Larger capacity scows (or more scows and dredges) could be used, and the project could be completed faster if an offloading facility were positioned near the confluence of Dutchman Slough with the Napa River (such a facility is described in the permit for Cullinan Ranch, but is not yet constructed for lack of funds). Faster construction is desirable from the standpoint of completing the restoration, as well as limiting the temporary effects of constructing the ship channel.

CONCLUSION

The proposed San Francisco Bay to Stockton Navigation Improvement project will have localized temporary effects on fish and wildlife resources, including the listed delta smelt, during dredging activities, and a relatively small permanent effect on X2 and the LSZ through the effect of channel depth on salinity distribution. The project will generate a quantity of relatively clean dredged material that is suitable for use at two permitted tidal restoration sites where it would yield near term benefits to wildlife and ecological processes generally, while improving

navigation safety and efficiency. Accordingly, we recommend the TSP be implemented as proposed.

RECOMMENDATIONS

We recommend the Corps:

1. Construct the TSP as proposed (-38 feet MLLW channels; -42 feet MLLW sediment trap; 2 feet overdepth; placement at Cullinan Ranch and Montezuma Wetlands); should the Corps be unable to construct the project in the dredge volume allocation described, the Service would support any alternative allocation up to the full volume at either Cullinan or Montezuma.
2. Minimize the timeframe for project construction by reasonable means, such as the use of larger capacity scows, additional scows and dredges, and/or additional offloading equipment;
3. Evaluate effects of the project on listed species and initiate consultation as appropriate with the Service and National Marine Fisheries Service, including incorporating any additional measures needed to minimize or offset these effects into the project.
4. Evaluate placement of dredged material from maintenance of the proposed project for beneficial purposes such as habitat restoration.

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APPENDIX A. Worksheet showing calculation of benefit of accelerating completion of restoration actions at Cullinan Ranch or Montezuma Wetlands phase II and proportion of total benefit (area and habitat value) associated with volume of material placed from SFBSNIP project

1. This part is a test calculation of benefits of habitat restoration acceleration due to availability of dredged material from the SFBSNIP at Cullinan Ranch

Scenario: this calculates benefits assuming that the dredged material from the ship channel accelerates completion of Cullinan Ranch by 2 years

This is a rough calculation given the uncertainty about actual dredged material volume; range of benefit would be 1 to 4 or more years.

TY	0	1	2	3	4	8	10	52	notes:
HSIw/o	0	0	0	0	0.1	0.8	1	1	this scenario finishes in year 4, and reaches maximum value in 6 years
HSI w/	0	0	0.1	0.2	0.3	1	1	1	this scenario finishes in year 2, assumes SFBSNIP accelerates by 2 years and reaches maximum value in year 8
area w/o	280	280	280	280	280	280	280	280	
area w/	280	280	280	280	280	280	280	280	
HUs w/o		0	0	0	14	504	504	11760	
HUs w/		0	14	42	70	728	560	11760	
AAHUs without								245.8	
AAHUs with								253.3	
change due to project								7.5	

Assumptions:

It takes 6 years after breaching to reach full tidal value, assumes rapid vegetation due to filling near vegetation threshold elevation.

it has limited value the first year after breaching

The amount of dredged material is probably on the order of 1 mcy; since in practice about 10-15% of unpaid overdepth is actually dredged.

The 1.45 mcy of material from going from the ship channel to cullinan would take 2 years to obtain from other sources if it isn't available

It would take 2 seasons to complete the ship channel dredging; that is, breaching in TY3.

2. This part is a test calculation of benefits of habitat restoration acceleration due to availability of dredged material

from the SFBSNIP at Montezuma Wetlands

Scenario: this calculates benefits of alternatively using the full amount at Montezuma Wetlands, which would accelerate completion there by about 2 years

This is based on the recent (2012-2017) fill rate of that site; of 3.376 mcy over the last 6 years, or about 0.56 mcy/year.

With .56 mcy/yr, it would take about 8 years to fill phase II of that site and breach it, without the project.

If all of the ship channel material were to go to Montezuma it is assumed to take 1 year for that dredging, since Montezuma can take larger scows.

At the time of dredging of the ship channel, 2023, Montezuma is assumed to be half full.

Assume that if the ship channel material were to go to Montezuma, it would be completed in 2 fewer years (TY3), compared to 4 more years without that material.

TY	0	1	2	3	4	12	14	52	notes:
HSIw/o	0	0	0	0	0.1	0.8	1	1	this scenario finishes Montezuma ph II in TY4, reaches maximum value by TY14
HSI w/	0	0	0.1	0.2	0.3	1	1	1	this scenario finishes Montezuma ph II in TY2, assume SFBSNIP accelerates by 2 yrs
area w/o	424	424	424	424	424	424	424	424	
area w/	424	424	424	424	424	424	424	424	
HUs w/o		0	0	0	21.2	1526.4	763.2	16112	
HUs w/		0	21.2	63.6	106	2204.8	848	16112	
AAHUs without								354.3	
AAHUs with								372.2	
change due to project								17.9	

Assumptions:

It takes 10 years after breaching to reach full tidal habitat value, slower than Cullinan due to larger unit size and not filling as close to vegetative threshold elevation.

It has limited value the first year after breaching.

The availability of the 1.45 mcy of material from cullinan would take 2 years to obtain from other sources if it isn't available.

3. this part estimates the restoration benefit, in area or value, associated with the volume of material coming from the ship channel as a fraction of the total benefit for disposal at Cullinan Ranch (CR) and Montezuma Wetlands (MZ) for SFBSNIP sediments.

Range of sediment volume varies from possible (high, includes all overdepth) to likely (lower, with assumptions)

High - 1.72 mcy (assumes full dredging down to 2 feet overdepth; 1.44 mcy PSC, 0.16 mcy BHR, 0.12 mcy sed trap)

Likely - ~1.03 mcy (assumes 85-90% of paid overdepth, i.e., to 1 ft, and 10-15% of unpaid overdepth, i.e., between 1-2 feet below 38 MLLW); would consist of 1 mcy from PSC, and 0.03 mcy (30,000) in BHR + sed trap

Note: the numbers under "high" and "likely" volume were derived from 12/7/18 workshop comments by David Doak, USACE

Proportion of restored AREA benefits under potential scenarios due to ship channel material:

	ACRES	ACRES	ACRES	
	As proposed, both		All to	
	CR	MZ	MZ	
High:	134.4	26.4	243.1	note: calculated as ship channel volume/total placement site volume * total placement site area
Likely:	96.1	2.8	145.6	

Proportion of habitat VALUE benefits for ship channel sediments to restoration sites under potential scenarios:

	AAHUs	AAHUs	AAHUs
	As proposed, both		All to
	CR	MZ	MZ
High volume:	1.44	0.28	1.72
Likely volume:	1.00	0.03	1.03
High Benefit:	122.5	23.2	213.4
Likely Benefit:	84.4	2.5	127.8

ACRONYMS:

AAHUs - Average Annualized Habitat Units
BHR - Bulls Head Reach
CR - Cullinan Ranch
HSI - Habitat Suitability Index
HU - Habitat Units
mcy - million cubic yards
MZ - Montezuma Wetlands
PSC - Pinole Shoal Channel
SFBSNIP - San Francisco Bay to Stockton Navigation Improvement Project
TY - Target Year

SAN FRANCISCO BAY TO STOCKTON NAVIGATION IMPROVEMENT PROJECT
Draft General Reevaluation Report and Environmental Impact
Statement/Environmental Impact Report

Appendix G – Attachment 5
Air Quality Report



April 2019
San Francisco Bay to Stockton Navigation Improvement Project



Draft Air Quality Technical Report

Prepared for the U.S. Army Corps of Engineers

April 2019

San Francisco Bay to Stockton Navigation Improvement Project

Draft Air Quality Technical Report

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APPENDICES

Appendix A	Air Quality Modeling Files
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ABBREVIATIONS

--	not applicable
µg/m ³	micrograms per cubic meter
AB	Assembly Bill
ARB	California Air Resources Board
BAAQMD	Bay Area Air Quality Management District
CAA	Clean Air Act
CAP	Climate Action Plan
CCAA	California Clean Air Act
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CO	carbon monoxide
Conc.	concentration
cy	cubic yard
DPM	diesel particulate matter
EIR	Environmental Impact Report
HAP	Hazardous Air Pollutant
hp	Horsepower
hr	hour
MLLW	mean lower low water
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO ₂	Nitrogen dioxide
NOP	Notice of Preparation
NO _x	Nitrogen oxides
PM	particulate matter
PM ₁₀	particles less than 10 microns in diameter
PM _{2.5}	particles less than 2.5 microns in diameter
ppb	parts per billion
ppd	parts per day
ppm	parts per million
ROG	reactive organic gases
SFBAAB	San Francisco Bay Area Air Basin
SIP	State Implementation Plan
SO ₂	sulfur dioxide
SVAB	Sacramento Valley Air Basin
TAC	toxic air contaminant

tpy	tons per year
TSP	Tentatively Selected Plan
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
YSAQMD	Yolo-Solano Air Quality Management District

1 Introduction

This report describes the air quality analysis conducted for the San Francisco Bay to Stockton Navigation Improvement Project, which involves deepening portions of federal navigation channels located in the San Francisco Bay: the Pinole Shoal Channel and the western portion of the Suisun Bay Channel. This report describes the potential effects of criteria air pollutants, toxic air contaminants (TACs), diesel particulate matter (DPM), and odors that would result from construction and implementation of the project.

Chapter 2 of this report describes the existing air quality conditions and air basins applicable to the project and presents an overview of the regulatory setting in the project area.

Chapter 3 presents the air quality impacts resulting from the TSP. Three alternatives: the 37-Foot Mean Lower Low Water (MLLW) Alternative (deepening throughout the project area to -37 feet MLLW with upland placement/beneficial reuse of dredged sediment); the 38-Foot MLLW Alternative (deepening throughout the project area to -38 feet MLLW with upland placement/beneficial reuse of dredged sediment); and the No Action Alternative were initially considered through project scoping. These analyses were used for preliminary screening of alternatives and to further develop the Tentatively Selected Plan (TSP). The TSP is identified as the 38-foot MLLW depth with widening footprint alternative, under which the existing maintained Pinole Shoal Channel and the western portion of the Suisun Bay Channel would be deepened from -35 feet MLLW to -38 feet MLLW, with approximately 13.2 miles of new regulatory depths. Air Quality impacts resulting from the TSP are presented in Section 3.1.

Chapter 4 summarizes the findings presented in this report.

2 Affected Environment

Air quality is affected by the rate, amount, and location of pollutant emissions and the meteorological conditions that influence pollutant movement and dispersal. Atmospheric conditions, including wind speed, wind direction, and air temperature, in combination with local surface topography (i.e., geographic features such as mountains, valleys, and large water bodies), determine the effect of air pollutant emissions on local air quality.

The following sections describe concepts and terms relevant to the air quality analysis as well as the regional air quality setting within the study area.

2.1 Criteria Air Pollutants

As required by the federal Clean Air Act (CAA) of 1970, the U.S. Environmental Protection Agency (USEPA) has identified six criteria air pollutants that are pervasive in urban areas and for which state and national health-based ambient air quality standards have been established. USEPA calls these pollutants “criteria air pollutants” because they are regulated by developing specific public health- and welfare-based criteria as the basis for setting permissible levels. Ozone, carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), particulate matter (PM), and lead are the six criteria air pollutants regulated by USEPA. PM is measured in two size ranges: PM₁₀ for particles less than 10 microns in diameter, and PM_{2.5} for particles less than 2.5 microns in diameter. Table 1 lists the criteria pollutants and their major health effects.

2.2 Toxic Air Contaminants

TACs are air pollutants that may lead to serious illness or increased mortality, even when present in relatively low concentrations. Potential human health effects of TACs include birth defects, neurological damage, cancer, and death. There are hundreds of different types of TACs with varying degrees of toxicity. Individual TACs vary greatly in the health risk they present. At a given level of exposure, one TAC may pose a hazard that is many times greater than another.

Table 1
Criteria Pollutants and Health Effects

Pollutant	Description	Health Effect
Ozone	Ozone is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving ROG (also sometimes referred to as volatile organic compounds by some regulating agencies) and NO _x . The main sources of ROG and NO _x , often referred to as ozone precursors, are combustion processes (including motor vehicle engines) and the evaporation of solvents, paints, and fuels. Ozone is referred to as a regional air pollutant because its precursors are transported and diffused by wind concurrently with ozone production through the photochemical reaction process.	Ozone causes eye irritation, airway constriction, and shortness of breath, and can aggravate existing respiratory diseases such as asthma, bronchitis, and emphysema.
Carbon Monoxide	CO is an odorless, colorless gas usually formed as the result of the incomplete combustion of fuels. The single largest source of CO is motor vehicles; the highest emissions occur during low travel speeds, stop-and-go driving, cold starts, and hard acceleration. CO concentrations have declined dramatically in California due to existing controls and programs and most areas of the state, including the study area, have no problem meeting the state and federal CO standards.	Exposure to high concentrations of CO reduces the oxygen-carrying capacity of the blood and can cause headaches, nausea, dizziness, and fatigue, impair central nervous system function, and induce angina (chest pain) in persons with serious heart disease. Very high levels of CO can be fatal.
Particulate Matter (PM ₁₀ and PM _{2.5})	PM ₁₀ and PM _{2.5} , also termed respirable particulate matter and fine particulate matter, respectively, are a class of air pollutants consisting of heterogeneous solid and liquid airborne particles from manmade and natural sources.	These particulates are small enough to be inhaled into the deepest parts of the human lung and can cause adverse health effects. Among the criteria pollutants that are regulated, particulates represent a serious ongoing health hazard.
Nitrogen Dioxide (NO ₂)	NO ₂ is a reddish-brown gas that is a byproduct of combustion processes. Automobiles and industrial operations are the main sources of NO ₂ . NO ₂ may be visible as a coloring component on high pollution days, especially in conjunction with high ozone levels.	Aside from its contribution to ozone formation, NO ₂ can increase the risk of acute and chronic respiratory disease and reduce visibility.
Sulfur Dioxide (SO ₂)	SO ₂ is a colorless acidic gas with a strong odor. It is produced by the combustion of sulfur-containing fuels such as oil, coal, and diesel.	SO ₂ has the potential to damage materials and can cause health effects at high concentrations. It can irritate lung tissue and increase the risk of acute and chronic respiratory disease (BAAQMD 2012).

Pollutant	Description	Health Effect
Lead	Leaded gasoline (phased out in the United States beginning in 1973), lead-based paint (on older houses and cars), smelters (metal refineries), and manufacturing of lead storage batteries have been the primary sources of lead released into the atmosphere.	Lead has a range of adverse neurotoxic health effects, of which children are at special risk. Some lead-containing chemicals cause cancer in animals. Lead levels in the air have decreased substantially since leaded gasoline was eliminated. Ambient lead concentrations are only monitored on an as-warranted, site-specific basis in California.

2.3 Diesel Particulate Matter

The California Air Resources Board (ARB) identified DPM as a TAC in 1998, primarily based on evidence demonstrating cancer effects in humans. The exhaust from diesel engines includes hundreds of different gaseous and particulate components, many of which are toxic. Mobile sources, such as trucks and buses, are among the primary sources of diesel emissions, and concentrations of DPM are higher near heavily traveled highways and rail lines with diesel locomotive operations. The estimated lifetime cancer risk from exposure to diesel exhaust is much higher than the risk associated with any other toxic air pollutant routinely measured in the region. The risk from DPM as determined by ARB declined from 750 in one million in 1990 to 570 in one million in 1995; by 2000, ARB estimated the average statewide cancer risk from DPM to be 540 in one million (ARB 2009). This calculated cancer risk value from ambient air exposure in the Bay Area can be compared against the lifetime probability of being diagnosed with cancer in the United States from all causes, which is more than 40% (based on a sampling of 17 regions nationwide), or greater than 400,000 in one million, according to the National Cancer Institute (NCI 2012).

TACs do not have ambient air quality standards, but are regulated by California air districts using a risk-based approach. This approach uses a health risk assessment to determine which sources and pollutants to control, as well as the degree of control. A health risk assessment is an analysis in which human health exposure to toxic substances is estimated and considered together with information regarding the toxic potency of the substances to provide quantitative estimates of health risks. In general, a health risk assessment is required if the air district concludes that projected emissions of a specific air toxic compound from a proposed new or modified source suggest a potential public health risk. Such an assessment generally evaluates chronic, long-term effects, calculating the increased risk of cancer as a result of exposure to one or more TACs.

2.4 Odors

Odors are generally regarded as an annoyance rather than a health hazard. Manifestations of a person's reaction to odors can range from psychological (e.g., irritation, anger, or anxiety) to physiological (e.g., circulatory and respiratory effects, nausea, vomiting, and headache). The ability to detect odors varies considerably among the population and overall is quite subjective. People may have different reactions to the same odor. An odor that is offensive to one person may be perfectly acceptable to another. An unfamiliar odor is more easily detected and is more likely to cause complaints than a familiar one. A person can become desensitized to almost any odor and recognition only occurs with an alteration in the intensity. The occurrence and severity of odor impacts depends on the nature, frequency, and intensity of the source; wind speed and direction; and the sensitivity of receptors. Odor impacts should be considered for any proposed new odor sources located near existing receptors, as well as any new sensitive receptors located near existing

odor sources. Increasing the distance between the receptor and the odor source will generally mitigate odor impacts.

2.5 Sensitive Receptors

Air quality does not affect every individual in the population in the same way, and some groups are more sensitive to adverse health effects than others. Population subgroups sensitive to the health effects of air pollutants include the elderly and the young, those with higher rates of respiratory disease such as asthma and chronic obstructive pulmonary disease, and those with other environmental or occupational health exposures (e.g., indoor air quality) that affect cardiovascular or respiratory diseases.

Land uses such as schools, children's day care centers, hospitals, and nursing and convalescent homes are considered to be more sensitive than the general public to poor air quality because the population groups associated with these uses have increased susceptibility to respiratory distress. Parks and playgrounds are considered moderately sensitive to poor air quality because persons engaged in strenuous work or exercise also have increased sensitivity to poor air quality. However, exposure times are generally far shorter in parks and playgrounds than in residential locations and schools. Residential areas are considered more sensitive to air quality conditions compared to commercial and industrial areas because people generally spend longer periods of time at their residences, with associated greater exposure to ambient air quality conditions.¹

Sensitive receptors include children, adults, and seniors occupying or residing in residential dwellings, schools, colleges and universities, daycares, hospitals, and senior-care facilities. Workers are not considered sensitive receptors because all employers must follow regulations set forth by the Occupational Safety and Health Administration to ensure the health and well-being of their employees.

2.6 Regional Setting

The geographic scope of the study area includes the waters within the North San Francisco Bay, San Pablo and Suisun Bays, covering the counties of Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, and San Francisco. The majority of the project area is located within the boundaries of the San Francisco Bay Area Air Basin (SFBAAB), though portions extend into the Sacramento Valley Air Basin (SVAB).

¹ The factors responsible for variation in exposure are also often similar to the factors associated with greater susceptibility to air quality health effects. For example, poorer residents may be more likely to live in crowded substandard housing and be more likely to live near industrial or roadway sources of air pollution.

2.6.1 San Francisco Bay Area Air Basin

The SFBAAB encompasses a nine-county region, including all of Alameda, Contra Costa, Santa Clara, San Francisco, San Mateo, Marin and Napa counties, and the southern portions of Solano and Sonoma counties. The Bay Area Air Quality Management District (BAAQMD) has jurisdiction over air quality within the SFBAAB. The climate of the SFBAAB is determined largely by a high-pressure system that is almost always present over the eastern Pacific Ocean off the west coast of North America. During winter, the Pacific high-pressure system shifts southward, allowing more storms to pass through the region. During summer and early fall, when few storms pass through the region, emissions generated within the Bay Area can combine with abundant sunshine under the restraining influences of topography and subsidence inversions to create conditions that are conducive to the formation of photochemical pollutants such as ozone and secondary particulates such as nitrates and sulfates.

2.6.2 Sacramento Valley Air Basin

The SVAB encompasses an eleven-county region, including all of Butte, Colusa, Glenn, Sacramento, Shasta, Sutter, Tehama, Yolo, and Yuba counties, and portions of Placer and Solano counties. The Yolo-Solano Air Quality Management District (YSAQMD) is responsible for Yolo County and the eastern portion of Solano County. Other counties within the SVAB are outside of the study area. The climate in the SVAB is Mediterranean. Prevailing winds originate offshore of San Francisco Bay and flow through the Carquinez Strait, then north through the Sacramento Valley. Elevations of the broad valley floor range from 60 to 500 feet above mean sea level. The valley is bordered to the north by the Sierra Cascade Mountains, to the east by the Sierra Nevada, and to the west by the Coast Ranges. The topography and climate of the air basin create a high potential for air inversions. Inversions occur frequently during all seasons. The most stable of these inversions occurs in the late summer and early fall, when cool coastal air is trapped beneath a warm air mass. Photochemical smog (i.e., ozone) trapped in these inversions is often exacerbated when preceded by sunny days with relatively high temperatures. During late fall and winter, air inversions occurring at ground level often result in low-lying fog when valley air becomes trapped and does not mix with coastal air. It is during these periods that the air basin experiences the highest concentrations of CO, NO_x, and PM.

2.6.3 Existing Air Quality

BAAQMD, YSAQMD, and ARB all monitor regional air quality through a network of monitoring stations, which record ambient concentrations of non-attainment criteria air pollutants. Probable future levels of air quality in the study area can generally be inferred from ambient air quality measurements conducted at the nearest monitoring stations by examining trends over time. The data gathered at these monitoring stations present the nearest available benchmark reference point

as to what the pollutants of greatest concern are in the region and the degree to which the area is out of attainment with specific air quality standards.

The two closest monitoring stations to the study area in the SFBAAB are in Vallejo and San Pablo. Table 2 shows a 3-year (2015 through 2017) summary of monitoring data for ozone, PM₁₀, and PM_{2.5} recorded at these stations. These stations recorded no violations of ozone or PM₁₀ standards but identified violations of state and federal 24-hour PM_{2.5} standards.

Table 3 shows a 3-year (2015 through 2017) summary of monitoring data for ozone, PM₁₀, and PM_{2.5} recorded at the Vacaville and Davis air monitoring stations, which are the stations closest to the study area within the SVAB. These stations recorded violations of the ozone federal standards, but no violations of the state or federal PM_{2.5} standards. Neither station monitors PM₁₀ concentrations.

YSAQMD currently meets USEPA's health standards for five pollutants. YSAQMD is part of the SVAB regional non-attainment area for ground-level ozone and fine particulate pollution.

Table 2
Summary of Air Quality Monitoring Data within the SFBAAB (2015–2017)

Pollutant	Applicable Standard	Number of Days Standards Were Exceeded and Maximum Concentrations Measured ^a		
		2015	2016	2017
Ozone				
Vallejo – 304 Tuolumne Street				
Days 1-hour State Std. Exceeded	>0.09 ppm ^b	0	1	1
Max. 1-hour Conc. (ppm)	--	0.085	0.097	0.105
Days 8-hour National Std. Exceeded	>0.070 ppm ^c	0	1	2
Days 8-hour State Std. Exceeded	>0.070 ppm ^b	1	1	2
Max. 8-hour Conc. (ppm)	--	0.071	0.072	0.088
San Pablo – Rumrill Blvd.				
Days 1-hour State Std. Exceeded	>0.09 ppm ^b	0	0	3
Max. 1-hour Conc. (ppm)	--	0.084	0.094	0.104
Days 8-hour National Std. Exceeded	>0.070 ppm ^c	0	0	2
Days 8-hour State Std. Exceeded	>0.070 ppm ^b	0	0	2
Max. 8-hour Conc. (ppm)	--	0.062	0.061	0.080
Suspended Particulates (PM ₁₀)				
San Pablo – Rumrill Blvd.				
Days Over 24-hour National Std.	>150 µg/m ^{3 c}	0	0	0
Days Over 24-hour State Std.	>50 µg/m ^{3 b}	0	0	25.8
Max. 24-hour Conc. (µg/m3)	--	43.0	33.0	95.3
Annual Average (µg/m3)	>20 µg/m ^{3 b}	18.1	14.9	19.8

Pollutant	Applicable Standard	Number of Days Standards Were Exceeded and Maximum Concentrations Measured ^a		
		2015	2016	2017
Suspended Particulates (PM _{2.5})				
Vallejo – 304 Tuolumne Street				
Days Over 24-hour National Std.	>35 µg/m ³ ^c	3	0	9
Max. 24-hour Conc. (µg/m3)	--	41.4	23.0	101.9
Annual Average (µg/m3)	>12 µg/m ³ ^b	9.6	7.3	11.5
San Pablo – Rumrill Blvd.				
Days Over 24-hour National Std.	>35 µg/m ³ ^c	0	0	9.3
Max. 24-hour Conc. (µg/m3)	--	33.2	19.5	71.2
Annual Average (µg/m3)	>12 µg/m ³ ^b	8.9	8.0	10.7

Notes:

Bold values are in excess of applicable standard.

a. Number of days exceeded is for all days in a given year, except for particulate matter. PM₁₀ and PM_{2.5} are monitored every 6 days.

b. state standard, not to be exceeded.

c. federal standard, not to be exceeded.

Source: ARB 2018

Table 3
Summary of Air Quality Monitoring Data within the SVAB (2015-2017)

Pollutant	Applicable Standard	Number of Days Standards Were Exceeded and Maximum Concentrations Measured ^a		
		2015	2016	2017
Ozone				
Vacaville – Ulatis Drive				
Days 1-hour State Std. Exceeded	>0.09 ppm ^b	0	0	0
Max. 1-hour Conc. (ppm)	--	0.085	0.092	0.089
Days 8-hour National Std. Exceeded	>0.070 ppm ^c	0	1	2
Days 8-hour State Std. Exceeded	>0.070 ppm ^b	1	1	2
Max. 8-hour Conc. (ppm)	--	0.070	0.072	0.079
Davis – UCD Campus				
Days 1-hour State Std. Exceeded	>0.09 ppm ^b	0	0	0
Max. 1-hour Conc. (ppm)	--	0.081	0.083	0.078
Days 8-hour National Std. Exceeded	>0.070 ppm ^c	1	1	1
Days 8-hour State Std. Exceeded	>0.070 ppm ^b	1	1	1
Max. 8-hour Conc. (ppm)	--	0.071	0.072	0.071
Suspended Particulates (PM _{2.5})				
Davis – UCD Campus				
Days Over 24-hour National Std.	>150 µg/m ³ ^c	NA	NA	NA

Pollutant	Applicable Standard	Number of Days Standards Were Exceeded and Maximum Concentrations Measured ^a		
		2015	2016	2017
Days Over 24-hour State Std.	>50 µg/m ³ ^b	NA	NA	NA
Max. 24-hour Conc. (µg/m ³)	--	36.3	30.5	59.2
Annual Average (µg/m ³)	>20 µg/m ³ ^b	10.1	NA	NA

Notes:

Bold values are in excess of applicable standard.

Source: ARB 2018

a. Number of days exceeded is for all days in a given year, except for particulate matter. PM₁₀ and PM_{2.5} are monitored every 6 days.

b. state standard, not to be exceeded.

c. federal standard, not to be exceeded.

2.7 Regulatory Setting

Development within the study area must comply with federal, state, regional, and local air quality regulations. This section discusses the effects of these regulatory requirements on development of the project.

2.7.1 Federal

2.7.1.1 Clean Air Act

The CAA and its subsequent amendments form the basis for the national air pollution control effort. USEPA is responsible for implementing most aspects of the CAA. Basic elements of the act include the National Ambient Air Quality Standards (NAAQS or "national standards") for major air pollutants, hazardous air pollutant standards, attainment plans, motor vehicle emission standards, stationary source emission standards and permits, acid rain control measures, stratospheric ozone protection, and enforcement provisions.

2.7.1.2 Criteria Pollutants

The 1970 CAA (last amended in 1990) required USEPA to identify NAAQS, which are the concentrations of pollutants (with an adequate margin of safety) to which the public can be exposed without adverse health effects. They are designed to protect those segments of the public most susceptible to respiratory distress, including asthmatics, the very young, the elderly, people weak from other illness or disease, or persons engaged in strenuous work or exercise. Healthy adults can tolerate occasional exposure to air pollution levels that are somewhat above ambient air quality standards before adverse health effects are observed. Pursuant to the 1990 CAA amendments, USEPA classifies air basins (or portions thereof) as "attainment" or "nonattainment" for each criteria air pollutant based on whether or not the NAAQS have been achieved.

Table 4 shows the current national and state ambient air quality standards and the health effects that can result when the standards are exceeded. Table 5 shows the current attainment status for the SFBAAB and SVAB. Both air basins are classified as nonattainment for the federal and state ozone and PM_{2.5} standards.

Table 4
Ambient Air Quality Standards

Pollutant	Averaging Time	State Standard	Federal Primary Standard	Major Pollutant Sources
Ozone	8-hour	0.070 ppm	0.075 ppm	Formed when ROG and NO _x react in the presence of sunlight. Major sources include on-road motor vehicles, solvent evaporation, and commercial/industrial mobile equipment.
	1-hour	0.090 ppm	--	
Carbon Monoxide	8-hour	9.0 ppm	9.0 ppm	Internal combustion engines, primarily gasoline-powered motor vehicles
	1-hour	20 ppm	35 ppm	
Nitrogen Dioxide	Annual Average	0.030 ppm	0.053 ppm	Motor vehicles, petroleum refining operations, industrial sources, aircraft, ships, and railroads
	1-hour	0.180 ppm	0.100 ppm	
Sulfur Dioxide	Annual Average	--	0.03 ppm	Fuel combustion, chemical plants, sulfur recovery plants and metal processing
	24-hour	0.04 ppm	0.14 ppm	
	1-hour	0.25 ppm	0.075 ppm	Dust- and fume-producing industrial and agricultural operations, combustion, atmospheric photochemical reactions, and natural activities (e.g., wind-raised dust and ocean sprays)
Particulate Matter (PM ₁₀)	Annual Arithmetic Mean	20 µg/m ³	--	
	24-hour	50 µg/m ³	150 µg/m ³	
Particulate Matter (PM _{2.5})	Annual Arithmetic Mean	12 µg/m ³	12 µg/m ³	Fuel combustion in motor vehicles, equipment, and industrial sources; residential and agricultural burning; also, formed from photochemical reactions of other pollutants, including NO _x , sulfur oxides, and organics
	24-hour	--	35 µg/m ³	
Lead	Calendar Quarter	--	1.5 µg/m ³	Present sources: lead smelters, battery manufacturing and recycling facilities. Past source: combustion of leaded gasoline
	30-Day Average	1.5 µg/m ³	--	
Hydrogen Sulfide	1-hour	0.03 ppm	No federal standard	Geothermal power plants, Petroleum production and refining
Visibility Reducing Particles	8-hour	Extinction of 0.23/km; visibility of 10 miles or more	No federal standard	See PM _{2.5}

Table 5
Air Quality Attainment Status of the SFBAAB and SVAB

Pollutant	SFBAAB Attainment Status		SVAB Attainment Status	
	California Standard	Federal Standard	California Standard	Federal Standard
Ozone 8-hr	Non-Attainment	Non-Attainment	Non-Attainment	Non-Attainment
Ozone 1-hr	Non-Attainment	--	Non-Attainment	--
CO 8-hr	Attainment	Attainment, maintenance	Attainment	Attainment, maintenance
CO 1-hr	Attainment	Attainment	Attainment	Attainment
NO ₂ Annual	Attainment	Attainment	Attainment	Attainment
NO ₂ 1-hr	Attainment	Unclassified	Attainment	Unclassified
SO ₂ Annual	Attainment	Attainment	Attainment	Attainment
SO ₂ 24-hour	Attainment	Attainment	Attainment	Attainment
SO ₂ 1-hour	Attainment	Attainment	Attainment	Attainment
PM ₁₀ Annual	Non-Attainment	--	Non-Attainment	--
PM ₁₀ 24-hr	Non-Attainment	Unclassified	Non-Attainment	Unclassified
PM _{2.5} Annual	Non-Attainment	Attainment	Non-Attainment	Attainment

2.7.1.3 Toxic Air Contaminants

TACs are regulated under both state and federal laws. Federal laws use the term "Hazardous Air Pollutants" (HAPs) to refer to the same types of compounds that are referred to as TACs under state law. Both terms encompass essentially the same compounds. The 1977 CAA amendments required USEPA to identify National Emission Standards for HAPs to protect public health and welfare. These substances include certain volatile organic compounds, pesticides, herbicides, and radionuclides that present a tangible hazard, based on scientific studies of exposure to humans and other mammals. Under the 1990 CAA amendments, 189 substances are regulated as HAPs.

2.7.1.4 State Implementation Plan

The CAA requires each state to prepare an air quality control plan referred to as the State Implementation Plan (SIP). The CAA amendments added requirements for states containing areas that violate the NAAQS to revise their SIPs to incorporate additional control measures to reduce air pollution. A SIP is a living document that is modified periodically to reflect the latest emissions inventories, planning documents, and rules and regulations of air basins as reported by the agencies with jurisdiction over them. USEPA has responsibility to review all SIPs to determine whether they conform to the mandates of the CAA amendments and will achieve air quality goals when implemented. If USEPA determines a SIP to be inadequate, it may prepare a Federal Implementation Plan for the nonattainment area and impose additional control measures. Failure to submit an

approvable SIP or to implement the plan within mandated timeframes can result in sanctions being applied to transportation funding and stationary air pollution sources in the air basin.

The 1977 CAA amendments require that regional planning and air pollution agencies prepare a regional air quality plan to outline the measures by which both stationary and mobile sources of pollutants can be controlled in order to achieve all standards specified in the CAA. The 1988 California Clean Air Act (CCAA) also requires development of air quality plans and strategies to meet state air quality standards in areas designated as nonattainment (except for areas designated as nonattainment for the state PM standards). Maintenance plans are required for attainment areas that had previously been designated nonattainment in order to ensure continued attainment of the standards. In California, these air quality plans are developed by the air districts and approved by ARB for inclusion in the SIP.

2.7.1.5 General Conformity Rule

Section 176(c) of the CAA states that a federal agency cannot issue a permit for or support an activity unless the agency determines it will conform to the most recent USEPA-approved SIP. This means that projects using federal funds or requiring federal approval must not: 1) cause or contribute to any new violation of a NAAQS; 2) increase the frequency or severity of any existing violation; or 3) delay the timely attainment of any standard, interim emission reduction, or other milestone. General conformity requirements were adopted by Congress as part of the CAA and were implemented by USEPA regulations on November 30, 1993, in "Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule" (58 Federal Register 62235, 1993). General conformity requires that all federal actions conform to the SIP as approved or promulgated by USEPA by determining that the action is either exempt from the General Conformity Rule requirements or subject to a formal conformity determination.

2.7.1.6 Emission Standards for Marine Diesel Engines

To reduce emissions from Category 1 (at least 50 horsepower [hp] but less than 5 liters per cylinder displacement) and Category 2 (5 to 30 liters per cylinder displacement) marine diesel engines, USEPA has established emission tier standards for new engines. Tier 2 standards were phased in from 2004 to 2007 (year of manufacture), depending on the engine size. Tier 3 and 4 emission standards for marine diesel engines were introduced in 2008. Tier 3 standards are designed to harmonize with international standards.² The Tier 4 standards are modeled after the 2007/2010 highway engine program and the Tier 4 nonroad rule, with an emphasis on the use of emission after treatment technology. For the purposes of this analysis, engine rules are assumed to affect harbor craft but not oceangoing vessels, as the latter would likely be manufactured overseas and therefore would be exempt from the rule. To enable catalytic after treatment methods, USEPA established a sulfur cap in

² International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI

marine fuels, limiting sulfur to 15 parts per million (ppm) in marine diesel fuel by June 2012. California also currently requires the use of diesel fuel with a sulfur content of 15 ppm or less, which is applicable to all marine vessels.

2.7.2 State

2.7.2.1 California Clean Air Act

Although the CAA established national ambient air quality standards, individual states retained the option to adopt standards that are more stringent and to include other pollution sources. California passed the CCAA in 1988 (California Health and Safety Code Sections 39600 et seq.), which, like its federal counterpart, called for the designation of areas as attainment or nonattainment, but based on state ambient air quality standards rather than the federal standards. Table 4 shows there is considerable diversity between California's and the NAAQS, with the state ambient standards being at least as protective as national ambient standards and often more stringent.

2.7.2.2 Toxic Air Contaminants

The State Air Toxics Program was established in 1983 under Assembly Bill (AB) 1807. A total of 243 substances have been designated TACs under California law, including the 189 (federal) HAPs adopted in accordance with AB 2728. The Air Toxics "Hot Spots" Information and Assessment Act of 1987 (AB 2588) seeks to identify and evaluate risk from air toxics sources; however, AB 2588 does not regulate air toxics emissions. In August 1998, ARB identified DPM emissions from diesel-fueled engines as TACs. ARB subsequently developed the *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles* (ARB 2000). The document represents proposals to reduce diesel particulate emissions, with the goals of reducing emissions and associated health risks by 75% in 2010 and 85% in 2020.

2.7.2.3 California Air Resources Board Regulation to Reduce Emissions from Diesel Engines on Commercial Harbor Craft

In November 2007, ARB adopted a regulation to reduce DPM and NO_x emissions from new and in-use commercial harbor craft. Under ARB's definition, commercial harbor craft include tug boats, tow boats, ferries, excursion vessels, work boats, crew boats, and fishing vessels. The regulation implemented stringent emission limits on harbor craft auxiliary and propulsion engines. In 2010, ARB amended the regulation to add specific in-use requirements for barges, dredges, and crew/supply vessels.

2.7.2.4 California Air Resources Board California Diesel Fuel Regulation 28

With this rule, ARB set sulfur limitations for diesel fuel sold in California for use in on-road and off-road motor vehicles (California Code of Regulations [CCR] Title 13, Sections 2281–2285; CCR Title 17, Section 93114). Harbor craft and intrastate locomotives were originally excluded from the rule but

were later included by a 2004 rule amendment (ARB 2005). Under this rule, diesel fuel used in motor vehicles, except harbor craft and intrastate locomotives, has been limited to 500 ppm of sulfur since 1993. The sulfur limit was reduced to 15 ppm on September 1, 2006. A federal diesel rule similarly limited sulfur content nationwide to 15 ppm by October 15, 2006.

2.7.2.5 California Air Resources Board Regulations for Fuel Sulfur and Other Operational Requirements for Ocean Going Vessels within California Waters and 24 Nautical Miles of the California Baseline

In 2008, ARB adopted a Clean Fuel Regulation for Ocean Going Vessels within 24 nautical miles of the California coast to further reduce emissions from shipping. Since then, the permitted sulfur content of marine gas oil and marine diesel oil has been progressively lowered and may not exceed 0.1% since 2014. ARB adopted a regulation in 2014 that allows marine vessels to be considered in compliance with the California Ocean Going Fuel Regulation when they are complying with the North American Emission Control Area using alternative emission control technologies or non-distillate low sulfur (less than or equal to 0.1% sulfur) marine fuels.

2.7.3 Regional

California's air quality is monitored and regulated at the state level by ARB and at the local and regional level by air pollution control authorities known as Air Pollution Control Districts or Air Quality Management Districts. The role of the air districts includes developing clean air plans and California Environmental Quality Act (CEQA) guidance.

2.7.3.1 Bay Area Air Quality Management District Rules, Regulations, and California Environmental Quality Act Guidelines

BAAQMD is the regional agency responsible for rulemaking, permitting, and enforcement activities affecting stationary sources in the Bay Area. BAAQMD does not have the authority to regulate emissions from personal motor vehicles. Specific rules and regulations adopted by BAAQMD limit the emissions that can be generated by emission sources and identify specific pollution reduction measures that must be implemented in association with various activities. These rules regulate not only emissions of the six criteria air pollutants, but also TAC emission sources, which are regulated through BAAQMD's permitting process and standards of operation.

BAAQMD adopted updated CEQA Air Quality Guidelines, including new thresholds of significance, in June 2010 and revised them in May 2011. The BAAQMD CEQA Air Quality Guidelines advise lead agencies on how to evaluate potential air quality impacts, including establishing quantitative and qualitative thresholds of significance. The thresholds BAAQMD adopted were set aside by an Alameda County Superior Court ruling in March 2012. In May 2012, BAAQMD updated its CEQA Air Quality Guidelines to continue to provide direction on recommended analysis methodologies, but without recommended quantitative significance thresholds (BAAQMD 2012). On August 13, 2013, the

First District Court of Appeal ordered the trial court to reverse the judgment and upheld BAAQMD's CEQA thresholds. BAAQMD published a new version of its CEQA Air Quality Guidelines dated May 2017, which includes revisions made to address the California Supreme Court's opinion. The May 2017 update does not address outdated references, links, analytical methodologies or other technical information that may be in the BAAQMD CEQA Air Quality Guidelines or Thresholds Justification Report. BAAQMD is currently working to update any outdated information in its guidelines (BAAQMD 2017). Therefore, this analysis considers both sets of guidelines to address significance.

2.7.3.2 Yolo-Solano Air Quality Management District Applicable Rules, Regulations, and California Environmental Quality Act Guidelines

YSAQMD is the regional agency responsible for rulemaking, permitting and enforcement activities affecting stationary sources in the Yolo and Solano County portion of the SVAB. Its authority and specific rules and regulations and permitting processes mirror those of BAAQMD. YSAQMD adopted its *Handbook for Assessing and Mitigating Air Quality Impacts*, including new thresholds of significance, in July 2007 (YSAQMD 2007). The guidelines advise lead agencies on how to evaluate potential air quality impacts, including establishing quantitative and qualitative thresholds of significance.

3 Environmental Consequences

This chapter presents project-specific air quality impacts resulting from the TSP and the No Action Alternative.

Two alternatives were preliminarily considered by the U.S. Army Corps of Engineers (USACE): the 37-Foot MLLW Alternative (deepening throughout the project area to -37 feet MLLW with upland placement/beneficial reuse of dredged sediment); the 38-Foot MLLW Alternative (deepening throughout the project area to -38 feet MLLW with upland placement/beneficial reuse of dredged sediment). No locally preferred plan (LPP) has been identified. Therefore, the recommended plan is the National Economic Development Plan, identified as the 38-foot MLLW depth alternative, or the TSP. Under the TSP, the existing maintained Pinole Shoal Channel and western portion of the Suisun Bay Channel would be deepened from -35 feet to -38 feet MLLW, with approximately 13.2 miles of new regulatory depths. There will also be a rock outcrop removed, and a sediment trap at Bull's Head Reach that will be -44 feet MLLW (as described further in Chapter 3 of the integrated General Reevaluation Report/Environmental Impact Statement.

This section presents the air quality analysis for the TSP and No Action Alternative, which is also the NEPA Baseline. For the purposes of this analysis, the NEPA No Action Alternative and the CEQA No Project Alternative are assumed to be equivalent. As such, a single impact assessment is presented.

3.1 Methods

Using the assumptions and models discussed in Sections 3.3 and 3.4, air pollutant emissions from the proposed construction and operational activities were calculated using the most current emission factors and methods, then compared to the thresholds identified in Section 3.5 to determine their significance. For impacts that exceeded a significance criterion, measures were evaluated for their ability to mitigate the impacts to insignificance. The analysis also considered impacts to sensitive receptors. Sensitive receptors are children, elderly, asthmatics, and others who are at a heightened risk of negative health outcomes due to exposure to air pollution. The locations where these sensitive receptors congregate for periods of time are considered sensitive receptor locations (CARB 2018). No sensitive receptors or land uses are located within 1,000 feet of the proposed dredging footprints, placement sites, or the docking locations for ships.

3.2 Baselines

Due to the differences between the NEPA and CEQA baselines described below, the NEPA and CEQA impact determinations for the TSP and No Action Alternative are generally presented separately in impact analysis. Where the NEPA and CEQA impact determinations and associated rationale are the same, a joint NEPA/CEQA impact determination is presented.

3.2.1 NEPA Baseline

The NEPA baseline condition for determining the significance of impacts of a federal action is defined by examining the full range of construction and operational activities likely to be implemented absent the federal action. The NEPA baseline can change if environmental conditions at the site would change over time in the absence of a federal action. The NEPA baseline for the study is identical to the No Action Alternative. Under the No Action Alternative, there would be neither new construction nor changes to operations, however, maintenance dredging would continue.

3.2.2 CEQA Baseline

Section 15125 of the CEQA Guidelines requires EIRs to include a description of the physical environmental conditions in the study area that exist at the time of issuance of the NOP. These environmental conditions normally serve as the baseline for analysis. For purposes of the air quality analysis, the CEQA baseline is defined as the conditions existing in the study area as of December 2015. The original analysis used the most available annual data for the 12-month period preceding December 2014, as described in the Economics Evaluation (USACE 2015b). During this time, there were 107 Panamax ships transiting the project area. Following completion of the Economic Evaluation, annual 2015 data became available. The 2015 data is essentially the same as the 2014 data (within 2 vessel calls) therefore, to maintain consistency with the Economics Analysis, this air quality study will continue to use 107 vessels as the CEQA baseline.

3.3 Assumptions

3.3.1 Construction Assumptions

The following assumptions were used to assess air quality emissions from construction of the TSP (USACE 2015a, updated 2019):

- Dredging would begin in June 2023 and would last 5.5 months. Dredging would occur 15 hours per day, 7 days per week. There are 20 hours total in each work day.
- Dredging would use a 21-cubic-yard (cy) clamshell dredging plant powered by a 2,500-hp engine and a 1,900-hp auxiliary engine; 150-hp tugs; 100-hp survey boat; and a 150-hp derrick barge.
- Dredging would occur at two locations: Pinole Shoal Channel and Suisun Bay Channel.
 - *Pinole Shoal Channel*: Dredging in Pinole Channel would last 4 months and use two clamshell dredgers. The dredging rate would be 9,000 cy per day.
 - *Suisun Bay Channel*: Dredging in Suisun Bay would last 1.5 months and use one clamshell dredger. The dredging rate would be 7,300 cy per day.

- There are two placement sites: Cullinan, which would receive material from Pinole Shoal, and Montezuma, which would receive material from Suisun Bay Channel. Both sites would use electrified pumps.
 - *Cullinan*: Placement at Cullinan would require two 2,000-cy scows using two tug boats because the Napa River is too shallow for a fully loaded 4,000-cy scow. The distance of travel is 10.5 miles to Cullinan from Pinole Shoal. All work would be within BAAQMD.
 - *Montezuma*: Two 4,000-cy scows using one tug boat would be used to haul dredged material. The distance of travel between Montezuma and Suisun Bay Channel is 17 miles, with 14 miles in BAAQMD and 3 miles in YSAQMD.
- Eight workers would be needed for the dredge plant, and two workers would be needed for the tugboats.
- Emissions from worker trips are estimated using ARB's EMFAC2017 modeling software.
- Emission factors for this equipment are based on ARB's 2011 California Harbor Craft Emissions Inventory.

3.3.2 Operational Assumptions

The Economics Evaluation prepared for the project (USACE 2015b) estimates that the volume of petroleum products (the dominant cargo in the project area) will grow at the same rate whether or not the TSP is implemented. The vessel mix, however, is projected to change if TSP deepening is implemented. The predicted increase in petroleum product volumes is expected to be shipped primarily in vessels of the Panamax medium class. The deeper channel depth would allow those vessels to avoid some of the costly operational strategies currently in use, such as transporting smaller volumes and making more frequent trips, making them a more efficient option than the larger vessels. Therefore, the air quality analysis focuses on the change of Panamax vessels over time as shown in Table 6. As shown, because the Panamax-sized vessels would not need to make more frequent trips, overall trips would be less than under the No Action Alternative, even as more product is moved by vessels of this size class.

Table 6
Projected Annual Panamax Ship Calls Over Time

Vessel Type	CEQA Baseline	No Action Alternative			TSP		
Year	2014	2023	2030	2040	2022	2030	2040
Panamax	107	127	151	179	113	136	165

The following assumptions were used to assess air quality emissions from operations:

- Annual ship calls are based on 2014 data from the USACE Waterborne Commerce Statistics Center (USACE 2015a).
- The maximum tugboat engine size is assumed to be 3,600 hp for main engines and 235 hp for auxiliary engines, based on the maximum values in ARB's OFFROAD2014 model. A load factor of 50% for main engines and 31% for tugboats is assumed based on OFFROAD2014.
- Two tugboats would accompany each Panamax vessel (Port of Los Angeles 2008).
- Marine vessel emissions are based on ARB's Emission Estimation Methodology for Ocean-Going Vessels (2011). ARB's estimation procedure uses separate calculations for main and auxiliary engines.
- Average vessel characteristics for tankers assumes main engine power of 13,034 kilowatts and auxiliary power of 2,339 kilowatts (ARB 2011). Estimates assume a load factor of 83% for main engines and 26% for auxiliary engines (ARB 2011). Emission factors for main engines and auxiliary engines are based on medium marine distillate (0.1% sulfur) (ARB 2011). Main engines are assumed to operate for 2 hours per ship call and auxiliary engines for 34 hours per ship call.

3.4 Thresholds

3.4.1 *National Environmental Policy Act*

The purpose of the general conformity program is to ensure that actions taken by the federal government do not undermine state or local efforts to achieve and maintain NAAQS. Before a federal action is taken, it must be evaluated for conformity with the SIP. All reasonably foreseeable emissions, both direct and indirect, predicted to result from the action are taken into consideration and must be identified with respect to location and quantity. Direct emissions occur at the same time and place as the action. Indirect emissions are reasonably foreseeable emissions that may occur later in time and/or farther removed from the action. The emissions are subject to conformity if the federal agency can practicably control them and maintain control through a continuing program responsibility. If it is found that the action would create emissions above de minimis threshold levels specified in USEPA regulations, the action cannot proceed unless mitigation measures are specified that would bring the project into conformance.

General conformity applies in both federal nonattainment and maintenance areas. In these areas, it applies to any federal action not specifically exempted by the CAA or USEPA regulations. General conformity does not apply to projects or actions that are covered by the transportation conformity rule. If a federal action falls under the general conformity rule, the federal agency responsible for the action is responsible for making the conformity determination. In some instances, a state will make the conformity determination under delegation from a federal agency. Private developers are not

responsible for making a conformity determination, but they can be directly affected by a determination.

The significance criteria used to evaluate NEPA air quality effects are based on the federal general conformity thresholds. Currently, the SFAAB is classified as moderate nonattainment for the federal 8-hour ozone standard, nonattainment for the 24-hour PM_{2.5} standard, and maintenance for the federal CO standards. Because sulfur dioxide is considered a precursor to PM_{2.5}, the conformity threshold for SO₂ also applies. The portion of the SVAB under jurisdiction of YSAQMD is currently classified as severe non-attainment for the federal 8-hour ozone standard, non-attainment for the 24-hour PM_{2.5} standard, and maintenance for the federal CO standards. Table 7 shows the applicable general conformity thresholds that apply to the TSP in both air basins.

Table 7
General Conformity de minimis Thresholds for Projects in the SFBAAB and SVAB

Pollutant	SFBAAB Threshold (tpy)	SVAB Threshold (tpy)
CO	100	100
NO _x	100	25
ROG	50	25
PM _{2.5}	100	100
PM ₁₀	--	100
SO ₂	100	100

Source: USEPA 2016

3.4.2 California Environmental Quality Act

According to Appendix G of the CEQA Guidelines, as updated in December 2018, air quality impacts resulting from implementation of a proposed project would be considered significant if the project would:

- Conflict with or obstruct implementation of the applicable air quality plan.
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard.
- Expose sensitive receptors to substantial pollutant concentrations.
- Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people.

BAAQMD's 2011 significance criteria are shown in Table 21 and YSAQMD's significance thresholds are shown in Table 8. YSAQMD has developed risk-based thresholds for emissions of TACs; however, those thresholds apply only to stationary sources, not to mobile sources. The analysis uses the

appropriate thresholds in relation to the location of the emission source. If the source spans two air districts, the most restrictive threshold is used to determine impacts. As shown in Tables 8 and 9, BAAQMD's thresholds are more restrictive and therefore were used to determine impacts.

Table 8
BAAQMD Air Quality CEQA Thresholds of Significance

Criteria Pollutants and Precursors	Construction-Related	Operations-Related	
	Average Daily Emissions (ppd)	Average Daily Emissions (ppd)	Maximum Annual Emissions (tpy)
ROG	54	54	10
NO _x	54	54	10
PM ₁₀	82 (exhaust)	82	15
PM _{2.5}	54 (exhaust)	54	10
PM ₁₀ /PM _{2.5} (fugitive dust)	Best Management Practices	None	None
Local CO	None	9.0 ppm (8-hour average), 20.0 ppm (1-hour average)	
Risks and Hazards for new sources and receptors (Individual Project)	Same as Operational Thresholds	Compliance with Qualified Community Risk Reduction Plan OR Increased Cancer Risk >10.0 in a million, Increased non-cancer risk >1.0 Hazard Index (Chronic or Acute), Ambient PM _{2.5} increase >0.3 µg/m ³ annual average	
		Zone of Influence: 1,000-foot radius from property line of source perimeter	
Risks and Hazards for new sources and receptors (Cumulative Thresholds)	Same as Operational Thresholds	Compliance with Qualified Community Risk Reduction Plan OR Increased Cancer Risk >100.0 in a million, Increased non-cancer risk >10.0 Hazard Index (Chronic or Acute), Ambient PM _{2.5} increase >0.8 µg/m ³ annual average	
		Zone of Influence: 1,000-foot radius from property line of source perimeter	
Odors	None	Five confirmed complaints per year averaged over 3 years	

Source: BAAQMD 2012

Table 9
YSAQMD Air Quality CEQA Thresholds of Significance

Pollutant	Threshold (Construction and Operation)
ROG	10 tpy
NO _x	10 tpy
PM ₁₀	80 pounds per day
CO	Violation of the state ambient air quality standards

Pollutant	Threshold (Construction and Operation)
Odor	Qualitative threshold

Source: YSAQMD 2007

3.4.3 *Summary of Significance Thresholds*

Considering the specific NEPA and CEQA threshold methodologies presented above, an alternative would be considered to have a significant impact on air quality if it would cause the following:

- Impact AQ-01: Conflict with or obstruct implementation of the applicable air quality plan
- Impact AQ-02: Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard
- Impact AQ-03: Expose sensitive receptors to substantial pollutant concentrations
- Impact AQ-04: Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people

3.5 Impact Evaluation

3.5.1 *Impact AQ-01: Would the Alternative Conflict with or Obstruct Implementation of the Applicable Air Quality Plan?*

NEPA Determination

Impacts. As discussed in Section 3.4.1, the applicable federal air quality plan is the general conformity program, which is to ensure that actions taken by the federal government do not undermine state or local efforts to achieve and maintain NAAQS. Before a federal action is taken, it must be evaluated for conformity with the SIP. Table 10 shows the annual construction emissions for the TSP. As shown, construction emissions would not exceed the applicable general conformity thresholds for any of the applicable criteria pollutants in the SFBAAB or SVAB under the TSP.

Table 10**Annual Construction Emissions for the TSP as Compared to Conformity Thresholds**

Construction Activities	Air Pollutant					
	ROG	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂
Year 2023 Within BAAQMD						
Dredging (tpy)	0.89	6.29	14.37	0.35	0.34	0.04
Worker Transport (tpy)	0.06	0.35	0.29	0.01	0.01	0.00
Sediment Transport (tpy)	1.46	29.43	9.64	0.21	0.2	0.05
Total Emissions (tpy)	2.41	36.07	24.3	0.57	0.54	0.09
SFBAAB de minimis Threshold (tpy)	50	100	100	--	100	100
Exceed?	No	No	No	No	No	No
Year 2023 Within YSAQMD						
Dredging (tpy)	0.0	0.0	0.0	0.0	0.0	0.0
Worker Transport (tpy)	0.0	0.0	0.0	0.0	0.0	0.0
Sediment Transport (tpy)	0.0	0.3	0.1	0.0	0.0	0.0
Total Emissions (tpy)	0.0	0.3	0.1	0.0	0.0	0.0
SVAB de minimis Threshold (tpy)	25	25	100	--	100	100
Exceed?	No	No	No	No	No	No

Table 11 shows the No Action Alternative (NEPA Baseline) and TSP emissions and Table 12 shows the annual operational emissions for the TSP as compared to the No Action Alternative (NEPA baseline). As shown, for the years 2022, 2030, or 2040, emissions would not exceed the applicable thresholds for any of the applicable criteria pollutants in the SFBAAB. This comparison uses BAAQMD thresholds because: 1) most of the impacts would occur in the SFBAAB; and 2) BAAQMD has more stringent thresholds than YSAQMD.

Table 11**Annual Operational Emissions for the No Action Alternative (NEPA Baseline) and TSP**

Operational Activities	Air Pollutant			
	ROG	NO _x	PM ₁₀	PM _{2.5}
No Action Alternative				
2022				
Vessels (tpy)	3.85	91.42	2.24	2.07
Tugs (tpy)	1.63	7.99	0.39	0.27
Total Emissions (tpy)	5.48	99.41	2.63	2.34
2030				
Vessels (tpy)	4.58	108.69	2.67	2.46
Tugs (tpy)	1.94	11.46	0.47	0.4

Operational Activities	Air Pollutant			
	ROG	NO _x	PM ₁₀	PM _{2.5}
Total Emissions (tpy)	6.52	120.15	3.14	2.86
2040				
Vessels (tpy)	5.43	128.85	3.16	2.91
Tugs (tpy)	2.3	14.55	0.55	0.5
Total Emissions (tpy)	7.73	143.4	3.71	3.41
TSP				
2022				
Vessels (tpy)	3.43	81.34	0.88	0.82
Tugs (tpy)	1.45	6.85	0.35	0.23
Total Emissions (tpy)	4.87	88.19	1.23	1.05
2030				
Vessels (tpy)	4.12	49.53	2.4	2.22
Tugs (tpy)	1.75	10.24	0.42	0.35
Total Emissions (tpy)	5.87	59.77	2.83	2.57
2040				
Vessels (tpy)	5.01	118.77	2.91	2.68
Tugs (tpy)	2.12	13.41	0.51	0.46
Total Emissions (tpy)	7.12	132.18	3.42	3.14

Table 12
Annual Operational Emissions for the TSP Compared to the No Action Alternative (NEPA Baseline)

Operational Activities	Air Pollutant			
	ROG	NO _x	PM ₁₀	PM _{2.5}
2022				
Vessels (tpy)	-0.42	-10.08	-1.36	-1.25
Tugs (tpy)	-0.18	-1.14	-0.04	-0.04
Total Emissions (tpy)	-0.61	-11.22	-1.4	-1.29
BAAQMD Thresholds (tpy)	50	100	100	100
Exceed?	No	No	No	No
2030				
Vessels (tpy)	-0.46	-59.16	-0.27	-0.24
Tugs (tpy)	-0.19	-1.22	-0.05	-0.05
Total Emissions (tpy)	-0.65	-60.38	-0.31	-0.29
BAAQMD Thresholds (tpy)	50	100	100	100
Exceed?	No	No	No	No

Operational Activities	Air Pollutant			
	ROG	NO _x	PM ₁₀	PM _{2.5}
2040				
Vessels (tpy)	-0.42	-10.08	-0.25	-0.23
Tugs (tpy)	-0.18	-1.14	-0.04	-0.04
Total Emissions (tpy)	-0.61	-11.22	-0.29	-0.27
BAAQMD Thresholds (tpy)	50	100	100	100
Exceed?	No	No	No	No

Because emissions would not exceed applicable NEPA thresholds, the TSP would result in less-than-significant impacts.

Mitigation Measures. No mitigation required.

Residual Impacts after Mitigation. Less than significant.

Cumulative Impacts. Construction and operational emissions associated with the TSP would be less than the conformity thresholds. Consequently, the air quality increases would not contribute to any cumulative impacts related to potential violations of air quality standards when considered in combination with other past, present, and reasonably foreseeable future activities within the study area.

CEQA Determination

Impacts. Table 13 shows the construction emissions associated with the TSP and compares them to applicable significance thresholds within the SFBAAB and SVAB. As shown, daily emissions would exceed BAAQMD's NO_x thresholds, and NO_x emissions would therefore be considered significant under CEQA.

Table 13
Annual Construction Emissions for the TSP as Compared to CEQA Thresholds

Construction Activities	Air Pollutant			
	ROG	NO _x	PM ₁₀	PM _{2.5}
Within BAAQMD				
Dredging	13	210	5	5
Sediment Transport and Placement	21	142	3	3
Worker Vehicles	1	4	0	0
Total	35	356	8	8
BAAQMD Threshold	54	54	82	54
Exceed?	No	Yes	No	No

Construction Activities	Air Pollutant			
	ROG	NO _x	PM ₁₀	PM _{2.5}
Within YSAQMD				
Dredging	0	0	0	0
Sediment Transport and Placement	0	2	0	0
Worker Vehicles	0	0	0	0
Total	0	2	0	0
YSAQMD Threshold	54	54	82	54
Exceed?	No	No	No	No

Table 14 presents the CEQA baseline operational emissions. Table 15 shows the net increase in operational emissions for the TSP in 2022, 2030, and 2040 compared to the CEQA baseline. Daily emissions would exceed BAAQMD's daily and annual NO_x significance thresholds in 2030 and 2040. This comparison uses BAAQMD thresholds because: 1) most of the impacts would occur in the SFBAAB; and 2) BAAQMD has more stringent thresholds than YSAQMD.

Table 14
CEQA Baseline (2014) and TSP Annual Emissions for Panamax Vessels

	ROG	NO _x	PM ₁₀	PM _{2.5}
CEQA Baseline (2014)				
Vessels (tpy)	3.25	77.02	1.89	1.74
Tugs (tpy)	1.38	6.73	8.7	0.33
Total Emissions (tpy)	4.63	83.75	10.59	2.07
TSP				
2020				
Vessels (tpy)	3.43	81.34	2	1.84
Tugs (tpy)	1.46	7.22	8.72	0.35
Total Emissions (tpy)	4.89	88.56	10.71	2.19
2030				
Vessels (tpy)	4.13	97.89	2.49	2.29
Tugs (tpy)	1.75	9.09	8.79	0.42
Total Emissions (tpy)	5.88	106.98	11.28	2.71
2040				
Vessels (tpy)	5.01	118.77	2.91	2.68
Tugs (tpy)	2.13	11.45	8.88	0.51
Total Emissions (tpy)	7.14	130.21	11.79	3.19

Table 15**Daily and Annual Net Increase in Operational Emissions for the TSP as Compared to CEQA Thresholds**

Operational Activities	Air Pollutant			
	ROG	NO _x	PM ₁₀	PM _{2.5}
Daily Emissions (ppd)				
2022				
Vessels	1	23.67	0.58	0.54
Tugs	0.42	2.67	0.1	0.1
Total Emissions	1.42	26.34	0.68	0.64
BAAQMD Thresholds	54	54	82 (exhaust)	54 (exhaust)
Exceed?	No	No	No	No
2030				
Vessels	4.82	114.38	3.29	3.03
Tugs	2.05	12.92	0.49	0.49
Total Emissions	6.87	127.3	3.78	3.52
BAAQMD Thresholds	54	54	82 (exhaust)	54 (exhaust)
Exceed?	No	Yes	No	No
2040				
Vessels	9.64	228.77	5.62	5.17
Tugs	4.09	25.84	0.98	0.98
Total Emissions	13.73	254.6	6.6	6.15
BAAQMD Thresholds	54	54	82 (exhaust)	54 (exhaust)
Exceed?	No	Yes	No	No
Annual Emissions (tpy)				
2022				
Vessels	0.18	4.32	0.11	0.1
Tugs	0.08	0.49	0.02	0.02
Total Emissions	0.26	4.81	0.12	0.12
BAAQMD Thresholds	10	10	15	10
Exceed?	No	No	No	No
2030				
Vessels	0.88	20.87	0.6	0.55
Tugs	0.37	2.36	0.09	0.09
Total Emissions	1.25	23.23	0.69	0.64
BAAQMD Thresholds	10	10	15	10
Exceed?	No	Yes	No	No

Operational Activities	Air Pollutant			
	ROG	NO _x	PM ₁₀	PM _{2.5}
2040				
Vessels	1.76	41.75	1.02	0.94
Tugs	0.75	4.72	0.18	0.18
Total Emissions	2.51	46.46	1.2	1.12
BAAQMD Thresholds	10	10	15	10
Exceed?	No	Yes	No	No

Mitigation Measures. As shown, NO_x emissions due to construction would primarily be generated from the dredger. USACE considered use of an electric dredger to reduce emissions. However, electric dredgers require a connection to land and are therefore not designed to work within an active marine system. Navigational constraints and the area needing to be dredged would preclude the use of electric dredgers. As discussed in Sections 2.7 and 3.3, marine vessels are assumed to comply with all ARB regulations ensuring tugs and vessel meet the highest required engine standards and use low sulfur fuel. No additional mitigation measures are available to reduce NO_x emissions associated with the dredging and associated marine transport emissions from construction to less-than-significant levels.

NO_x emissions associated with operational emissions would exceed the BAAQMD significance threshold in years 2030 and 2040. As described in the analysis of the No Action Alternative, although IMO- and ARB-led emissions reduction measures would likely reduce fleet emissions in the study area, they may not apply to all ships uniformly. Because the 38-Foot MLLW Alternative does not include any terminal specific work, it does not present a mechanism for imposing mitigation on shipping companies. Therefore, no mitigation is feasible to reduce these emissions.

Residual Impacts after Mitigation. Construction-related ROG and NO_x would remain significant and unavoidable, and operational NO_x emissions would remain significant and unavoidable in the future 2030 and 2040, but will not exceed thresholds in 2022 under CEQA.

Cumulative Impacts. The TSP's construction related ROG and NO_x emissions and the operational NO_x emissions would contribute to cumulative impacts related to potential violations of air quality standards and therefore result in a significant cumulative impact.

3.5.2 *Impact AQ-02: Would the Alternative Result in a Cumulatively Considerable Net Increase of Any Criteria Pollutant for Which the Project Region Is Nonattainment Under an Applicable Federal or State Ambient Air Quality Standard?*

NEPA Determination

Impacts. As shown in Tables 25 and 27, construction and operations under the TSP would not result in substantial emission increases. Consequently, the TSP would not cause or contribute to significant increases in air quality criteria pollutants as compared to the NEPA baseline.

Mitigation Measures. No mitigation required.

Residual Impacts after Mitigation. None.

Cumulative Impacts. Because the No Action Alternative would be unchanged from present and anticipated future conditions with respect to this resource, it would not contribute to cumulative impacts related to the potential increase in any air quality criteria pollutant for which the project region is in nonattainment status, when considered in combination with other past, present, and reasonably foreseeable future activities within the study area.

CEQA Determination

Impacts. As shown in Tables 28 and 29, construction and operations for the TSP would result in significant and unavoidable increases in emissions of NO_x. Consequently, the TSP would cause or contribute to significant cumulative increases in criteria pollutants for which the project region is in a nonattainment status.

Mitigation Measures. No feasible mitigation is available.

Residual Impacts after Mitigation. Significant and unavoidable.

Cumulative Impacts. The TSP's construction-related and operational NO_x emissions would contribute to cumulatively considerable net increases of criteria pollutants for which the project region is in nonattainment when considered in combination with other past, present, and reasonably foreseeable future activities within the study area. Therefore, impacts would be significant and unavoidable.

3.5.3 *Impact AQ-03: Would the Alternative Expose Sensitive Receptors to Substantial Pollutant Concentrations?*

NEPA and CEQA Determination

Impacts. The TSP includes construction and increased ship calls as compared to the CEQA baseline. The No Action also has increased ship calls (127) over the CEQA baseline (107). With the TSP, the number of ship calls is lower (113) than it would be without the project (127). However, emissions associated with construction and ship calls are not expected to expose sensitive receptors to substantial pollutant concentrations because emissions would occur in the existing ship channel, more than 1,000 feet from sensitive receptors. This impact is considered less than significant under NEPA and CEQA.

Mitigation Measures. No mitigation required.

Residual Impacts after Mitigation. None.

Cumulative Impacts. Construction and ship emissions associated with the No Action Alternative would be located more than 1,000 feet from sensitive receptors. Consequently, such emissions would not contribute to cumulative impacts related to exposing sensitive receptors to substantial pollutant concentrations and no cumulatively considerable impacts are expected under NEPA and CEQA from this alternative.

3.5.4 *Impact AQ-04: Would the Alternative Result in other Emissions (such as those leading to odors) Adversely Affecting a Substantial Number of People?*

NEPA Determination

Impacts. The TSP would include construction and a decrease in ship calls as compared to the No Action Alternative (NEPA baseline). Both activities would generate odors from diesel fuel combustion. However, construction dredging would occur in the ship channel, which is located at substantial distances from sensitive receptors. Similarly, the placement sites are also located at considerable distances from sensitive receptors. Operationally, fewer ships would travel in the ship channel than under the No Action Alternative, and these ships would dock at industrial locations, distant from sensitive receptors. Therefore, there would be no incremental odor impacts as a result of the TSP.

Mitigation Measures. No mitigation required.

Residual Impacts after Mitigation. None.

Cumulative Impacts. Due to the substantial distance of construction and operational odor emissions from sensitive receptors, the TSP would not contribute to cumulative impacts in odors when considered in combination with other past, present, and reasonably foreseeable future activities within the study area.

CEQA Determination

Impacts. The TSP would include construction and an increase in ship calls as compared to the CEQA baseline. However, construction dredging and disposal would occur in the ship channel, which is located at substantial distances from sensitive receptors. Although there would be an increase in ship calls, ships would travel in the ship channel and dock at locations that are distant from sensitive receptors. Therefore, there would be no incremental odor impacts as a result of the TSP.

Mitigation Measures. No mitigation required.

Residual Impacts after Mitigation. Less than significant.

Cumulative Impacts. Due to the substantial distance of construction and operational odor emissions from sensitive receptors, the TSP would not contribute to cumulative impacts in odors when considered in combination with other past, present, and reasonably foreseeable future activities within the study area.

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