US Army Corps
of Engineers®

Oakland Harbor Turning Basins Widening

Revised Draft Integrated Feasibility Report and Environmental Assessment

APPENDIX A1:

Biological Assessment

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bgs	below ground surface
BMP	best management practices
CCC	Central California Coast
CDFW	California Department of Fish and Wildlife
CEMP	California Eelgrass Mitigation Policy and Implementation Guidelines
Central Bay	Central San Francisco Bay
CFR	Code of Federal Regulations
cSEL	cumulative sound exposure level
dB	decibel
Delta	Sacramento-San Joaquin Delta
DMMO	Dredged Material Management Office
DPS	Distinct Population Segment
EFH	Essential Fish Habitat
ESA	Federal Endangered Species Act
ESU	evolutionarily significant unit
FHWG	Fisheries Hydroacoustic Working Group
IHTB	Inner Harbor Turning Basin
LTMS	Long-Term Management Strategy
mg/L	milligram per liter
MHEA	Middle Harbor Enhancement Area
MLLW	mean lower low water
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Unit
OBM/MS	Old Bay Mud/Merritt Sand
OHTB	Outer Harbor Turning Basin
PCB	polychlorinated biphenyl
PCE	primary constituent element
Port	Port of Oakland
RMS	root mean square
RWQCB	Regional Water Quality Control Board
SEL	sound exposure level
SPCC	Spill Prevention Control and Countermeasure
USACE	United States Army Corps of Engineers
USC	United States Code
USFWS	United States Fish and Wildlife Service

CHAPTER 1: INTRODUCTION

This Biological Assessment (BA) supports consultation with United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) as required by Section 7 of the federal Endangered Species Act (ESA), Public Law 93-205, 18 United States Code (USC) Section 1536, as amended, and Title 50, Code of Federal Regulations (CFR), Part 402. Section 7(a) of the ESA of 1973, as amended, requires federal agencies to consult with USFWS and NMFS to ensure that any action authorized, funded, or conducted by such agency is not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of designated critical habitat of such species. Section 7(c) of the ESA requires federal agencies to prepare a BA for the purpose of complying with Section 7(a) by identifying any threatened or endangered species, designated critical habitat, or species or habitat proposed as such that are likely to be affected by the Proposed Action (the Oakland Harbor Turning Basins Widening).

The following federally threatened, endangered, or candidate species, and designated or proposed critical habitats may be found within the Action Area:

- California least tern (Sternula antillarum browni)
- Southern Population of North American Green Sturgeon DPS (Acipenser medirostris) including critical habitat
- Steelhead, Central California Coast DPS (Oncorhynchus mykiss) including critical habitat
- Steelhead, Central Valley DPS (Oncorhynchus mykiss)
- Chinook Salmon, Sacramento winter-run ESU (Oncorhynchus tshawytscha)
- Chinook Salmon, Central Valley spring-run ESU (Oncorhynchus tshawytscha)
- Longfin Smelt, San Francisco Bay-Delta DPS (Spirinchus thaleichthys)

This BA presents technical information about the Proposed Action in sufficient detail to determine to what extent associated activities may affect any of the federally threatened, endangered, or candidate species, and designated or proposed critical habitats identified in the Action Area (the Action Area for the Proposed Action is defined in Section 3). This BA is prepared in accordance with legal requirements set forth under regulations implementing Section 7 of the ESA (50 CFR 402; 16 USC 1536 (c)).

The document is organized as follows:

- **Chapter 1: Introduction.** This section describes the federal action and regulatory environment pertaining to the Oakland Harbor Turning Basins Widening project. The project location and background are also described.
- **Chapter 2: Description of the Proposed Action.** This section provides a detailed description of the Proposed Action including construction and operations. This section also identifies avoidance and minimization measures integrated into the Proposed Action to avoid potential adverse effects to the environment.
- **Chapter 3. Action Area.** This section describes the "Action Area," defined as the extent of all areas that may be affected directly or indirectly by the federal action(s) and not merely the immediate area involved in the action.

- **Chapter 4. ESA-Listed Species and Resources.** This section identifies federal ESA threatened, endangered, and candidate species identified as having the potential to occur in the vicinity of the Proposed Action, as well as critical habitat in the Action Area.
- **Chapter 5. Environmental Baseline Conditions.** This section identifies baseline conditions for habitats in the Action Area, as well as the presence or potential presence of federal ESA–listed species and critical habitat in the Action Area.
- **Chapter 6. Effects of the Proposed Action.** This section provides a description of effects to federal ESA–listed species and critical habitat, as well as the effects determination and conclusions.
- **Chapter 7. Conclusion and Determination of Effects Summary.** This section summarizes the conclusions and determinations of effects to federal ESA–listed species and critical habitat.

A separate Essential Fish Habitat (EFH) Assessment has been prepared for the Proposed Action in accordance with Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act for EFH and Habitat Areas of Particular Concern.

1.1 Project Location and Background

The Port of Oakland further referred to as Oakland Harbor, is on the eastern side of San Francisco Bay (Figure 1-1). It includes the Entrance Channel, the Outer Harbor Channel and Outer Harbor Turning Basin (OHTB), and the Inner Harbor Channel and Inner Harbor Turning Basin (IHTB). The Outer Harbor Channel is immediately south of the San Francisco-Oakland Bay Bridge and is maintained to a depth of -50 feet mean lower low water (MLLW). The Outer Harbor Channel and OHTB serve the TraPac and Ben E. Nutter terminals. The Outer Harbor Channel also serves Berth 10, a dredged material rehandling site, which is at the eastern end of the Outer Harbor. The Inner Harbor Channel is also maintained to -50 feet MLLW. The Inner Harbor Channel and IHTB serve the following operating terminals: Oakland International Container Terminal, Matson Terminal, and Schnitzer Steel Terminal.

The existing federal navigation channel was designed for a ship with a capacity of 6,500 20-foot equivalent units, with a 1,139-foot length overall, 140-foot beam, and 48-foot draft, as part of the Oakland Harbor Navigation Improvement (-50-Foot) Project Study. The Proposed Action involves the expansion of the IHTB and OHTB in the Oakland Harbor. The need for this expansion arises from inefficiencies currently experienced by vessels in harbor, specifically in the turning basins, where the current fleet exceeds the maximum dimensions of the constructed -50-Foot Oakland Harbor Navigation Project. These inefficiencies are projected to continue and magnify into the future because the frequency and quantity of vessels exceeding the size of vessel for which the existing turning basins were designed for is expected to increase.

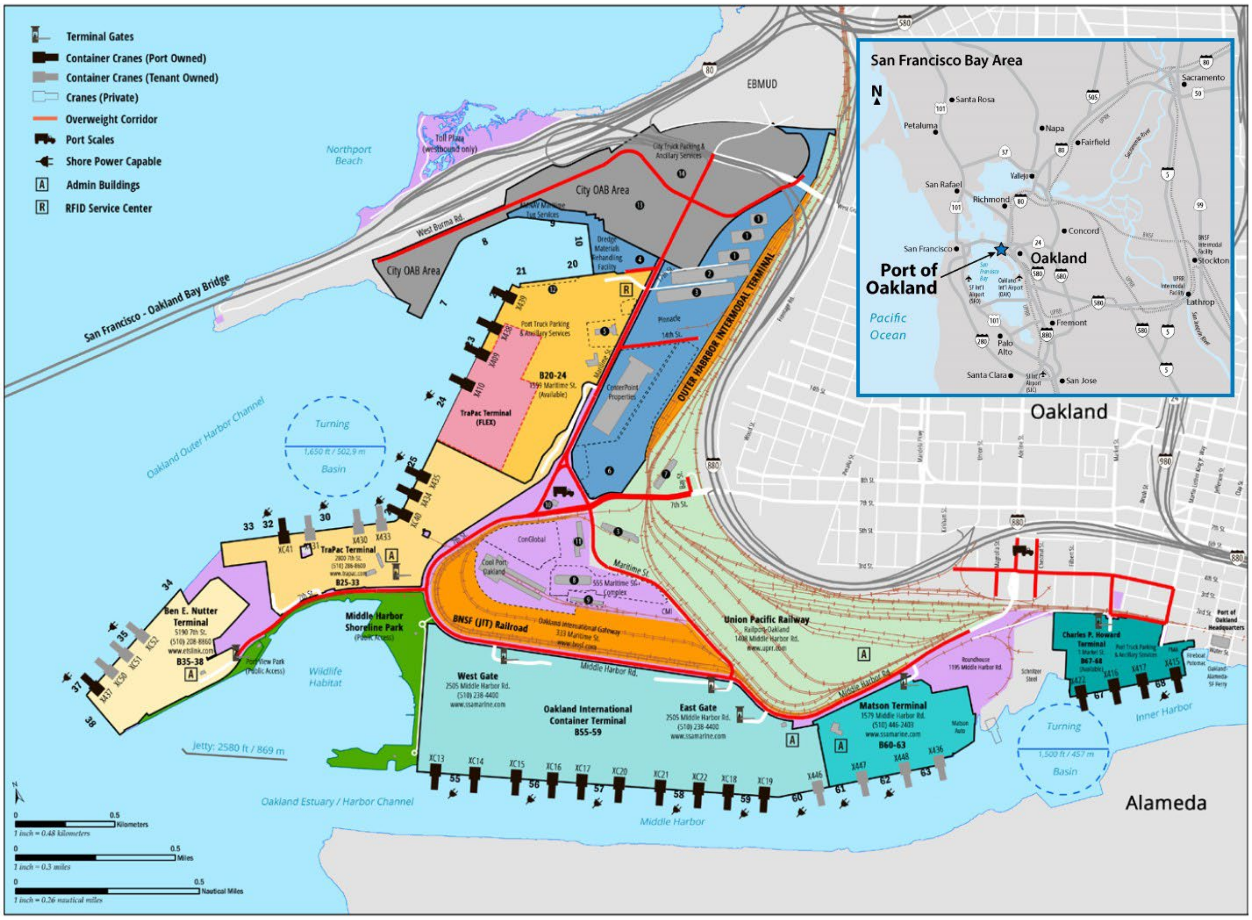

Figure 1-1Current Port of Oakland Navigation Features

CHAPTER 2: DESCRIPTION OF PROPOSED ACTION

The Proposed Action entails expansion of both the IHTB and OHTB. The proposed improvements and construction methods for each turning basin are described under Sections 2.1 and 2.2 below. Expansion of the turning basins would improve the efficiency of vessels entering and exiting the Port; however, the project would not change volumes of freight that are projected to come into the Port in the future.

2.1 Expansion of Inner Harbor Turning Basin

The expansion of IHTB consists of widening the existing IHTB from 1,500 feet to 1,834 feet, with a depth of -50 feet MLLW, consistent with the existing depth of the IHTB. In addition to in-water work to widen the IHTB, land would be impacted in two locations: Howard Terminal and private property along the Alameda shoreline (Figure 2-1).

Construction activities at Howard Terminal (in the northeastern corner of the widened IHTB on Figure 2-1) include removal of asphalt and concrete pavement, installation of a new bulkhead, removal of piles, and excavation of landside soil between the new bulkhead and existing rock dike. The construction of the new bulkhead includes installing steel sheet piles, steel pipe piles, and/or pre-cast, pre-stressed concrete piles through vibratory or impact pile-driving methods; 10 percent of the total piles are assumed to be installed through the aquatic environment. Subsequently, batter piles would be installed, additional material would be dredged, and rock would be removed. Following installation of the new bulkhead wall and batter piles and dredging/rock removal, rock would be installed for slope protection in the front of the new bulkhead wall. A typical rock slope protection section is shown on Figure 2-2.

Construction activities at the Alameda site (in the southeastern portion of the widened IHTB on Figure 2-1) would require partial demolition of two existing buildings, estimated to impact five warehouse bays. Like Howard Terminal, Alameda improvements include removal of asphalt and concrete pavement, installation of a new bulkhead, removal of piles, and excavation of landside soil between the new and existing bulkheads. The construction of the new bulkhead includes installing steel sheet piles, steel pipe piles, and/or pre-cast, pre-stressed concrete piles through vibratory or impact pile-driving methods; 10 percent of the total piles are assumed to be installed through the aquatic environment. Subsequently, batter piles would to be installed and the existing bulkhead would be removed, followed by dredging of material and removal of rock. Following installation of the new bulkhead wall and batter piles and dredging/rock removal, rock would be installed for slope protection in the front of the new bulkhead wall. A typical rock section is shown on Figure 2-2.

An approximately 300- to 400-foot long, in-water retaining structure may be required between the northwestern portion of the IHTB footprint and Schnitzer Steel property. Construction would include installation of steel sheet piles, steel pipe piles, and/or pre-cast, pre-stressed concrete piles by vibratory or impact pile-driving methods, through the aquatic environment. Batter piles and rock would be installed through the water column to stabilize the structure.

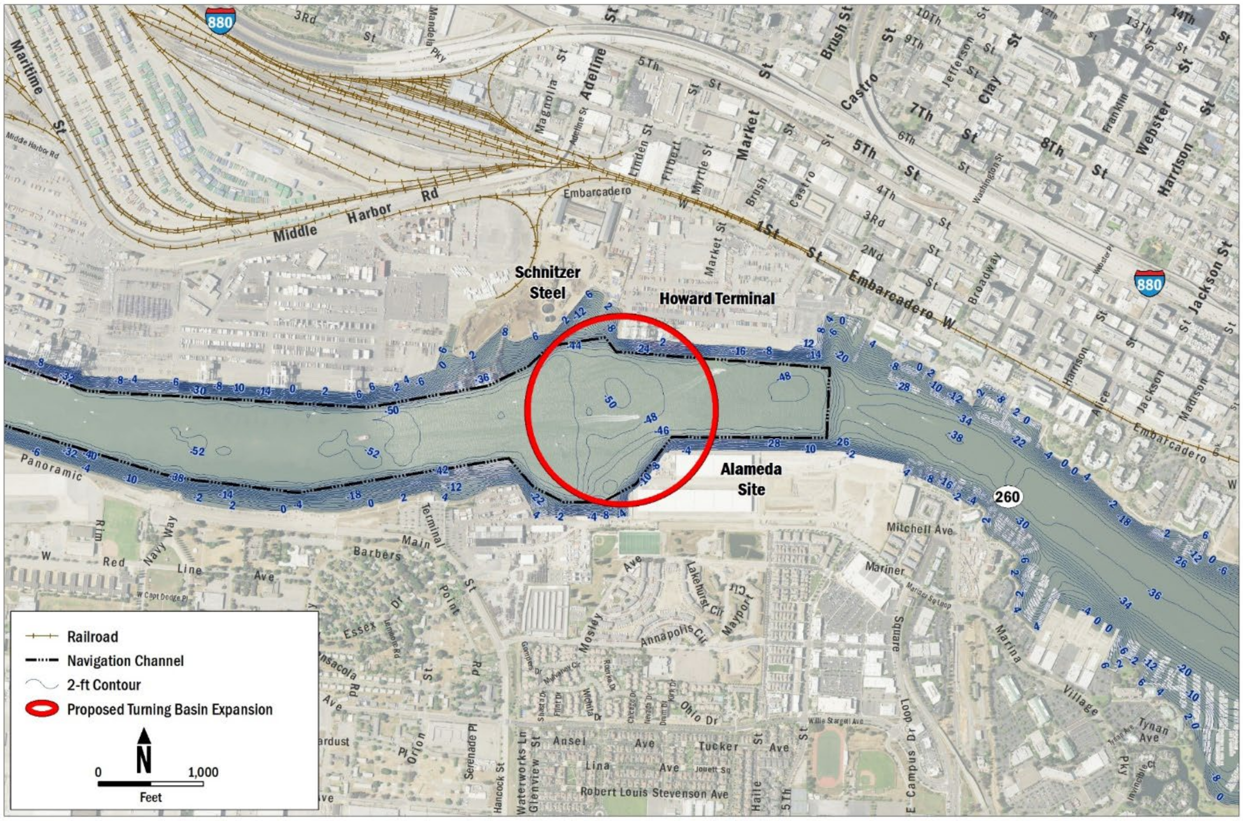

Figure 2-2Proposed Expansion of Inner Harbor Turning Basin

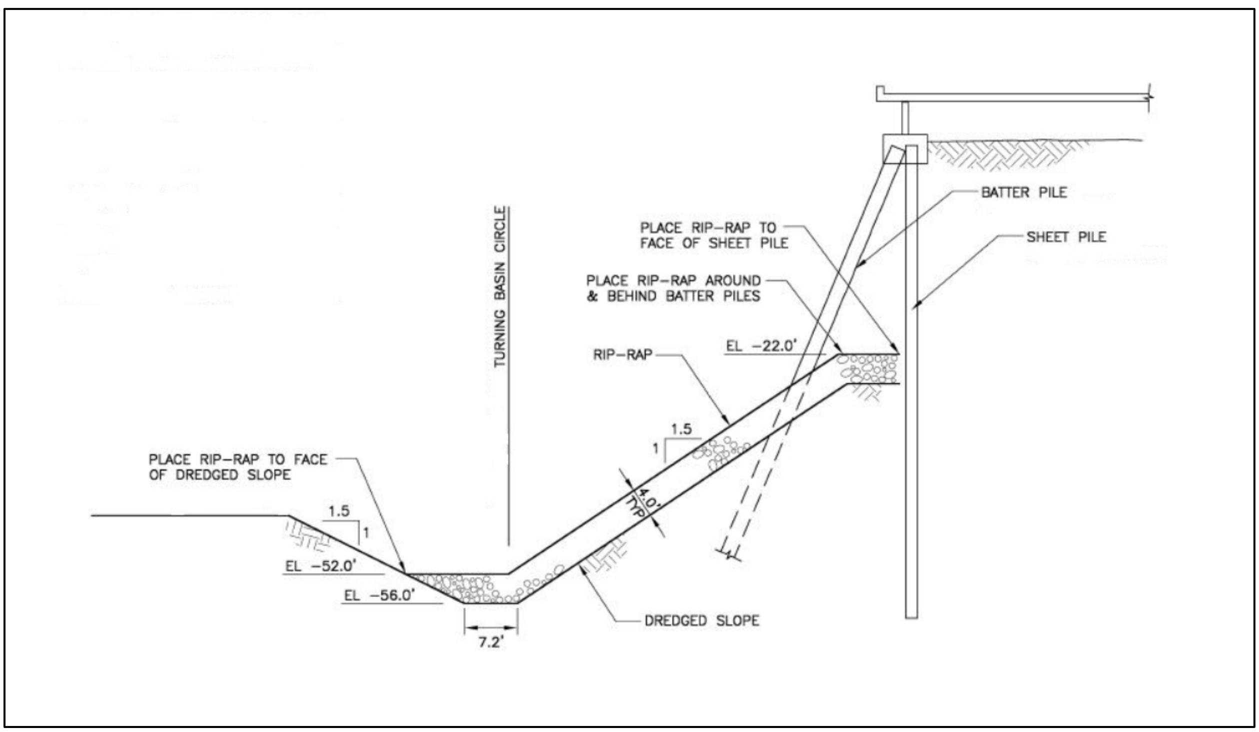

Figure 2-3Preliminary Bulkhead Wall Cross-Section

For the Howard Terminal and Alameda sites, landside excavation of soils would occur to a depth of approximately -5 feet MLLW, which is approximately 15 feet below existing ground surface elevations. Due to the historical industrial use of these sites and the documented presence of contaminants underlying portions of Howard Terminal, it is assumed that landside excavated materials would be disposed at a Class I or Class II landfill. Table 2-1 summarizes truck trip totals for the transportation of asphalt and concrete to a local recycler, and soils to a landfill. Material below the limits of landside excavation at each site would be dredged, with all suitable dredged material going to beneficial reuse. In addition, for both sites, the depth of sheet pile/bulkhead installation and removal is assumed to be between 65 and 125 feet below ground surface (bgs). Dredging of existing Inner Harbor sediments—that is, areas currently considered submerged lands—would also be required. Volumes of material to be excavated landside or dredged for this alternative are summarized in Table 2-2. A total area of approximately 800,100 square feet would be impacted by dredging and landside construction activities for the IHTB widening.

Construction staging, including a construction trailer, equipment and construction materials storage, and material stockpiles, would occur at Howard Terminal and the Alameda property, immediately adjacent to or close to the excavation areas.

Construction is expected to start in July 2027 with an approximate duration of 2 years and 4 months. Construction, excluding dredging, would occur Monday through Friday between the hours of 7 a.m. and 7 p.m. During the first year of construction, land-based activities would be completed at Howard Terminal. Marine-based pile removal activity is anticipated to be conducted at Howard Terminal during the 2027 in-water work window (June 1 through November 30). Marine-based dredging activity at Howard Terminal and in-water bulkhead and rock installation activities at Howard Terminal and nearby Schnitzer Steel are anticipated to be conducted during the 2028 in-water work window. Land-based construction at the Alameda property is anticipated to commence in April 2028 and take approximately 14 months to complete. Marine-based activities at the Alameda property (sheet pile/bulkhead removal and in-water installation, and rock installation), dredging at the Alameda property, and dredging of Inner Harbor sediments is anticipated to occur during the 2029 in-water work window. Most piles for the new bulkheads at Howard Terminal and Alameda would be installed landside; approximately 10 percent of the pile installation would require in-water work, which would be completed during the in-water work windows.

Table 2-1 Truck Trips for Hauling Demolished, Excavated and Dredged Materials

Location	Cubic Yards[1]	Trips[2]
HOWARD TERMINAL		
Class I landfill	2,900	290
Class II landfill	25,800	2,580
Recycler	22,900	2,290
ALAMEDA		
Class I landfill	8,000	800
Class II landfill	151,900	15,190
Recycler	101,600	10,160
INNER HARBOR SEDIMENTS		
Class II landfill	9,700	970
TOTAL		
Class I landfill	10,900	1,090
Class II landfill	187,400	18,740
Recycler	124,500	12,450
All	322,800	32,280

[1] Quantities include 10 percent contingency and applicable bulking factor (0 to 25 percent), and are rounded up to nearest hundredth

[2] Trip numbers are based on a 10-cubic-yard truck size.

Table 2-2 Inner Harbor Only Construction Actions

Action	Quantity[1]	Unit
Howard Terminal		
Pavement and wharf deck removal – area	180,600	square feet
Pile removal (total, 125-foot-long, 24-inch-diameter concrete piles)	800	Each
Landside soil excavation	24,900	cubic yards
Dredging (includes rock removal)	244,200	cubic yards
Bulkhead installation (total length)	850	linear feet
Bulkhead installation – in water (10 percent of total)	85	linear feet
Batter pile installation (total, 115-foot-long, 24-inch-diameter steel piles)	90	Each
Batter pile installation in water (10 percent of total)	9	Each
Rock installation	8,400	cubic yards
Impacted upland area	167,500	square feet
Schnitzer Site		
Bulkhead installation – in water	330	linear feet
Batter pile installation – in water	34	Each
Rock installation	6,000	cubic yards
Alameda Site		
Building demolition – area	175,900	square feet
Pavement and wharf deck – area	287,800	square feet
Pile removal (total, 65-foot-long, 24-inch-diameter concrete piles)	4,200	Each

Batter pile removal (total, 115-foot-long, 24-inch-diameter steel piles)	55	Each
Existing sheet pile removal length	900	linear feet
Landside soil excavation	159,900	cubic yards
Dredging (includes rock removal)	493,100	cubic yards
Bulkhead installation – total length	1,200	linear feet
Bulkhead installation – in water length (10 percent of total)	120	linear feet
Batter pile installation – total	122	Each
Batter pile installation – in water (10 percent of total)	12	Each
Rock installation	11,700	cubic yards
Impacted area (upland)	262,000	square feet
Inner Harbor Sediments (Dredged)		
Dredging	143,300	cubic yards
Impacted area (submerged land)	370,600	square feet
Total		
Building demolition – area	175,900	square feet
Pavement and wharf deck removal – area	468,400	square feet
Pile removal	5,000	Each
Batter pile removal	55	Each
Existing sheet pile removal length	900	linear feet
Landside soil excavation	184,800	cubic yards
Dredging (includes rock removal)	880,600	cubic yards
Bulkhead installation – total	2,380	Feet
Bulkhead installation – in water	535	Feet
Batter pile installation – total	246	Each
Batter pile installation – in water	55	Each
Rock installation	26,100	cubic yards
Impacted area	800,100	square feet

[1] Quantities include 10 percent contingency

Equipment for pavement removal, landside excavation, warehouse demolition, pile removal, sheet pile/bulkhead removal and installation, rock removal and installation, and batter pile installation and removal would include backhoes/front loaders, concrete saws, cranes, bulldozers, excavators, dump trucks, drilling rigs, barges, dive vessels, pile drivers, vibratory hammers, tugboats, compressors, and generators. Depending on the concurrent activities occurring over the course of construction, the number of construction workers at any given time would range from approximately 8 to 65 (excluding dredging operations, described below).

Excavated landside material, removed piles, and debris from warehouse demolition at the Howard Terminal and Alameda sites would be hauled off site for disposal at a landfill or recycling facility, as required. Current estimates, based on available information and past project experience, assume that approximately 5 to 10 percent of excavated landside material from the two sites would require disposal at a Class I landfill. Furthermore, it is assumed that approximately 90 to 95 percent of excavated landside material from the two sites would require disposal at a Class II landfill. General construction debris, including removed piles, concrete, pavement, and warehouse demolition debris would be transported to a local recycler. Truck trip totals for the Howard Terminal and Alameda sites are summarized in Table 2-1.

Dredging would be conducted with an electric-powered barge-mounted excavator dredge with a clamshell bucket; dredged material would be placed onto scows for transport for beneficial reuse, or to Berth 10 for rehandling prior to transport via truck to a landfill. Tugboats are required for positioning the barge and for towing the scows. It is assumed that approximately 7 percent of Inner Harbor sediments would require disposal at a Class II landfill, which would be rehandled at Berth 10 prior to truck transport. Truck trip totals for transport of Inner Harbor sediments from Berth 10 to a landfill are summarized in Table 2-1. Approximately 907,500 cubic yards of dredged materials from the Inner Harbor work locations are expected to be suitable for beneficial reuse. Approximately 26 workers would be required for the dredging operation, and approximately 28 workers would be required for rehandling operations at Berth 10. Dredging would be conducted 24 hours per day, 7 days per week. Best management practices (BMPs), such as silt and bubble curtains, would be used during dredging and in-water pile driving, when required, to minimize impacts to the aquatic environment.

2.2 Expansion of Outer Harbor Turning Basin

The OHTB would be widened from 1,650 feet to 1,965 feet. The proposed expanded OHTB relative to the current limits of the navigation channel is shown on Figure 2-3. This alternative involves dredging material to widen the basin to a depth of -50 feet MLLW, consistent with the existing depth of the OHTB.

To support electrical dredging for widening the OHTB without diverting power or using an outlet used by ships, electrical infrastructure would be added near Berth 26 at the Outer Harbor. An electrical switchgear would be constructed adjacent to the nearest existing substation, Substation SS-C-57, which is approximately 270 feet southeast from the water’s edge at Berth 26 and from which the dredging operator would then draw power used for the electrical dredging activities. A switchgear allows the Port to regulate, isolate, and meter power during dredging activities. A switchgear consists of switching devices that include circuit breakers, switches, fuses, isolators, relays, currents, potential transformers, indicating instruments, control panels, and other devices that together are referred to as a “switchgear.” The dredging operator would supply their own 12 kilovolt cable and terminations to directly connect to the Port’s switchgear. Once connected, the dredging operator would have an on-board system to regulate power during dredging activities.

Construction activities would include excavating a 2-foot-wide by 4-foot-deep trench for new conduits that run from the new switchgear to existing utility vaults and Substation SS-C-57 and backfilling this trench with controlled density fill and base rock before repaving with asphalt concrete. If an existing concrete slab at the site is unsuitable for the placement of the switchgear, excavation would be conducted for a new concrete foundation. Excavation would also be required for the placement of bollards and fencing that would be installed along the perimeter of the switchgear. The new switchgear would be UL-certified and tested prior to use.

The construction equipment is anticipated to include a backhoe/front loader, concrete saw, smooth drum roller, and dump truck. Approximately six workers would be required for this activity. The excavation for the foundations associated with the new switchgear, bollards, and fence posts, in addition to the trenching for the new conduit, would generate approximately 15 cubic yards of soil for disposal and 15 cubic yards of asphalt concrete for off-haul to a local recycling facility. The estimated construction duration for this activity is 3 months; it is anticipated that this work would commence in August 2027.

Dredge equipment includes an electric-powered barge-mounted excavator dredge with a clamshell bucket, scows for dredged material transport to the beneficial reuse site, and tugboats for positioning of the barge and towing the scows for transport to a beneficial reuse site. Approximately 26 workers would be required for the dredging operation. Dredging of the OHTB would be conducted for 6 months during the 2028 in-water work window (June 1 through November 30) and 2 months of the 2029 in-water work window. Dredging would be conducted up to 24 hours per day, 7 days per week. BMPs such as silt curtains would be used during dredging, when required, to minimize impacts to the aquatic environment.

Construction staging would occur at Berth 10, at the eastern end of the Outer Harbor. Table 2-3 summarizes volumes of dredged material for the Outer Harbor.

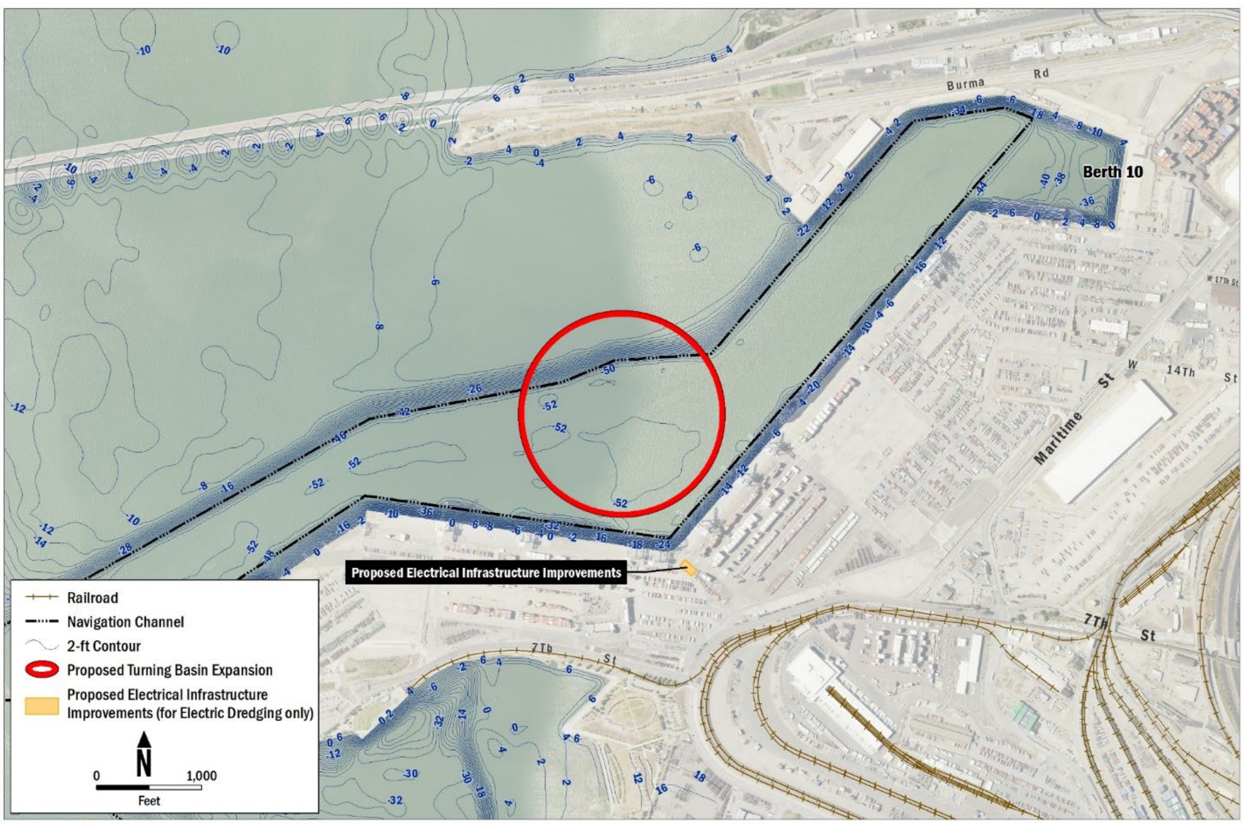

Figure 2-4Proposed Expansion of Outer Harbor Turning Basin

Table 2-3 Outer Harbor Sediments

TYPE OF SOIL (DREDGING)	QUANTITY	UNIT
Dredging	1,342,000	cubic yards
Impacted area (submerged land)	1,005,000	square feet

2.3 AVOIDANCE AND MINIMIZATION MEASURES

Environmental protection measures have been integrated into the Proposed Action to avoid potential adverse effects to the environment. These measures are considered an integral part of the Proposed Action and would be implemented by the United States Army Corps of Engineers (USACE), the Port, or their contractors during, prior to, or after the execution of the Proposed Action.

General Measures

- Marine-based construction and dredging would occur during the in-water work window (June 1 through November 30).
- A worker education program would be implemented for listed fish and shorebirds that could be adversely impacted by in-water construction activities. The program would include a presentation to all workers on biology, general behavior, distribution, habitat needs, sensitivity to human activities, legal protection status, and project-specific protective measures for each listed species. Workers would also be provided with written materials containing this information.
- Standard BMPs would be applied to protect species and their habitat(s) from pollution due to fuels, oils, lubricants, and other harmful materials. Vehicles and equipment that are used during the course of the project would be fueled and serviced in a manner that would not affect the aquatic environment.
- A Spill Prevention Control and Countermeasure (SPCC) plan would be prepared to address the emergency cleanup of any hazardous material, and would be available on site. The SPCC plan would incorporate SPCC, hazardous waste, stormwater, and other emergency planning requirements.
- Silt curtains would be used where specific site conditions demonstrate that they would be practicable and would effectively minimize any potential adverse effects caused by the mobilization of material that may cause adverse water quality conditions, or contain contaminants at levels in excess of applicable regulatory thresholds. Prior to in-water construction, a silt curtain would be deployed from the water’s edge and pushed out to the deployed location to avoid entrapping aquatic species.
- All dredging and in-water construction activities would be consistent with the standards and procedures set forth in the Long-Term Management Strategy (LTMS) for dredging in the San Francisco Bay waters to guide the disposal of dredged materials in an environmentally sound manner. Prior to construction, a sampling and analysis plan would be developed and implemented to characterize soils and sediments to be removed or exposed. In addition, a dredge operations plan would need to be submitted to all regulatory agencies before the start of dredge operations.
- Piles would be removed by direct pull or vibratory means, where possible; piles that cannot be pulled would, to the extent feasible, be cut 2 feet below the mudline or 2 feet below the overdredge depth elevation if they are in a navigable waterway.

- No pilings or other wood structures that have been pressure-treated with creosote would be installed.
- A Water Quality Monitoring Plan would be developed that specifies sample locations, depths, constituents, and objectives during in-water construction work. The Water Quality Monitoring Plan would also specify when work would be suspended for water quality exceedances, and potential BMPs to comply with turbidity requirements stated in the 401 Certification.

Dredging Measures

- Dredging would be conducted with a clamshell bucket dredger; there would be no hydraulic dredging. An environmental bucket would be used where technically feasible.
- No overflow or decant water would be allowed to be discharged from any barge, with the exception of spillage incidental to mechanical dredge operations, unless monitoring or relevant studies show the effects of such discharge are negligible.
- Multiple horizontal dredge cuts would be taken where a thick horizontal volume needs to be dredged to avoid overfilling the bucket and causing spillage.
- The load line on disposal barges used for mechanical dredging would be predetermined, and the barge would not be filled above this predetermined level. Before each disposal barge is transported to a placement site, the dredging contractor and a site inspector would certify that it is filled correctly.
- The cycle time would be increased as needed to reduce the velocity of the ascending loaded bucket through the water column, which reduces potential to wash sediment from the bucket.
- Floating debris would be removed from the water and disposed of properly.

Pile-Driving Measures

- To the extent feasible, pile driving shall not occur during the bird breeding season of February 1 to August 15. If such activities must occur during the bird breeding season, work areas plus an appropriate buffer area determined by a qualified biologist shall be surveyed by a qualified biologist to verify the presence or absence of nesting raptors or other birds. Pre-construction surveys shall be conducted within 15 days prior to the start of pile-driving work during the bird breeding season. If the survey indicates the potential presence of nesting raptors or other nesting birds, the biologist shall determine an appropriately sized buffer around the nest in which no work will be allowed until the young have successfully fledged, so that nesting birds are not disturbed by the project activity. The size of the nest buffer will be determined by the biologist, in coordination with USFWS, and will be based to a large extent on the nesting species and its sensitivity to disturbance. In general, buffer sizes of 200 feet for raptors and 50 feet for other birds should suffice to prevent disturbance to birds nesting in the urban environment, but these buffers may be increased or decreased, as appropriate, depending on the bird species and the level of disturbance anticipated near the nest, as necessary to avoid disturbance of nesting birds.
- A Hydroacoustic and Biological Monitoring Plan would be prepared prior to the start of construction. This plan would provide details on the methods used to monitor and verify sound levels during pile-driving activities. The plan would include specific measures to minimize exposure of marine mammals and fish to high sound levels.

- Construction monitoring would be conducted by qualified observers familiar with marine mammal species and their behavior. An "exclusion zone," defined as the area over which underwater sound levels may exceed Level A harassment thresholds for marine mammals, would be established during pile removal and installation work. The exclusion zone would be monitored for 15 minutes prior to any pile extraction and driving activities to ensure that the area is clear of any marine mammals. Pile extraction or driving would not commence until marine mammals have not been sighted within the exclusion zone for a 15-minute period. If a marine mammal enters the exclusion zone during pile replacement work, activity would continue, and the behavior of the animal would be monitored and documented. If the animal appears disturbed by the pile replacement activity, work would stop until the animal leaves the exclusion zone.
- To the extent feasible, all pilings or similar in-water structures would be installed and removed with vibratory pile drivers only. An impact pile driver would only be used where necessary to complete installation of piles or in-water structures in accordance with seismic safety or other engineering criteria. If impact driving is needed for in-water pile installation, the following measures would be implemented:
    - Prior to the start of impact pile driving, the project applicant would prepare an NMFS-approved sound attenuation monitoring plan to protect fish and marine mammals.
    - Piles driven with an impact driver would employ a "soft start" technique to give fish an opportunity to move out of the area before full-powered impact driving begins. Only a single impact hammer would be operated at a time.
    - The impact hammer would be cushioned using a 12-inch-thick wood cushion block during all impact hammer pile-driving operations.
    - During impact pile-driving of steel piles, a bubble curtain would be used to attenuate underwater sound levels.
    - The Port and USACE would monitor and verify sound levels during pile-driving activities. The sound monitoring results would be made available to NMFS and other regulatory agencies as needed.

Eelgrass-Related Measures

Prior to the start of any in-water construction, the Port and USACE would conduct a NMFS-approved eelgrass survey, consistent with the measures described in the NMFS October 2014 California Eelgrass Mitigation Policy and Implementation Guidelines (CEMP) (NMFS 2014). The survey would include the following:

- Before in-water construction activities occur in the marine environment, eelgrass surveys would be conducted in the Action Area and an appropriate reference site(s). Surveys would take place within 60 days before the start of construction, consistent with the methods outlined in the CEMP.
- After construction, a post-action survey of the eelgrass habitat in the Action Area and at an appropriate reference site(s) would be completed. Surveys would take place within 30 days of completion of construction, or within the first 30 days of the next active growth period that follows completion of construction and occurs outside of the active growth period.

- Areas of direct and indirect impact would be determined from an analysis that compares the pre-action condition of eelgrass habitat with the post-action conditions from this survey, relative to eelgrass habitat change at the reference site(s), in accordance with the methods described in the CEMP.

  If impacts to eelgrass are known to occur prior to construction or observed to occur after construction, the Port and USACE would develop a mitigation plan to achieve no net loss in eelgrass function, following the steps recommended in the CEMP. Potential mitigation options include comprehensive management plans, in-kind mitigation, mitigation banks and in-lieu-fee programs, and out-of-kind mitigation, as defined in the CEMP.

CHAPTER 3: ACTION AREA

The "Action Area" is defined as the extent of all areas that may be affected directly or indirectly by the federal action(s) and not merely the immediate area involved in the action [50 CFR 402.02]. For the purposes of the analysis, the Action Area extends beyond the direct project footprint described in the Description of the Proposed Action (Chapter 2).

To account for all areas that may be directly or indirectly affected by the Proposed Action, the Action Area includes the Proposed Action's construction footprint and a buffer that accounts for potential dredge plume effects on the aquatic environment, as well as potential underwater noise from pile driving that may exceed behavioral impact thresholds established for fish (see Section 6.1.1. for additional information). At the Outer Harbor, where no in-water pile driving is proposed, this includes a 250-meter (820-foot) dredge plume buffer surrounding the dredge boundary, consistent with LTMS guidance. At the Inner Harbor, where impact hammer pile driving may occur, this includes a maximum 736-meter (2,415-foot) buffer surrounding the impact pile-driving location where the established 150-decibel (dB) underwater noise threshold for behavioral impacts to fish may occur (also inclusive of the 250-meter [820-foot] buffer that accounts for dredge plume effects). The Action Area is shown on Figure 3-1.

The Proposed Action would include vessel transport routes between: 1) the IHTB and OHTB and dredged material placement sites, such as the Montezuma Wetlands Restoration Project, and 2) the IHTB and Berth 10, where sediments requiring landfill disposal would be dewatered. Avoidance and minimization measures for dredging activities, as described in Section 2.3, would minimize potential turbidity impacts during vessel transport by establishing load lines on barges and having fill levels inspected prior to transport. Therefore, movement of the dredge, transport scows, and other construction vessels would not be expected to increase turbidity above ambient ranges generated by natural hydrologic processes, weather, and existing vessel traffic. As such, this activity would have no impacts to ESA listed species. While technically part of the Action Area, the haul routes will not be discussed further in this BA since none of the impacts discussed in relation to the construction area apply.

Airborne noise from construction of the Proposed Action may extend outside of the Action Area, but would not affect sensitive terrestrial habitats (i.e., nesting or breeding habitat for California least tern described in Section 5.3.1).

Figure 3-5Action Area

3.1 BASELINE CONDITIONS

General Characteristics and History

The Port is situated on the eastern shoreline of Central San Francisco Bay (Central Bay), often referred to as the Oakland-Alameda Estuary. The estuary was originally a shallow tidal slough connected to Lake Merritt but was partially dredged in the mid- to late-1800s to create a viable port and shipping channel. The shipping channel is now dredged annually to a design depth of -50 feet MLLW to support shipping operations in the Port. Freshwater inflow to the Oakland-Alameda Estuary is provided from natural creeks, human-made stormwater drainage facilities, and direct surface runoff. Tidal and wind-driven currents also influence the estuary. Sediment to the Oakland-Alameda Estuary is contributed from other portions of the San Francisco Bay Estuary, as well as vicinity shorelines and creeks, which cause siltation of the existing turning basins and shipping channels, necessitating annual maintenance dredging. Dredged material from Oakland Harbor has typically been less than 80 percent sand.

Aquatic habitat throughout the Action Area is likely affected by vessel traffic, industrial activity, and maintenance dredging activities. The entirety of the aquatic habitat in the Action Area occurs in or adjacent to areas serviced by shipping vessels. Existing waterfront facilities at the Inner Harbor include Howard Terminal and Schnitzer Steel, while the Outer Harbor is adjacent to the Outer Harbor Terminal and the TraPac Terminal. Several of the facilities surrounding Action Area waters serve industrial or commercial activities. Maintenance dredging in the existing ITHB and OHTB and navigation channels occurs annually.

The Action Area aquatic habitat falls within the "San Francisco Bay, Central" waterbody as included in the 2018 California 303(d) list of water quality limited segments (State Water Resource Control Board 2018a). San Francisco Bay, Central, is a Category 5 waterbody, which includes water segments where standards are not met for one or more pollutants, and a Total Maximum Daily Load is required but not yet completed. Pollutants identified for the San Francisco Bay, Central include the following:

- Chlordane
- DDT
- Dieldrin
- Dioxin compounds
- Furan compounds
- Invasive species
- Mercury
- Polychlorinated biphenyls (PCBs)
- Selenium
- Trash

The Oakland Inner Harbor area also includes indicator bacteria as a pollutant source (State Water Resource Control Board 2018b).

Background turbidity in San Francisco Bay is naturally high, with total suspended solids levels ranging up to more than 200 milligrams per liter (mg/L) (Rich 2010), and typically varying from 10 mg/L to more than 100 mg/L (SFEI 2011). Waters in the navigation channels and turning basins are naturally turbid because of the resuspension of sediments from wind, waves, and tides.

Aquatic habitat in the Action Area can be divided among the following classes: pelagic open water, intertidal, and benthic habitats. Each of these aquatic habitat types is described in the following sections. The Action Area does not include wetlands or non-San Francisco Bay water features.

Pelagic (Open Water)

Pelagic (open water) habitat includes the open water column between the water's surface and the Bay floor in the Action Area. The physical conditions of the open-water environment change constantly with tidal flow, storm runoff, and weather conditions. As a result, San Francisco Bay waters vary in temperature, salinity, dissolved oxygen, and turbidity depending on water depth, location, and season. Pelagic habitat in San Francisco Bay is predominantly inhabited by planktonic organisms, fish, and marine mammals.

The Goals Report (Goals Project 1999) subdivides the open bay habitats into two habitat subunits: deep bay and shallow bay. Deep bay habitat is defined as those portions of San Francisco Bay deeper than 18 feet below MLLW, including the deepest portions of San Francisco Bay and the largest tidally influenced channels. The regularly dredged navigation channels throughout San Francisco Bay, such as the IHTB, OHTB, and navigation channels, also meet this definition. Shallow bay is defined as that portion of San Francisco Bay above 18 feet below MLLW, which comprises most of San Francisco Bay.

Most of the Action Area occurs in the navigation channels where channel depths are maintained to the design elevation of -50 feet MLLW, thereby meeting the Goals Project definition of deep open bay habitat. Shallower open water areas are present in the Action Area at the margins of the navigation channels. Deep and shallow estuarine pelagic habitats are discussed in the following subsections.

Deep Estuarine Pelagic

Deep estuarine pelagic waters may provide habitat to free-swimming invertebrates such as California Bay shrimp (*Crangon franciscorum*), and fishes such as Brown Rockfish (*Sebastes auriculatus*), halibut (*Hippoglossus* sp.), and sturgeon (*Acipenser* sp.). Deepwater habitat may also serve as a migratory pathway for anadromous fish such as Chinook Salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*). Waterbirds such as surf scoter (*Melanitta perspicillata*), scaups (*Aythya* spp.), brown pelican (*Pelecanus occidentali*s), and terns (*Sterna* spp.) may forage, roost or loaf in these open waters, particularly in areas protected from strong winds and waves. Marine mammals may also frequent deep estuarine pelagic waters, such as Pacific harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*), and harbor porpoise (*Phocoena phocoena*). The entirety of the dredged federal navigation channel is classified as deep estuarine pelagic habitat.

Shallow Estuarine Pelagic

Shallow open bay habitat may function as a feeding area for Pacific Herring (*Clupea pallasii*), northern anchovy (*Engraulis mordax*), bat ray (*Myliobatis californica*), and jacksmelt (*Atherinopsis californiensis*), as well as at least 40 other species of fish, crabs, and shrimp. Spawning habitat for Pacific Herring occurs on hard substrates and eelgrass (*Zostera marina*) along the shallow margins of the Central Bay. Shallow bay habitat is also a nursery area for juvenile halibut and sanddabs (*Citharichthys stigmaeus*), shiner perch (*Cymatogaster aggregata*), herring, and other fishes. Similar to deep estuarine pelagic waters, anadromous fish may use shallow open bay waters as migratory pathways. Shallower waters also provide important avian foraging habitat for diving bird species. Marine mammals may also be present, such as Pacific harbor seals. Some shallow water areas are also suitable habitat for eelgrass, a seagrass species that provides spawning habitat for Pacific Herring and foraging habitat for the California least tern (*Sterna antillarum browni*). The shallow portions of the Action Area occur on the northern margins of the OHTB and at the outer margins of the IHTB.

Intertidal Habitat

Intertidal habitats are the regions of the Action Area that lie between low and high tides. There is very limited intertidal habitat in the Action Area, consisting of seawalls, piles, and rock riprap. In the Outer Harbor portion of the Action Area, intertidal habitat is limited to portions of the existing seawall that are exposed and inundated during tidal cycles. Intertidal habitat in the Inner Harbor portion of the Action Area is also predominantly seawall surfaces, but may also include piles that support above-water structures. The Inner Harbor portion of the Action Area also includes short lengths of rock-riprapped shoreline in the intertidal zone. These rock-riprapped shoreline areas, however, occur outside of the immediate expansion area footprint.

Invertebrate taxa associated with intertidal habitat in the San Francisco Bay shoreline include balanoid barnacles (*Balanidae* spp.) in the high and middle intertidal zones; and limpets, mussels (*Mytilus* spp.), and Olympia oysters (*Ostrea lurida*) in the lower middle and low intertidal zones. Common intertidal algae species in the Central Bay include sea lettuce (*Ulva* spp.), rockweed (*Fucus gardneri*), red algae species (*Polyneura latissima* and *Gigartina* spp.) and nonnative brown algae species (*Sargassum muticum*) (NOAA 2007). Typically, the high intertidal zone is dominated by sea lettuce; the middle intertidal zone is dominated by sea lettuce, rockweed, and red algae; and the low intertidal zone is dominated by brown algae (NOAA 2007). When inundated, intertidal areas may also be frequented by fish and other aquatic species.

Benthic Habitat

Benthic habitat includes the channel bottom and associated biota in and adjacent to the navigation channels and turning basins. In subtidal areas, the predominant benthic habitat in the Central Bay is composed of unconsolidated soft sediment with a mixture of mud, silt, and clay; and lesser quantities of sand, pebbles, and shell fragments (NOAA 2007). Sediment in the Oakland Harbor is predominately fine-grained (USACE 2019). Areas outside of the turning basins and navigation channels, where annual dredging does not occur, are typical of San Francisco Bay waters and have primarily silty mud and sand substrates that are naturally no more than 25 feet deep (City of Oakland 2021). Benthic habitat also less commonly includes hard substrates such as piers, breakwaters, and riprap.

Benthic communities in the harbor and channel areas of the Central Bay are affected by increased water flow and sedimentation. Relatively high numbers of subsurface deposit feeding polychaetes and oligochaetes inhabit these areas, including *Tubificidae* spp., *Mediomastus* spp., *Heteromastus filiformis*, and *Sabaco elongatus*. Community complexity and abundance also supports relatively high abundances of three carnivorous polychaete species: *Exogone lourei*, *Harmothoe imbricata*, and *Glycinde armigera* (City of Oakland 2021). Other commonly occurring benthic species in the Central Bay include the obligate amphipod filter-feeder *Ampelisca abdita*, the tube dwelling polychaete *Euchone limnicola* (City of Oakland 2021), clams (including the overbite clam, *C. Amurensis* or *Corbula*), amphipods such as *Monocorophium* and *Ampelisca*, polychaete worms, and bay mussels (SFEP 1992). Larger mobile benthic invertebrate organisms are also present in the Central Bay, such as blackspotted shrimp (*Crangon nigromaculata*), bay shrimp (*Crangon franciscorum*), Dungeness crab (*Metacarcinus magister*), and slender rock crab (*Cancer gracilis*; City of Oakland 2021).

Benthic hard substrates such as piers, breakwaters, and riprap provide colonization habitat for benthic invertebrates. Common species include algae, barnacles (*Balanus glandula* and *Chthamalus fissus*), mussels, tunicates, bryozoans, cnidarians, and crabs.

Several common benthic species in Central Bay were accidentally or intentionally introduced, such as the eastern oyster (*Crassostrea virginica*), the Japanese littleneck clam (*Tapes philippinarum*), and the soft-shelled clam. Some of these nonindigenous species serve ecological functions similar to those of the native species that they have displaced, while other species have reduced phytoplankton populations, and consequently impacted the zooplankton populations and organisms that depend on them.

Benthic biota provide an important food source for carnivorous fishes, marine mammals, and birds in San Francisco Bay's food web. Communities of benthic organisms also play a vital role in maintaining sediment and water quality and are important indicators of environmental stress, because they are particularly sensitive to pollutant exposure.

Sediment Quality

Dredging may resuspend constituents of concern in the water column if they are present in the surface sediments. Sediment quality in the Action Area is therefore relevant to this BA.

For the Howard Terminal and Alameda portions of the IHTB expansion Action Area, landside excavation of soils would occur to a depth of approximately -5 feet MLLW, which is approximately 15 feet below existing ground surface elevations. At both sites, material below the depth excavated from land would be dredged following removal of the existing bulkhead.

Howard Terminal Excavation and Dredging Footprint. Ongoing data collections indicate low levels of hydrocarbons in the fill at or near the range of groundwater tidal movement (ENGEO 2019). In addition, metals have been detected in soils above groundwater; however, they are present at concentrations consistent with Merritt/Posey formation sands that were likely mined for fill (Apex 2021). Old Bay Mud, Merritt Sand, and Posey Formations (OBM/MS) material are likely present in fills below the 8-foot bgs groundwater elevation, including in the proposed dredging footprint that occurs below 15 feet bgs. There are no specific data regarding the fill quality between the groundwater elevation and the underlying OBM/MS interface where dredging would occur; however, there is no mechanism for contaminants to be transported to depths between 10 feet bgs and 60 feet bgs (Apex 2021). Because the fill is marine-derived, it is unlikely that the deeper fill is contaminated. Therefore, sediments below the groundwater table are likely suitable for beneficial reuse.

Alameda Excavation and Dredging Footprint. The -50-Foot Project previously removed a corner of the Alameda property to expand the IHTB to its current dimensions. The material that would be removed for this project is adjacent to the material removed for the -50-Foot Project and has no additional or new sources of contamination, and therefore should be similar to the material removed for the -50-Foot Project. Based on the previous testing results, it is unlikely that the material below groundwater would contain any contaminants to prevent beneficial reuse (Apex 2021).

Inner Harbor Turning Basin Expansion Area Open Water Dredging Footprint. There are two areas in the proposed IHTB expansion area that are subtidal: the basin between Howard Terminal and Schnitzer Steel, and a portion of the current Port Berth 67. With project implementation, both of these areas would require dredging to a depth of -50 feet MLLW.

During the -50-Foot Project, Berth 67 was tested to allow deepening from the currently maintained depth of -42 feet MLLW with 2 feet of overdepth allowance, to -50 feet MLLW with 2 feet of overdepth allowance; however, the dredging was not completed by the Port. The material tested to support Berth 67 dredging was approved by the Dredged Material Management Office (DMMO) agencies for beneficial reuse as wetland noncover (USACE

1998). Because the deepening material has not been exposed to any new contaminant sources since the testing was completed, it can be assumed that the material from Berth 67 would still be suitable for wetland noncover (Apex 2021).

There is a lack of site-specific information about the quality of the sediment in the basin between Howard Terminal and Schnitzer Steel. However, a few things can be assumed from the site history and the stratigraphy. First, as with other areas, the OBM/MS formation underlying the basin should be free of contaminants and suitable for any beneficial reuse. This was true even in areas that contained significant contamination in the overlying areas such as the Drydock Pits on the Alameda side of the channel, which had a similar use to the Oakland side Moore Shipyard, and that were removed for the -50-Foot Project. Material above OBM/MS may contain contaminants that would preclude open-water disposal or beneficial reuse as cover. If the material is similar to the Drydock Pits, it would also not be suitable for use as wetland noncover. It is reasonable and conservative to assume that the material above OBM/MS would require landfill disposal in a Class II (nonhazardous) landfill (Apex 2021).

Outer Harbor Turning Basin Expansion Area Open Water Dredging Footprint. The OHTB expansion area is divided into two definable units: a Young Bay Mud layer, and an underlying OBM/MS layer. Data from samples collected for the -50-Foot Project close to the proposed OHTB expansion area suggest that the Young Bay Mud layer sediments would be suitable for habitat creation, noncover; and the OBM/MS strata should be considered clean and suitable for any disposal or reuse (Apex 2021).

Eelgrass

Small patches of eelgrass have been observed in both the Inner and Outer Harbors, as shown in Appendix A. The nearest patch at the Outer Harbor is approximately 167 meters (548 feet) northeast of the proposed OHTB expansion area. The nearest patch in the Inner Harbor occurs more than 500 meters (1,640 feet) west of the proposed IHTB expansion area, adjacent to the Alameda Island Shoreline (Merkel and Associates 2021).

Oakland Middle Harbor Enhancement Area

Situated outside of the Action Area, the 180-acre Middle Harbor Enhancement Area (MHEA) is adjacent to Middle Harbor Shoreline Park. The MHEA is approximately 1,500 feet south of the proposed OHTB expansion footprint and 10,500 feet northwest of the proposed IHTB expansion footprint. The MHEA supports a variety of migratory birds, including wading shorebirds and burrowing owls. The MHEA restoration entails creation of shallow wildlife habitats through beneficial reuse of dredged material. Habitats present include intertidal and shallow subtidal soft-bottom habitat and eelgrass. Phase I of the eelgrass planting took place in June 2019 and a supplemental planting occurred in August 2022. The minimum target eelgrass acreage for the MHEA is 15 acres.

3.2 Terrestrial Habitats

Terrestrial habitat in the Action Area includes the industrialized shoreline of the IHTB. Project activities for the OHTB expansion are limited to in-water dredging, landside electrical infrastructure improvements near Berth 26, and upland staging and material rehandling in the existing Berth 10 dredged material rehandling facility.

Upland industrial and maritime support facilities in the immediate IHTB expansion area include Howard Terminal and warehouses at the Alameda site. Above mean higher high water, the facility shorelines consist of seawalls or pile-supported hardscaping. Inland facility areas are characterized by offloading equipment, concrete or asphalt staging and parking areas, shipping containers, material stockpiles, warehouses, dry docks, and roadways. Upland vegetation is very limited, composed of ruderal vegetation and isolated ornamental shrubs and trees. Operations at facilities in the vicinity of the IHTB include metal recycling at Schnitzer Steel; Port logistical operations such as vessel berthing and truck and container parking at Howard Terminal; and a variety of services such as warehousing, vessel docking, ferry operations, and commercial retail on the Alameda shoreline.

Approximately half of the Berth 10 facility is constructed on a pile-supported concrete wharf, and the remaining half is on asphalt-covered land. The facility is enclosed by a system of gravel and earthen berms topped with concrete "K" rail. The "K" rail also divides the facility into two sections (SFRWQCB 2013). Vegetation at the facility is extremely limited, consisting only of ruderal vegetation occurring in earthen areas at the margin of concrete and asphalt-covered land. The proposed electrical infrastructure improvements near Berth 26 would occur in an area that is completely developed and paved, and devoid of vegetation.

Developed, landscaped, and ruderal areas can provide cover, foraging, and nesting habitat for a variety of birds, as well as some reptiles and small mammals, especially those that are tolerant of disturbance and human presence. These types of habitat are, however, of limited value compared to natural habitat. Developed upland areas are unlikely to provide habitat to federally listed terrestrial species potentially occurring in the Action Area vicinity.

Avian species common to highly developed urban areas have potential to nest in ruderal shrubs, street trees, or building roofs in the Action Area. Potentially present species include the nonnative house sparrow (*Passer domesticus*), rock pigeon (*Columba livia*), and European starling (*Sturnus vulgaris*); and native species such as house finch (*Haemorhous mexicanus*), American goldfinch (*Spinus tristis*), white-crowned sparrow (*Zonotrichia leucophrys*), Brewer's blackbird (*Euphagus cyanocephalus*), and mourning dove (*Zenaida macroura*). The Oakland-Alameda Estuary also supports loafing gulls; recent surveys at the Howard Terminal recorded presence of ring-billed, California, and western gulls (*Larus californicus, L. delawarensis, L. occidentalis*) (City of Oakland 2021). Peregrine falcons (*Falco peregrinus*) have nested on the easternmost crane on the Howard Terminal waterfront since approximately 2015; however, these cranes are moved along the Howard Terminal waterfront and would not be present in the expansion area at the time of construction. Osprey (*Pandion haliaetus*) are also regularly seen at the Port terminals.

Small mammals may also occur in industrial and maritime support facilities in the Action Area. Species common to developed areas include striped skunk (*Mephitis mephitis*) and raccoon (*Procyon lotor*), and nonnatives such as Virginia opossum (*Didelphis virginiana*), Norway rat (*Rattus norvegicus*), black rat (*Rattus rattus*), and feral cat (*Felis silvestris catus*). Bat roosting may occur in vacant or infrequently used buildings in the Action Area, potentially including the common Mexican free-tailed bat (*Tadarida brasiliensis*) (City of Oakland 2021).

The former Alameda Naval Air Station has hosted a breeding colony of California least terns since at least 1976, though it may have been used for breeding and rearing young prior to documentation (H.T. Harvey and Associates 2012). The colony is approximately 1.5 miles southwest of the IHTB and is outside of the Action Area.

CHAPTER 4: ESA-LISTED SPECIES AND RESOURCES

This chapter identifies federal ESA threatened, endangered, and proposed species identified as having the potential to occur in the vicinity of the Proposed Action, as well as critical habitat in the Action Area. Data sources reviewed to identify resources occurring in the Action Area include the following:

- USFWS Information for Planning and Consultation report search of Oakland Harbor navigation channels, turning basins, and shoreline (USFWS 2021)
- CDFW California Natural Diversity Database search of Oakland Harbor navigation channels, turning basins, and shoreline (CDFW 2021)
- Waterfront Ballpark District at Howard Terminal Draft Environmental Impact Report (ESA 2020)
- Biological Assessment/EHF Assessment for the San Francisco Bay to Stockton, California Navigation Improvement Study (USACE 2019)
- Final Environmental Assessment/Environmental Impact Report for Maintenance Dredging of the Federal Navigation Channels in the San Francisco Bay Fiscal Years 2015-2024 (USACE and RWQCB 2015)

Review of these data sources showed that several species could be eliminated from the analysis in this BA because they are considered not present, or habitat does not exist in the Action Area. Appendix B provides a comprehensive list of species identified as potentially present in the region, including species not carried forward for analysis in this BA. As listed in Table 4-1, there are seven federal ESA–listed species known or considered to have the potential to occur in the Action Area, and potential effects to all seven species are assessed in this BA.

Table 4-4 Federally Listed Species Occurring or Potentially Occurring in the Action Area

SPECIES	
BIRDS	
California least tern (*Sternula antillarum browni*)	FE
FISH	
Southern Population of North American Green Sturgeon DPS (*Acipenser medirostris*)	FT/CH
Steelhead, Central California Coast DPS (*Oncorhynchus mykiss*)	FT/CH
Steelhead, Central Valley DPS (*Oncorhynchus mykiss*)	FT
Chinook Salmon, Sacramento winter-run ESU (*Oncorhynchus tshawytscha*)	FE
Chinook Salmon, Central Valley spring-run ESU (*Oncorhynchus tshawytscha*)	FT
Longfin Smelt, San Francisco Bay-Delta DPS (*Spirinchus thaleichthys*)	FP

Status: Federal status (determined by USFWS): CH = Critical Habitat; FE = Federally Listed Endangered; FP – Federal Proposed Species for Listing; FT = Federally Listed Threatened
DPS = distinct population segment
ESU = evolutionarily significant unit

Designated critical habitat has been established in the Action Area for two aquatic species: North American Green Sturgeon Southern Distinct Population Segment (DPS) and Steelhead Central California Coast (CCC) DPS. There is no designated critical habitat for terrestrial species in the Action Area.

4.1 Aquatic Species

This section provides a description of the life history, threats, and critical habitat (if applicable) for federal ESA–listed aquatic species identified as potentially present in the Action Area. A description of each species' likely occurrence in the Action Area is provided in Section 5.2.

North American Green Sturgeon Southern DPS

Life History

Green Sturgeon are the most widely distributed members of the sturgeon family and the most marine-oriented of the sturgeon species, entering rivers only to spawn. Green Sturgeon are thought to spawn every 3 to 5 years in deep pools with turbulent water velocities; they prefer cobble substrates but may use substrates ranging from clean sand to bedrock. Females produce 60,000 to 140,000 eggs that are broadcast to settle into the spaces between cobbles. Adult Green Sturgeon migrate into freshwater beginning in late February, with spawning occurring in the Sacramento River in late spring and early summer (March through July), with peak activity in April and June. After spawning, juveniles remain in fresh and estuarine waters for 1 to 4 years and then begin to migrate out to sea (Moyle et al. 1995). The upper Sacramento River has been identified as the only known spawning habitat for Green Sturgeon in the southern DPS (Moyle 2002). According to studies, Green Sturgeon adults begin moving upstream through San Francisco Bay during winter (Kelly et al. 2003). Adults in the Sacramento-San Joaquin Delta (Delta) are reported to feed on benthic invertebrates, including shrimp, amphipods, and occasionally small fish (Moyle et al. 1995), while juveniles have been reported to feed on opossum shrimp (*Acanthomysis* sp. and *Neomysis mercedis*) and amphipods. In the bays and estuaries, sufficient water flow is required to allow adults to successfully orient to the incoming flow and migrate upstream to spawning grounds.

Sub-adult and adult Green Sturgeon occupy a diversity of depths for feeding and migration. Tagged adults and sub-adults in San Francisco Bay and the Delta have been observed occupying waters with shallow depths of less than -33 feet MLLW, either swimming near the surface or foraging along the bottom. Sturgeon tagged in the Sacramento River have been reported captured in coastal and estuarine waters to the north of San Francisco Bay (Miller and Kaplan 2001). During periods of migration, adults occur throughout San Francisco Bay and the Delta, while juveniles are present in southern San Francisco Bay year-round, mostly south of the Dumbarton Bridge (NMFS 2015).

Juvenile distribution and habitat use are still largely unknown, and juveniles are presumed present year-round in all parts of the San Francisco Bay Estuary (Israel and Klimley 2008) but in low densities. Juvenile rearing habitats for Green Sturgeon include spawning areas and migration corridors. Rearing habitat use varies depending on seasonal flows and temperatures, and juvenile Green Sturgeon are strong swimmers with the ability to select or avoid habitats.

Threats

A primary factor for the decline of the Green Sturgeon is the restriction of spawning habitat to a limited area below Keswick Dam. Insufficient flow velocities to initiate the upstream spawning migration also contribute to this decline (Kohlhorst et al. 1991 as cited in CDFG 2002; NMFS 2008). Reduced flows have been identified as a factor in weakened year class recruitment in the white sturgeon population and are believed to have the same effect on Green Sturgeon recruitment. In addition, numerous agricultural water diversions exist in the Delta along the migratory route of larval and juvenile sturgeon. Entrainment and impingement in water pumps and screens are considered serious threats to sturgeon during their downstream migration. Sturgeon are also susceptible to uptake of contaminants from contaminated sediments through both dermal contact and incidental ingestion of sediments while feeding. Bioaccumulation is also a concern due to their long lives. All of the above threats were identified by the NMFS Biological Review Team as potentially affecting the continued existence of the Southern DPS Green Sturgeon (70 Fed. Reg. 17386).

Critical Habitat

Critical habitat for the Green Sturgeon includes the Sacramento River, the Delta, and Suisun and San Pablo Bays along with all of San Francisco Bay below the higher high-water elevation (NMFS 2009). This includes the Action Area.

Primary constituent elements (PCEs) essential to the conservation of Green Sturgeon 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 compose Green Sturgeon PCEs, estuarine habitat is the only habitat type that occurs in the Action Area and could be affected by the Proposed Action. Components of the PCE include:
    - **Food resources:** Green Sturgeon require abundant prey items in estuarine habitats and benthic substrate for juvenile, adult, and subadult life stages. Adult and subadults prey on ghost shrimp (*Palaemonetes paludosus*), amphipods, clams, juvenile Dungeness crab, anchovies, sand lances, ling cod (*Ophiodon elongatus*), and other unidentified fish. Juveniles feed on shrimp (*Artemia* spp.), amphipods, isopods, clams, annelid worms, and unidentified crabs and fishes.

- **Water flow***:* Sufficient water flow into San Francisco Bay and the 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 to 21.9 degrees Celsius [°C]) and salinity range (8.8 to 32.1 parts per thousand), and a wide range of dissolved oxygen (6.54 to 8.89 mg/L).
- **Migratory corridor***:* The migratory corridor should allow for safe and timely passage of sturgeon in estuarine habitats and between estuarine and riverine or marine habitats. Adults enter the San Francisco Bay 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 San Francisco Bay and the Delta in shallow depths ranging from 1 to 3 meters (3.3 to 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.

Steelhead, Central California Coast DPS

Life History

Steelhead are anadromous and nearly indistinguishable from resident rainbow trout that also reside in the same streams in which they spawn, except for steelhead being larger when hatched (Moyle 2002). Winter-run steelhead are at or near sexual maturity when they enter freshwater during late fall and winter, and spawn from late December through April, with the peak between January and March. Juvenile steelhead typically rear in freshwater for a longer period than other salmonids, ranging from 1 to 3 years. However, the actual time is highly variable with the individual. Throughout their range, steelhead typically remain at sea for one to four growing seasons before returning to freshwater to spawn (Burgner et al. 1992).

Steelhead typically enter San Francisco Bay in early winter, using the main channels in San Francisco Bay and the Delta to migrate to upstream spawning habitat, as opposed to small tributaries. However, migrating steelhead may be seen in San Francisco Bay and Suisun Marsh as early as August (Leidy 2000). Migrating fish require deep holding pools with cover such as underwater ledges and caverns. Coarse gravel beds in riffle areas are used for egg laying and yolk sac fry habitat once eggs have hatched. Because juvenile steelhead remain in the creeks year-round for several years while rearing, adequate flows, suitable water temperatures, and an abundant food supply are necessary to sustain steelhead populations. The most critical period is in summer and early fall when these conditions become limiting. Additionally, steelhead require cool, clean, well-oxygenated water, and appropriate gravel for spawning. Spawning habitat condition is strongly affected by water flow and quality, especially temperature, dissolved oxygen, shade, and silt load; these condition effects can greatly affect the survival of eggs and larvae (NMFS 2006).

Little is known about transit times and migratory pathways of steelhead in San Francisco Bay. A 2008 to 2009 study on the migration and distribution of juvenile hatchery-raised steelhead released in the lower Sacramento River show that steelhead spend an average of 2.5 days in transit in the San Pablo and San Francisco Bays (Klimley et al. 2009). The study concluded that transit time was greater in the upper San Francisco Bay Estuary than in the lower estuary (San Francisco Bay). This could be due to the lower salinity in the upper estuary that serves as a transition zone between freshwater and saltwater, allowing steelhead to transition from freshwater to saltwater. Once steelhead reach San Francisco Bay, salinities are similar to ocean water, which may lead steelhead to spend less time in this portion of the estuary. Studies conducted by NMFS (NMFS 2001) and CDFW (Baxter et al. 1999) indicate that the primary migration corridor is through the northern reaches of the Central Bay (Raccoon Straight, which is between Angel Island and the Tiburon Peninsula of mainland Marin County, and north of Yerba Buena Island). CCC steelhead have small spawning runs in multiple San Francisco Bay tributaries including San Leandro Creek, approximately 5 miles southeast of the Action Area (Goals Project 2000).

Steelhead are primarily drift feeders and may forage in open water of estuarine subtidal and riverine tidal wetland habitats (Leidy 2000). The diet of juvenile steelhead includes emergent aquatic insects, aquatic insect larvae, snails, amphipods, opossum shrimp, and small fish (Moyle 1976). Adults may also feed on newly emergent fry (Leidy 2000). Steelhead usually do not eat when migrating upstream and often lose body weight (Pauley and Bortz 1986).

Distribution of steelhead includes coastal river basins from the Russian River south to the Soquel and Aptos Creeks, California (inclusive), and the drainages of San Francisco and San Pablo Bays, including the Napa River. They are also known to migrate to the South Bay, where they spawn in the Guadalupe River, Coyote Creek, and San Francisquito Creek. Also included are adjacent riparian zones, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay from San Pablo Bay to the Golden Gate Bridge.

Threats

Threats specific to CCC steelhead include ongoing impacts from urbanization and diversion facilities (including small diversions as well as large dams) which continue to impair habitat and limit species viability; ongoing threats associated with urban expansion and illegal marijuana cultivation; and climate change (NMFS 2016b). 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 Federal Register 36075; USACE 2019). Other threats to steelhead include agricultural operations, forestry operations, gravel extraction, illegal harvest, streambed alteration, unscreened or substandard fish screens on diversions, suction dredging, urbanization, water pollution, wetland loss, potential genetic modification in hatchery stocks resulting from domestication selection, incidental mortality from catch-and-release hooking, and climatic variation leading to drought, flooding, variable ocean conditions, and predation (NMFS 2007; USACE 2019).

Critical Habitat

Critical habitat includes all natal spawning and rearing waters, migration corridors, and estuarine areas that serve as rearing areas accessible to listed steelhead in coastal river basins, from the Russian River to Aptos Creek (inclusive), and the drainages of San Francisco and San Pablo Bays. Also included are adjacent riparian zones, all waters of San Pablo Bay west of the Carquinez Bridge, and all waters of San Francisco Bay to the Golden Gate Bridge (USFWS 2000). This includes the Action Area.

PCEs essential to the conservation of the CCC Steelhead DPS include:

- Freshwater spawning sites with water quality and substrate conditions that can support spawning, incubation, and larval development. This PCE does not occur in the Action Area, and therefore would not be affected by the Proposed Action.
- Freshwater rearing sites with water quality and floodplain connectivity to support juvenile growth, mobility, foraging, and development. This PCE does not occur in the Action Area, and therefore would not be affected by the Proposed Action.
- 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. This PCE does not occur in the Action Area, and therefore would not be affected by the Proposed Action.
- Freshwater migration corridors free of obstruction and excessive predation with water quality conditions and natural cover to support juvenile and adult mobility and survival. This PCE does not occur in the Action Area, and therefore would not be affected by the Proposed Action.
- 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.

<u>Steelhead, Central Valley DPS</u>

Life History

Central Valley DPS Steelhead have a similar life history as CCC Steelhead, as described in Section 4.1.2. Distribution of this species historically occurred throughout the Sacramento and San Joaquin River systems: from the upper Sacramento/Pit River systems south to the Kings and possibly Kern River systems in wet years (Yoshiyama et al. 1996). Currently, the Central Valley Steelhead DPS includes steelhead in all river reaches accessible to the Sacramento and San Joaquin rivers and their tributaries in California (NMFS 2000). Also included are river reaches and estuarine areas of the Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco–Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas of the San Joaquin River upstream of the Merced River confluence and areas above specific dams identified, or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years; NMFS 2000).

Unlike CCC Steelhead, Central Valley Steelhead rearing is not known to occur at San Leandro Creek. The primary migration corridor for Central Valley Steelhead is similar to that used by migrating salmon in San Francisco Bay, and occurs through Raccoon Straight north of Angel Island.

Threats

Major threats to Central Valley DPS Steelhead include loss of historical spawning habitat and degradation of remaining habitat, including flow diversions. Despite completion of several fish passage and habitat restoration projects, these habitat losses remain a major threat to this DPS. Genetic threats from the stocking program are a continuing major threat to the Central Valley DPS of steelhead; per the NMFS 2016 5-year review for this species, information released since the preceding 2011 review suggests a loss of genetic diversity and population structure over time. Further, recent drought conditions will likely contribute to reduced abundance and productivity of this DPS (NMFS 2016c).

Critical Habitat

Critical habitat for the Central Valley DPS Steelhead was designated throughout the Central Valley (NMFS 2005a). Critical habitat for the species is divided into multiple hydrologic units by watersheds in the Central Valley; none occur in San Francisco Bay or the Action Area.

Chinook Salmon, Sacramento Winter-Run ESU

Life History

The Chinook Salmon is the largest and least abundant species of Pacific salmon. Like all salmonids, the Chinook Salmon is anadromous; but unlike steelhead, Chinook Salmon are semelparous (i.e., they die following a single spawning event). The Sacramento River winter-run Chinook Salmon evolutionarily significant unit (ESU) was listed as an endangered species on January 4, 1994 and includes all populations of winter-run Chinook Salmon in the Sacramento River and its tributaries in California (NMFS 1993).

Chinook Salmon feed on aquatic and terrestrial invertebrates and salmon eggs in freshwater. In intertidal areas, Chinook Salmon feed on amphipods, insects, and fish larvae. During the oceanic life stage, Chinook Salmon feed on fish, large crustaceans, and squid (Hallock and Fisher 1985). Chinook Salmon, like other salmonids, typically minimize foraging energy cost by feeding on drift species via sit-and-wait predation. When sit–and–wait habitats are sparse, salmonids tend to select benthic invertebrates as prey (Orgon 2015).

Sacramento River winter-run Chinook Salmon enter San Francisco Bay between November and May or June. Their migration into the Sacramento River begins in December and continues through early August, with the majority of the run occurring between January and May and peaking in mid-March (Hallock and Fisher 1985). Adults enter freshwater in an immature reproductive state, similar to spring-run Chinook Salmon. However, winter-run

Chinook Salmon move upstream much more quickly, and then hold in the cool waters below Keswick Dam for an extended period before spawning.

Adults use the coastal waters of California, migrating through the Golden Gate, Central Bay, North Bay, San Pablo Bay, and Suisun Bay and into the Sacramento River. Out-migrating juveniles follow the same path in reverse. Studies conducted by NMFS (2001) and CDFW (Baxter et al. 1999) indicate that the primary migration corridor is through the northern reaches of the Central Bay (Raccoon Straight and north of Yerba Buena Island).

In general, winter-run Chinook spawn in the area from Redding downstream to Tehama from mid-April through August. At present, winter-run Chinook Salmon occur only in the Sacramento River below Keswick Dam. Fry and smolts emigrate downstream from July through March through the Sacramento River, reaching the Delta from September through June.

Threats

According to the most recent 2016 NMFS 5-year review, factors responsible for this ESU's decline include blockage of access to historic habitat, other passage impediments, degradation of remaining available habitat, unscreened water diversions, heavy metal pollution from mine runoff, disposal of contaminated dredge sediments in San Francisco Bay, ocean harvest, predation, drought effects, losses of juveniles at the Central Valley Project and State Water Project Sacramento-San Joaquin Delta pumping facilities, and elevated water temperatures at the spawning grounds (NMFS 2016a).

Some threats to this ESU have increased since the preceding 2011 review, and despite actions to address threats, the ESU continues to decline in abundance. Impacts from factors such as drought, diseases, and poor survival conditions have increased since the 2011 review, and most likely have contributed substantially to the declining abundance of the ESU. Regulatory and other actions have been implemented since 2011 to address declines, which include controlling water temperatures with cold water releases, augmenting annual spawning gravel, stabilizing mainstem flows, removing impeded fish passages, restricting harvests, and reducing Delta export pumping.

Critical Habitat

Critical habitat for the winter-run Chinook Salmon includes the Sacramento River from Keswick Dam; Shasta County (River Mile 302) to Chipps Island (River Mile 0) at the westward margin of the Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco–Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge (NMFS 1993). This does not include the Action Area.

<u>Chinook Salmon, Central Valley Spring-Run ESU</u>

Life History

The spring-run Chinook Salmon has a similar life history to the winter-run salmon as discussed above, but begins its spawning migration to the Delta in late winter to spring.

Adults occur in San Francisco Bay during the migratory period in the spring, and juveniles have the potential to inhabit San Francisco Bay in the fall, winter, and spring. As with other Chinook Salmon in San Francisco Bay, telemetry studies tracking the movement of juvenile salmonids suggest that the primary migration corridor is through the northern reaches of Central Bay (Raccoon Straight and north of Yerba Buena Island; NMFS 2001, Baxter et al. 1999), and no spawning or rearing habitat for listed runs of Chinook Salmon exist in close proximity to the Action Area.

Threats

As part of its 5-year reviews for this ESU, NMFS completed a five-factor analysis of species threats from the following: 1) the present or threatened destruction, modification, or curtailment of its habitat or range; 2) over-utilization for commercial, recreational, scientific, or education purposes; 3) disease or predation; 4) inadequacy of existing regulatory mechanisms; or 5) other natural or human-made factors affecting its continued existence. The most recent 5-year review for this ESU from 2016 builds on and cites the findings from previous reviews, including the preceding 2011 review. According to these sources, major threats to the Central Valley spring-run ESU of Chinook Salmon include loss of historical spawning habitat, degradation of habitat, and genetic threats from hatchery influences (NMFS 2011, 2016a).

Other threats pertaining to the five-factor analysis remain applicable to this ESU, but are not identified as major threats. Issues pertaining to ocean harvest, disease, or predation, and inadequacy of existing regulatory mechanisms remain unchanged since the 2011 review. Drought conditions from 2012 to 2015 likely reduced the abundance of brood during those years, which likely impacted the abundance of returning adults in 2015 through 2018.

Critical Habitat

Critical habitat for the spring-run Chinook Salmon includes all river reaches accessible in the Sacramento River and its tributaries in California; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco–Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge (NMFS 2005b). This does not include the Action Area.

<u>Longfin Smelt</u>

Life History

Longfin Smelt, a small anadromous fish that was historically among the most abundant fish in the San Francisco Bay estuary and the Delta. The San Francisco Bay-Delta DPS of Longfin Smelt is currently proposed for listing as endangered under the federal ESA (USFWS 2022). Significant declines in Longfin Smelt abundance have occurred throughout its range during the past quarter century. Longfin Smelt are distinguished by their long pectoral fins, which reach or nearly reach the base of their pelvic fins. They reach a maximum size of about 150 millimeters (total length) and reach maturity near the end of their second year. As they mature in the fall, adults found throughout San Francisco Bay migrate to brackish or freshwater in Suisun Bay, Montezuma Slough, and the lower reaches of the Sacramento and San Joaquin Rivers. Spawning occurs primarily from January through March, after which most adults die (CDFG 2009a). In April and May, juveniles are believed to migrate downstream to San Pablo Bay. Juvenile Longfin Smelt are collected throughout San Francisco Bay during the late spring, summer, and fall, and occasionally venture offshore as far as the Gulf of the Farallones. Juveniles typically inhabit the middle and lower portions of the water column. Longfin Smelt are most likely to occur in the Central Bay during the late summer months before migrating upstream in fall and winter. Adult Longfin Smelt prey primarily on opossum shrimp in the San Francisco Bay-Delta estuary. In addition, copepods and other crustaceans make up a significant component of the Longfin Smelt's diet and may be of particular importance to juvenile fish (LSA 2012).

Threats

The annual abundance of Longfin Smelt is significantly and positively correlated with the amount of freshwater flow during spawning and larval periods (Stevens and Miller 1983; Hieb and Baxter 1993; Jassby et al. 1995; Baxter 1999). The following three factors have been identified as potentially responsible for this significant correlation: 1) a reduction in predation during high flows; 2) increased habitat availability that may improve survival by reducing intraspecies competition; and 3) an increase in nutrients stimulating the base of the food chain (Stevens and Miller 1983). However, the relationship changed to substantially lower Longfin Smelt abundance after the introduction of the invasive Amur River clam (*Corbula amurensis*) in the late 1980s. This corresponded with a decline in phytoplankton and zooplankton abundance due to grazing by the Amur River clam (Bennett et al. 2002). Other introduced species such as striped bass and inland silversides have had an impact on Longfin Smelt populations due to predation (CDFG 2009b). In 2004, numbers of Longfin Smelt (along with other pelagic species, including Delta Smelt, striped bass, and threadfin shad) exhibited a sharp decline in abundance that continues to the present. The pelagic organism decline phenomenon is currently under investigation to better understand how stock-recruitment effects, declines in habitat quality, increased mortality rates, and reduced food availability due to invasive species may be working separately or together to contribute to the declining abundance of Longfin Smelt and other pelagic species.

4.2 TERRESTRIAL SPECIES

California Least Tern

Life History

The California least tern (*Sterna antillarum*) is the smallest member of the subfamily Sternidae (family Laridae), measuring about nine inches long with a 20-inch wingspread. The California least tern has gray upper plumage, white under plumage, a distinctive black cap, and black stripes from the cap across the eyes to the beak. Least terns typically feed in shallow estuaries or lagoons where small fish are abundant. Its most common prey species include jacksmelt (*Atherinopsis californiensis*), topsmelt (*Atherinops affinis*) and northern anchovy (*Engraulis mordax*) (Elliott et al. 2007). When looking for prey, they hover above the water and plunge to its surface when fish are spotted. Eelgrass is particularly important to the California least tern, which can forage on small fishes associated with the eelgrass.

The least tern breeds in California from mid-May to August. California least terns create scrape nests in the sand or among shell fragments at established breeding colonies. After mating, females lay their eggs in shallow depressions on barren to sparsely vegetated sites near water, usually on sandy or gravelly substrate. The California least tern typically departs California in August and winters in Latin America.

There is a California least tern breeding colony are at the former Alameda Naval Air Station on Alameda Island, approximately 1.5 miles southwest of the IHTB. The former Naval Air Station on Alameda Point has hosted a breeding colony since at least 1976, and possibly earlier (H.T. Harvey and Associates 2012). Least terns have been observed to forage primarily along the breakwaters and shallows of the southern shoreline of the former Naval Air Station Alameda and in Ballena Bay from May through August (USACE and RWQCB 2015). California least terns are known to use the MHEA for foraging and roosting (USACE and RWQCB 2015).

Threats

Threats to the California least tern include loss and degradation of habitat, expansion of urban development, and disturbances due to human activities (e.g., people and/or their pets disturbing nesting areas, motorized vessels in foraging areas). Other threats to California least tern include effects from climate change, disturbances due to altered hydrological conditions, and an increasing predator population, both native and introduced, which can cause a significant level of loss to a nesting colony from brief disturbance (Scott et al. 2005; Scott and Goble 2006; USFWS 2006).

CHAPTER 5: ENVIRONMENTAL BASELINE CONDITIONS

5.1 Action Area Habitats

Aquatic and terrestrial habitats in the Action Area are described in detail in Chapter 3. Aquatic habitats include deep pelagic open waters in the existing turning basins and navigation channels; shallower pelagic open waters at the margins of the turning basins and navigation channels; limited intertidal habitat consisting of seawalls, piles, and rock riprap; benthic habitat composed of deposited sediment in the turning basins and navigation channels, silty mud and sand substrates in areas less than 25 feet deep (areas that are not maintenance dredged), and in lesser quantities on hard substrates such as piers, breakwaters, and riprap. Terrestrial habitats include the industrialized shoreline of the IHTB and the Berth 10 dredged material rehandling facility, which contain very limited vegetation. Each of these habitat types is substantially affected by existing and historic operations at the Port and other industrial or marine support facilities. Upland habitats in the Action Area are unlikely to provide substantial habitat to any ESA-listed species.

Chapter 3 provides additional discussion of habitats outside of the Action Area, including the MHEA and former Alameda Naval Air Station on Alameda Island. Although these areas would be unaffected by the Proposed Action, these areas provide habitat for California least tern, and are therefore described to provide context to the impact analysis.

5.2 Aquatic Special-Status Species in the Action Area

This section describes the potential presence of federal ESA–listed aquatic species in the Action Area. Potential species presence has been determined based on species habitat requirements and distribution trends, and recorded occurrences in or near the Action Area.

Fish species occurrence data are available from CDFW studies and surveys, including trawl surveys. Most CDFW surveys occur in the Delta and terminate in Suisun or San Pablo Bay, outside of the Action Area. Only the San Francisco Bay Study (Bay Study; CDFW 2018) includes the entirety of San Francisco Bay, including the Action Area.

The Bay Study was established in 1980 to determine the effects of freshwater outflow on the abundance and distribution of fish and mobile crustaceans in the San Francisco Estuary, primarily downstream of the Delta. The Bay Study uses a 42-foot stern trawler to sample with two trawl nets at each open water station. The otter trawl samples demersal fishes, shrimp, and crabs. The midwater trawl samples pelagic fishes. The Bay Study observation stations nearest the Action Area are just south of Yerba Buena Island (Station 110) and near Alameda Island (Station 142). Although these locations are 2 miles or more from the Action Area, observation data at Stations 110 and 142 are the best available for the Proposed Action.

As noted, the Central Bay is poorly represented in trawl survey data, and the Bay Study provides limited data. Comparisons of multiple trawl surveys throughout San Francisco Bay demonstrate the need for multiple surveys to provide accurate findings, including population trends (Stompe et al. 2020). Therefore, conclusions on potential species presence provided herein cannot be made conclusively using Bay Study data.

North American Green Sturgeon Southern DPS

Green Sturgeon are potentially present throughout all marine portions of the Action Area at any time of the year. However, their preferred migration routes do not traverse the Action Area; adult Green Sturgeon typically take the more direct migratory route from San Pablo Bay, past the Raccoon Strait adjacent to Angel Island, and out to the Golden Gate Bridge (Kelly et al. 2003). Sub-adult and adult Green Sturgeon occupy a diversity of depths for feeding and migration, although most of the Action Area waters are maintained to depths that exceed observed benthic foraging depths for this species (i.e., -33 feet MLLW; Miller and Kaplan 2001). No spawning or rearing habitat for Green Sturgeon exists in or near the Action Area.

No Green Sturgeon have been observed during Bay Study trawl surveys, although these findings do not preclude their presence from the Action Area.

Steelhead, Central California Coast DPS

Steelhead are primarily present during in-migration and out-migration periods. They are suspected to forage in the shallow water areas of the Central Bay (less than 30 feet deep) during in-migration and out-migration transits. Fish migrating to and from these spawning grounds may occur in Action Area waters, including the Oakland-Alameda Estuary. Juvenile steelhead travel episodically from natal streams during fall, winter, and spring high flows, with peak migration occurring in April and May (Fukushima and Lesh 1998). Adult CCC steelhead are most likely to be present during the winter, while juveniles may be present year-round. No spawning or rearing habitat for steelhead exists in the Action Area; however, CCC steelhead have small spawning runs in multiple San Francisco Bay tributaries, including San Leandro Creek, approximately 5 miles southeast of the project footprint (Goals Project 2000). Construction would occur during the established June 1 to November 30 in-water work window for CCC steelhead and other salmonids.

The Bay Study Survey did not observe any steelhead at stations nearest the Action Area, or in the Central Bay. Steelhead were only observed in 2000 and 2003, in Suisun Bay and the Sacramento River.

Steelhead, Central Valley DPS

Central Valley DPS Steelhead are primarily present during in-migration and out-migration periods. They are suspected to forage in the Central Bay shallow water areas (less than 30 feet deep) during in-migration and out-migration transits. Adult Central Valley DPS Steelhead are most likely to be present in the Action Area during the winter, while juveniles may be present year-round. No spawning or rearing habitat for Central Valley DPS Steelhead exists in or near the Action Area. Construction would occur during the established June 1 to November 30 in-water work window for Central Valley DPS Steelhead and other salmonids.

The Bay Study Survey did not observe any steelhead at stations nearest the Action Area, or in the Central Bay. Steelhead were only observed in 2000 and 2003, in Suisun Bay and the Sacramento River.

Chinook Salmon, Sacramento Winter-Run ESU

Winter-run Chinook Salmon are primarily present during in-migration and out-migration periods. They are suspected to forage in Central Bay shallow water areas (less than 30 feet deep) during in-migration and out-migration transits. However, telemetry studies tracking the movement of juvenile salmonids suggest that the primary migration corridor is through the northern reaches of the Central Bay (Raccoon Straight and north of Yerba Buena Island; NMFS 2001; Baxter et al. 1999; Jahn 2011). No spawning or rearing habitat for listed runs of Chinook Salmon exists near the Action Area. Construction would occur during the established June 1 to November 30 in-water work window for Chinook Salmon and other salmonids.

The Bay Study did not observe any Chinook Salmon at stations nearest the Action Area, or in the Central Bay. Most Chinook Salmon observations during the Bay Study Survey were made in the lower reaches of the Sacramento and San Joaquin Rivers and east of Suisun Bay, with a single recorded occurrence in San Pablo Bay in 2006.

Chinook Salmon, Central Valley Spring-Run ESU

The spring-run Chinook Salmon are primarily present during in-migration and out-migration periods and are known to forage in Central Bay shallow water areas. As noted for Sacramento winter-run ESU Chinook, telemetry studies tracking the movement of juvenile salmonids suggest that the primary migration corridor is through Raccoon Straight and north of Yerba Buena Island (Jahn 2011). No spawning or rearing habitat for listed runs of Chinook Salmon exist near the Action Area. Construction would occur during the established June 1 to November 30 in-water work window for Chinook Salmon and other salmonids.

As noted for the Chinook Salmon winter-run ESU, the Bay Study did not observe any Chinook Salmon at stations nearest the Action Area or in the Central Bay, and the nearest observation of Chinook Salmon was recorded in San Pablo Bay in 2006.

Longfin Smelt

Longfin Smelt are most likely to occur in the Central Bay during the late summer months before migrating upstream in fall and winter. Since about 2000, the abundance of Longfin Smelt in San Francisco Bay and the Delta has steadily declined (Hobbs et al. 2017; Baxter 2018; USACE 2019). Only adult and juvenile Longfin Smelt have the potential to be present in the Action Area. Unlike larvae, juveniles and adults are capable of active swimming and have the ability to avoid stressors, and therefore would unlikely be directly impacted by in-water work along the waterfront (ESA 2015).

During Bay Surveys, Longfin Smelt have been predominantly observed in observation stations in or upstream of San Pablo and Suisun Bays. At stations nearest the Action Area (Stations 110 and 142), Longfin Smelt were last observed in 2007, with additional observations in 2001, 2000, 1988, 1987, and 1985. Between 2014 and 2018, no Longfin Smelt were recorded south of San Pablo Bay. Based on these findings and Longfin Smelt population trends, there is a low likelihood of Longfin Smelt occurrence in the Action Area.

5.3 Terrestrial Special-Status Species in the Action Area

California Least Tern

The Action Area may provide some foraging habitat for California least terns on an infrequent basis, due to the proximity of their breeding colony at the former Alameda Naval Air Station, approximately 1.5 miles southwest of the IHTB Action Area. However, the species forages most actively in San Francisco Bay waters in the marina near Alameda Point (USFWS 2013) and is generally described as preferring shallow foraging habitat. Terns are also known to use the MHEA restoration site for foraging and roosting (USACE and RWQCB 2015). California least terns are not expected to breed in the Action Area due to existing operations at Howard Terminal, the Alameda site, and other shoreline industrial and marine support facilities. Presence of breeding populations in the Action Area is likely further precluded given the close proximity of preferred habitat conditions and the established breeding colony on Alameda Point.

CHAPTER 6: EFFECTS OF THE PROPOSED ACTION

This section discusses the direct, indirect, temporary, and permanent effects of the Proposed Action on special-status species and habitats present or potentially present in the Action Area. Direct effects are the direct or immediate effects of the Proposed Action on listed species or habitats, such as physical damage to an individual, physical loss of a spawning or foraging habitat, a blocked migration corridor, or harassment of an animal species to the point where it abandons part of its normal range. Indirect effects are those that are caused by—or would result from—the Proposed Action, but occur later in time and are reasonably certain to occur. These include ecosystem-type changes that primarily affect food web dynamics or habitat suitability as would occur with decreased suitability of foraging habitat. The Action Area described in Chapter 3 is inclusive of areas where direct and indirect effects to federal ESA-listed species are likely to occur.

6.1 Aquatic Special-Status Species and Resource Effects

Aquatic species potentially present in the Action Area may experience temporary construction-related impacts related to entrainment during dredging, altered water quality, turbidity and sediment suspension, mobilization of chemicals of concern, temporary benthic habitat disturbance, underwater noise, impediments to localized movement and migration, and invasive species. Permanent habitat alteration would occur, including conversion of uplands to aquatic habitat and deepening of existing aquatic habitat. A general description of these impacts and their effects on aquatic species is provided in Section 6.1.1. Impact determinations for individual species and critical habitat are provided in Sections 6.1.2 through 6.2.2, and summarized in Chapter 7. These determinations were made in consideration of the respective characteristics of the potentially present species and habitats, including seasonal presence in the Action Area during construction.

Underwater Noise

Underwater noise has the potential to alter the behavior of fish and, if sufficiently loud, can cause temporary shifts in hearing ability or injury to internal organs. Project construction would result in underwater sound pressure waves due to noise generated by mechanical dredging and from pile installation and extraction at the IHTB. The vibratory extraction and installation of piles, and the impact driving of piles—into as well as immediately adjacent to water—has the potential to generate underwater noise that may be harmful to fish. Sheet piles are generally fully installed using vibratory hammers. Vibratory drivers generally produce less sound than impact hammers and are often employed as an avoidance and minimization measure to reduce the underwater sound pressure that transmits into the water.

The interagency Fisheries Hydroacoustic Working Group has established interim criteria for noise impacts from pile driving on fishes. Although these criteria are not formal regulatory standards, they are generally accepted as viable criteria for underwater noise effects on fish. The thresholds for impulse-type noise to harm fish have been set at a 206 dB peak for fish of all weights, 187 dB cumulative sound exposure level (cSEL) for fish greater than 2 grams, and 183 dB cSEL for fish less than 2 grams (Table 6-1). With regard to ESA-listed fish potentially occurring in the Action Area, only adults or juveniles with a size greater than 2 grams may be present; accordingly, the 187 dB cSEL criterion for fish greater than 2 grams is applied for this analysis of impact pile-driving noise, along with the 206 dB peak level. There are no formal sound exposure level (SEL) thresholds established for nonimpulse noise, such as vibratory pile driving, and resource agencies are less concerned that vibration pile driving would result in injury or other adverse effects on fish (Caltrans 2020).

Table 6-5 Fisheries Hydroacoustic Working Group Underwater Impulse Noise Thresholds for Fish

Thresholds for Impulse and Continuous Sound	Peak Noise (dB)	Accumulated Noise (cSEL) (dB)
Fish less than 2 grams in weight	>206	>183
Fish greater than 2 grams in weight	>206	>187

Source: FHWG 2008
> = greater than
cSEL = cumulative sound exposure level
dB = decibel
FHWG = Fisheries Hydroacoustic Working Group

The Fisheries Hydroacoustic Working Group has determined that noise at or above the 206 dB peak level can cause barotrauma to auditory tissues, the swim bladder, or other sensitive organs. Noise levels above the cSEL threshold may cause temporary hearing threshold shifts in fish. Behavioral effects are not covered under these criteria but could occur at these levels or lower. Behavioral effects may include fleeing and the temporary cessation of feeding or spawning behaviors. NMFS often uses a 150 dB root mean square (RMS) noise threshold to establish the area of potential behavioral effects to fish species for both impulse and continuous noise. Although underwater sound produced by an action may be audible to fish beyond this point, overall sound levels less than 150 dB RMS are not expected to adversely affect fish behavior.

Mechanical hydraulic dredges produce a complex combination of repetitive sounds that may be intense enough to cause adverse effects on fish. In addition, the intensity, periodicity, and spectra of emitted sounds differ among dredge types and the substrate being dredged. Clamshell dredges generate a repetitive sequence of sounds from winches, bucket impact with the substrate, closing and opening the bucket, and dumping the dredged material into the barge. The most intense sound impacts are produced during the bucket's impact with the substrate, with peak SELs of 124 dB measured 150 meters (approximately 500 feet) from the bucket strike location (Dickerson et al. 2001; Reine et al. 2002). Existing ambient underwater noise at the IHTB and OHTB include levels of 1,600 to 180 dB produced by small boats and ships at 1 meter (MALSF 2009), and 180 to 189 dB produced by commercial shipping at 1 meter (Reine and Dickerson 2014). The Oakland Outer Harbor is identified as having ambient sound levels of 120 to 155 dB (peak), which exceeds NMFS behavioral thresholds for fish (Caltrans 2020). In addition, ambient underwater noise levels in the IHTB were monitored for this study at half the depth of the water column during an active turning event for a large container vessel (*One Aquila*), with three assist tugboats. Noise levels during this event were found to generate a peak underwater sound exposure level of 174 to 175 dB. Therefore, underwater noise from clamshell dredging would not be expected to exceed ambient levels experienced in the turning basins when vessels are turning or from other vessel traffic. Similarly, the transport barges carrying dredge material are not expected to generate underwater noise that is different from or greater than existing vessel traffic.

For determining cSEL levels that would result from construction of the Proposed Action, the analysis of impact pile-driving noise assumed that a receptor (such as a fish) in the area of noise effects would be stationary during the pile driving and would not relocate away from the activity during driving; and that all pile strikes would produce noise at the maximum cSEL. Therefore, this represents a conservative calculation for accumulated sound effects over a 24-hour period.

Hydroacoustic effects on fish resulting from pile driving can vary based on site conditions; and transmission loss assumptions can be affected by factors including substrate type, depth of water, and ambient noise. Site-specific data can be used to estimate the loss of sound energy over distance and establish a transmission loss assumption to calculate effects from proposed work. This can be expressed as a transmission loss coefficient (F-value), or as a rate of attenuation in dB per doubling of distance. This analysis assumes an F-value (transmission loss coefficient) of 15 (approximately 4.5 dB per doubling of distance), which is the standard F-value recommended by the California Department of Transportation when site-specific conditions are unknown. Underwater noise measurements taken from pile extraction and driving conducted under similar conditions are used to estimate the source levels for pile extraction and installation for this analysis. The distances to the applicable underwater noise thresholds were calculated by using these values in the practical spreading model. The details regarding the source values and other assumptions are provided in the following subsections for each pile extraction or driving activity. The NMFS hydroacoustic worksheets detailing the calculations are provided in Appendix C.

Extraction of Existing Steel Sheet Piles for Inner Harbor Turning Basin Expansion

Expansion of the IHTB would require the demolition of a portion of a sheet pile bulkhead at the Alameda site; approximately 900 linear feet of steel sheet piles would be removed. These piles would be extracted using vibratory pile extraction.

The analysis assumed that as many as 20 sheet piles may be removed per workday and that each pile would require up to 300 seconds of active vibratory extraction. There is a substantially smaller amount of data available regarding underwater noise source levels for pile extraction than for pile installation. In the absence of such data, values for pile driving of the same pile type are a reasonable proxy because noise from extraction is expected to be similar to, if not less than, noise from their installation. As a source level, this analysis used the vibratory driving of steel sheet piles at Berths 35/37 at the Port, where underwater noise levels of 177 dB Peak and 162 dB RMS were recorded (Caltrans 2020). Extraction of these sheet piles is not expected to generate underwater noise above the 206 dB peak noise I njury threshold. See Table 6-2 for the distances over which the 150 dB RMS behavioral threshold for fish may be exceeded. Figure 6-1 displays the distance over which these underwater noise thresholds may be exceeded during vibratory extraction of sheet piles.

Table 6-6 Summary of Underwater Noise Effects to Fish

Description of Work	Pile Type	Installation Method	Estimated Days Work[3]	Distance to Fish Thresholds (meters/feet)			
				cSEL		206 dB Peak Threshold	150 dB RMS Threshold
				187 dB[1]	183 dB[1]		
Extraction of steel sheet piles at the Alameda site	12- or 24-inch-wide steel sheet piles	Vibratory	50	NA[2]	NA[2]	0	63/207
Extraction of steel pipe piles at the Alameda site	24-inch-diameter steel pipe piles	Vibratory	116	NA[2]	NA[2]	0	29/95
Extraction of concrete piles at the Howard Terminal site	24-inch-diameter concrete piles	Vibratory	40	NA[2]	NA[2]	0	29/95
Installation of steel sheet piles at the Alameda site, in-water near Schnitzer Steel, and at Howard Terminal	24-inch-wide steel sheet piles	Vibratory	54	NA[2]	NA[2]	0	63/207
Installation of steel pipe batter piles at the Alameda site, in-water near Schnitzer Steel, and at Howard Terminal	24-inch-diameter steel pipe piles	Vibratory or impact hammer	11	80/262	86/282	3/10[4]	736/2,415

[1] This calculation assumes that single-strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet).
[2] SEL thresholds are for impulse noise only and are not applicable for vibratory driving.
[3] In-water piles only.
[4] This radius is similar in size to the area where the water would be agitated by a bubble curtain.

cSEL = cumulative sound exposure level
dB = decibel
RMS = root mean square

Figure 6-6 Estimated Distance to In-Water Sound Pressure Criteria for Fish for Vibratory Driving

Extraction of Existing Steel Pipe Piles and Concrete Piles for Inner Harbor Turning Basin Expansion

Expansion of the IHTB would require the demolition of a portion of the pile-supported wharfs at Howard Terminal and the Alameda site. Approximately 4,255 24-inch steel pipe piles would be removed at the Alameda site, and 800 24-inch concrete piles would be removed from Howard Terminal. These piles would be extracted using vibratory pile extraction.

The analysis assumed that as many as 40 of these concrete and steel pipe piles may be removed per workday, and that each pile would require up to 300 seconds of active vibratory extraction. As a source level, this analysis used vibratory driving of 24-inch steel pipe piles at the Downtown Ferry Terminal in San Francisco, where underwater noise levels of 178 dB Peak and 157 dB RMS were recorded (Caltrans 2020). Extraction of these piles is not expected to generate underwater noise above the 206 dB peak noise injury threshold. See Table 6-2 for the distances over which the 150 dB RMS behavioral threshold for fish may be exceeded. Figure 6-1 displays the distance over which these underwater noise thresholds may be exceeded during extraction of steel pipe piles and concrete piles.

Installation of Steel Sheet Piles for Inner Harbor Bulkheads

Steel sheet piles would be installed using vibratory pile driving methods to create new bulkheads at the IHTB. Most sheet piles at Howard Terminal and the Alameda site would be installed into land, but an estimated 10 percent of sheet piles at these locations would be installed into or immediately adjacent to water. All of the sheet piles for the in-water retaining structure by Schnitzer Steel would be installed into water.

The analysis assumed that as many as 10 sheet piles may be installed per day, with each pile requiring up to 1,200 seconds of active vibratory driving. During vibratory driving of steel sheet piles at Berths 35/37 at the Port, underwater noise levels of 177 dB Peak and 162 dB RMS were recorded (Caltrans 2020). Installation of these sheet piles is not expected to generate underwater noise above the 206 dB peak noise injury threshold. See Table 6-2 for the distances over which the 150 dB RMS behavioral threshold for fish may be exceeded. Figure 6-1 displays the distance over which these underwater noise thresholds may be exceeded during vibratory driving of sheet piles.

Installation of Steel Pipe Piles for Inner Harbor Bulkheads

To construct new bulkheads at the IHTB, 24-inch steel pipe piles would be installed using impact or vibratory pile driving methods. Because impact driving produces a greater level of underwater noise that may be harmful to fish, the noise analysis provided here assumes that the 24-inch steel pipe piles would be impact driven. These piles would be battered in at an angle to help support the bulkhead (Figure 2-3). Most of the batter piles at Howard Terminal and the Alameda site would be installed into land, but an estimated 10 percent of the batter piles at these locations would be installed into or immediately adjacent to water. All of the steel pipe batter piles for the in-water retaining by Schnitzer Steel would be installed into water.

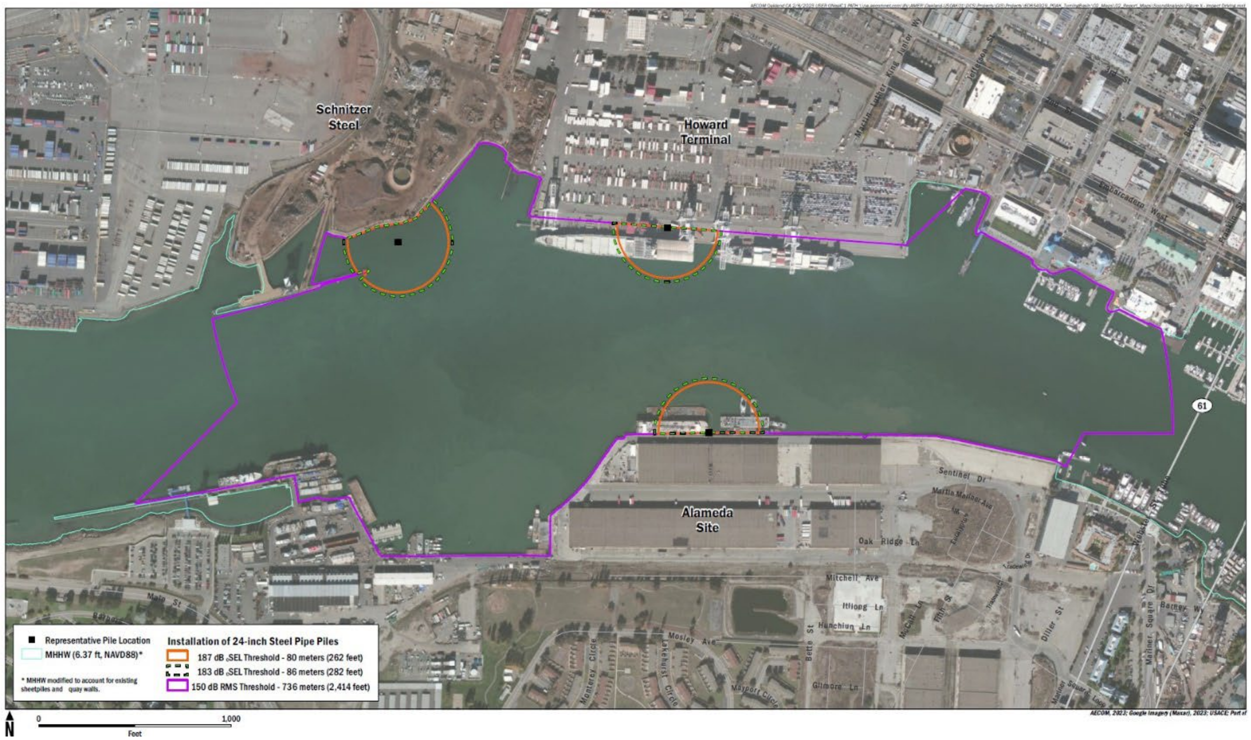

Figure 6-7Estimated Distance to In-Water Sound Pressure Criteria for Fish for Impact Driving

The analysis assumed that as many as five of these piles may be installed per day, with each pile requiring as many as 1,200 blows from an impact hammer. During impact driving of battered 24-inch steel shell piles at the Plains Terminal retrofit in Richmond, California, underwater noise levels of 205 dB Peak, 185 dB RMS, and 173 dB SEL were recorded (Caltrans 2020). As described in the Proposed Action's avoidance and minimization measures for pile driving (Section 2.3), a bubble curtain or similar attenuation system would be used for the installation of impact-driven piles; such a system is assumed to provide 7 dB of noise attenuation (a 7 dB reduction) to the aforementioned source values. With the use of bubble curtain or similar attenuation, installation of the 24-inch piles is not expected to generate underwater noise above the 206 dB peak noise injury threshold outside of the area agitated by the bubble curtain. See Table 6-2 for the distances over which the 187 dB cSEL threshold and 150 dB RMS behavioral threshold for fish may be exceeded. Figure 6-2 displays the distance over which these underwater noise thresholds may be exceeded during impact driving of steel pipe piles. If vibratory driving methods are used, the areas over which these thresholds may be exceeded would be smaller than those presented in Table 6-2 and Figure 6-2.

Because the 206 dB peak noise criteria for injury of fish would not be exceeded by project activities, no thus physical injury to fish (barotrauma) is expected. The 187 dB cSEL criteria would be exceeded during impact pile driving, but only relatively close to the pile driving, as shown in Table 6-2. The cessation of pile driving at the end of each work day would allow cumulative noise levels to reset before driving continues the following day. Because the project is in a channel, the area over which behavioral noise effects would occur is relatively confined (Figure 6-1).

Depending on the rate at which the piles are installed and removed, pile extraction and driving is expected to occur on 40 days during 2027, 155 days during 2028, and 76 days during 2029. In areas where the cSEL threshold would be exceeded, fish could experience temporary shifts in hearing-threshold and behavioral effects. Temporary shifts in hearing thresholds may reduce the ability of affected fish to detect predators and prey items. Behavioral effects that could result include the temporary cessation of feeding or movement out of the area of effect during active pile driving. As noted above, background underwater noise levels in Inner Harbor are elevated due to frequent ship traffic. Fish that frequent the area may be habituated to increased noise and thus less likely to exhibit a behavioral response differing from existing conditions (Caltrans 2020).

Underwater noise from the Proposed Action's construction activities is not anticipated to substantially affect federal ESA-listed fish due to their mobility, the ambient noise conditions in Oakland Harbor, and the anticipated intensity of sound produced by construction. During pile-driving activities, fish are not expected to be present within a zone of 6 to 8 feet of the piles, because the movement of the piling through the shallow water and initial contact with the San Francisco Bay seafloor would result in fish quickly leaving the immediate area. Similarly, fish are anticipated to avoid the dredging areas during construction. Proposed construction activities are not anticipated to substantially exceed ambient noise levels present in the Action Area, and associated with vessel traffic. The Proposed Action includes avoidance and minimization measures pertaining to underwater noise, including use of vibratory hammers for sheet pile installation and contingency measures if impact hammers are required. In-water construction would also be limited to the established June 1 through November 30 construction window, when salmonids are less likely to be present.

In consideration of this analysis, injury to fishes from peak noise (e.g., rupture of swim bladder) or accumulated noise (temporary threshold shifts) is not expected to occur, but behavioral effects (e.g., changes in feeding behavior, fleeing, and startle responses) could occur. Behavioral effects, however, would likely be similar to those experienced under existing conditions.

Other Effects Common to All Aquatic Species

Entrainment During Dredging

All forms of dredging have the potential to incidentally remove organisms from the environment along with the dredge material, a process referred to as entrainment. Entrained fish are likely to suffer mechanical injury or suffocation during dredging, resulting in mortality. Although individual fish have the potential to be struck or entrained by a 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, USACE 2019). Therefore, the use of a clamshell dredge minimizes the risk of fish entrainment for all fishes. Mechanical dredging is also generally accepted to entrain far fewer fish than hydraulic dredging, because less water is removed along with the sediment and no suction is involved.

In consideration of the construction methods and avoidance and minimization measures, the potential to entrain or physically injure or kill federally listed aquatic species is very low. General disturbance from construction vessels is expected to be minimal, because fish avoid the areas where active dredging is occurring. Dredging and in-water construction associated with the Proposed Action would be conducted in accordance with standard practices, including measures to reduce the potential for entrainment, as discussed in Section 2.3. This includes dredging during the in-water work window between June 1 and November 30, when salmonids are less likely to be present.

Accidental Discharges

Construction activities have the potential to result in accidental discharge of contaminants into San Francisco Bay. Various contaminants, such as fuel oils, grease, and other petroleum products used in construction activities, could be introduced into the system directly during dredging and nearshore construction. Shoreline construction, including demolition, excavation, and sheet pile installation, could also result in increased surface run-off and contaminant loading to San Francisco Bay waters. Compliance with National Pollutant Discharge Elimination System (NPDES) Construction General Permit conditions, including implementation of a Stormwater Pollution Prevention Plan and measures to prevent accidental spills of hazardous materials, would prevent contaminants and disturbed sediments from reaching storm drains and subsequently San Francisco Bay waters, or from being directly discharged into Bay waters. The implementation of standard BMPs and other measures identified in Section 2.3 would further reduce the potential for accidental discharges during construction to adversely affect aquatic species and habitat.

Stormwater Management

There would be minor long-term alterations to upland drainage patterns at Howard Terminal and the Alameda site because of IHTB expansion, which are unlikely to result in adverse water quality impacts. This may include removal, replacement, or redesign of drainage infrastructure such as curbs and gutters resulting from upland excavation and reconfiguration of the facility shorelines. Any such alterations would occur in compliance with NPDES post-construction runoff requirements for new development and redevelopment, including treatment measures and other appropriate source control and site design features to reduce the pollutant load in stormwater discharges and to manage runoff flows. With adherence to these requirements, upland drainage changes are unlikely to substantially affect water quality or biological resources.

Turbidity and Suspended Sediment

During any type of dredging operations, the interaction of the dredge equipment with the dredged material resuspends sediment into the water column. The mechanisms by which mechanical dredging causes increased suspended sediment concentrations include the impact and withdrawal of the bucket from the substrate, the washing of material out of the bucket as it moves through the water column, and the loss of water as the sediment is loaded onto the barge (Nightingale and Simenstad 2001).

Removal or installation of sheet piles, piles, or other in-water improvements may also temporarily disturb benthic sediments and increase turbidity and suspended sediment levels in the immediate vicinity of the Action Area during construction. Increases in turbidity and suspended sediment levels from removal or installation of piles or other in-water structures would be substantially less significant than similar effects from dredging. Movement of the dredge and other construction vessels would not be expected to increase turbidity above ambient ranges generated by natural hydrologic processes, weather, and existing vessel traffic.

Effects on turbidity and suspended sediment levels from new dredging to expand the IHTB are anticipated to be like those from existing annual maintenance dredging. Dredging typically results in suspended sediment levels of less than 700 mg/L at the surface, and less than 1,100 mg/L at the bottom adjacent to a dredge source (within approximately 300 feet) (LaSalle 1988). This concentration would decrease rapidly with distance due to settling and mixing. Although concentrations of this magnitude could occur at locations with fine silt or clay substrates, much lower concentrations (50 to 150 mg/L at 150 feet) are expected at locations with coarser sediment; sediment in the Oakland Harbor is predominately fine-grained (USACE 2019), although there is evidence that coarser sand substrates may be present in areas 25 feet deep or shallower (City of Oakland 2021). 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. 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 San Francisco Bay (USACE 2019).

Turbidity plumes were measured during clamshell dredging in the Oakland Harbor during USACE monitoring in 2016 and 2017 (USACE 2019). The San Francisco Bay navigation channel maintenance dredging water quality certification requires that increased turbidity be less than 50 Nephelometric Turbidity Units (NTUs), 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 USACE monitoring in the Oakland Harbor, exceedances of the water quality turbidity standards at the point of compliance occurred only periodically.

Temporary turbidity plumes from dredging would be localized and would affect a relatively small area in relation to surrounding areas of similar habitat. In the naturally turbid San Francisco Bay, turbidity plumes would be quickly diluted to near or within background particulate concentrations (USACE and RWQCB 2015). Furthermore, silt curtains would be used where specific site conditions demonstrate that they would be practicable, and effectively minimize any potential adverse effects caused by the mobilization of material that may cause adverse water quality conditions, or contain contaminants at levels in excess of applicable regulatory thresholds.

Dredging, pile driving, and other in-water construction activities would result in increased turbidity from suspended sediments. Suspended sediments have been shown to affect fish behavior, including avoidance responses, territoriality, feeding, and homing behavior. Wilber and Clarke found that suspended sediments result in cough reflexes, changes in swimming activity, and gill flaring. Suspended sediments can have other impacts, including abrasion to the body and gill clogging (Wilber and Clarke 2001). The effect of dredging on fish can vary with life stage; early life stages tend to be more sensitive than adults.

The life stages of federal ESA–listed fish species potentially present in the Action Area are likely less susceptible to adverse direct effects from increased turbidity. The eggs or larval life stages of steelhead, Chinook Salmon, Green Sturgeon, and Longfin Smelt are not expected to be present in the Action Area. Large adult and juvenile fish (including steelhead, Chinook, and Green Sturgeon) would be mobile enough to avoid areas of high-turbidity plumes caused by dredging. The USACE Waterways Experiment Station Technical Report DS-78-5 (Effects of Dredging on Aquatic Organisms) reports that: “Most organisms tested are very resistant to the effects of sediment suspensions in the water, and aside from natural systems requiring clear water such as coral reefs and some aquatic plant beds, dredging-induced turbidity is not a major ecological concern” (Hirsch et al. 1978).

Dredging associated with the Proposed Action would be conducted in accordance with standard practices, including measures to reduce the potential for causing turbid conditions that could affect listed species and their habitat, as discussed in Section 2.3. This includes, but is not limited to, use of silt curtains where specific site conditions demonstrate that they would be practicable and effective; avoiding spillage; increasing cycle times as needed; and dredging during the established in-water work window. In addition, water quality monitoring would be conducted in compliance with anticipated requirements of a water quality certification, biological opinion, or other regulatory permits.

In consideration of the potential fish life stages present, the brief duration and relatively small area of effect, background turbidity levels in San Francisco Bay, and with implementation of proposed avoidance and minimization measures, the Proposed Action is unlikely to substantially affect federal ESA–listed fish species from increased turbidity.

Mobilization of Contaminants of Concern

Dredging or other bottom-disturbing activities can disturb aquatic habitats by resuspending sediments, thereby recirculating toxic metals, hydrocarbons, pesticides, pathogens, and nutrients into the water column. Any toxic metals and organics, pathogens, and viruses, absorbed or adsorbed to fine-grained particulates in the sediment may become biologically available to organisms either in the water column or through food-chain processes.

Most available studies suggest that there is no significant transfer of metal concentrations into the dissolved phase during dredging, even though release of total metals associated with the suspended matter may be large (Jabusch et al. 2008). Organic contaminants such as pesticides, PCBs, and polyaromatic hydrocarbons are generally not very soluble in water, and direct toxicity by exposure to dissolved concentrations in the water column is not very likely (Jabusch et al. 2008; USACE and RWQCB 2015).

Under direction of the LTMS agencies, a study on the short-term water quality impacts of dredging and dredged material placement on sensitive fish species in San Francisco Bay was completed by the San Francisco Estuary Institute (Jabusch et al. 2008). The review considered five fish species: Chinook Salmon, Coho Salmon, Delta Smelt, steelhead trout, and Green Sturgeon. Water quality impacts of concern include dissolved oxygen reduction, pH decrease, and releases of toxic components such as heavy metals, hydrogen sulfide, ammonia, and organic contaminants (including polyaromatic hydrocarbons, PCBs, and pesticides). Potential short-term effects include acute toxicity, subacute toxicity, and biological and other such as avoidance. The study concluded that direct short-term effects on sensitive fish by contaminants associated with dredging plumes are minor. The study identified a need to better study the potential of ammonia releases during dredging in San Francisco Bay. However, ammonia has not been identified as a contaminant of concern for the Action Area, and the amount of ammonia released by maintenance dredging is expected to be minimal, and the consequent effects short term and minor. Mobile organisms, such as fish, are likely to relocate outside of the dredge material plume, rather than be exposed to potential harm. The dredge material plume would only occupy a small percentage of the habitat available to fish species in the vicinity of the Action Area at any given time.

Existing upland areas surrounding the proposed IHTB expansion area are known to contain several contaminants (see Section 3.11 in the Integrated Feasibility Report and Environmental Assessment); however, excavation and offsite disposal of these materials to a depth of -15 feet bgs would occur prior to dredging as part of the Proposed Action. Although there are no specific data regarding the fill quality below groundwater at the upland areas in the proposed IHTB expansion area, or in the subtidal areas in the IHTB expansion footprint, most of these areas are not expected to contain elevated constituents of concern that would preclude beneficial reuse (see Section 3.1.5 for details). The exception is the basin between Howard Terminal and Schnitzer Steel, where sediment may be contaminated with heavy metals requiring landfill disposal in a Class II landfill, which would occur as needed. As detailed in Section 3.1.1, the Central Bay is a Category 5 waterbody for several pollutants, which may also be present in sediments in the Action Area.

Sediments would be tested prior to dredging, and the results would be reviewed by the DMMO prior to dredging and placement, including evaluation of the potential for water quality impacts. This process would identify contaminated sediments and appropriate placement site options for dredged materials based on the characteristics of the sediment and criteria for each placement site. Additionally, water quality protection measures would be included as conditions to the water quality certification issued by the Regional Water Quality Control Board (RWQCB), and other project permits and approvals.

In consideration of the low likelihood for aquatic organisms to be exposed to toxins during dredging and other in-water construction; avoidance and minimization measures described in Section 2.3; and in consideration of DMMO procedures, the Proposed Action is unlikely to result in substantial adverse impacts to special-status fish species from mobilization of contaminants of concern.

Temporary Benthic Habitat Disturbance

Dredging would directly affect benthic communities through physical disruption and direct removal of benthic organisms, resulting in the potential loss of most, if not all, organisms in the dredged area. Organisms immediately adjacent to the navigation channels and turning basins may also be lost because of smothering or burial from sediments resuspended in the water column during dredging (USACE 2019). These effects may also occur as a result of other bottom-disturbing activities, such as pile driving, although to a lesser degree. Benthic habitat in the federal channel and turning basins, and their margins, is regularly disturbed under baseline conditions because of maintenance dredging and the propeller wash of ship traffic. The expansion areas, however, include subtidal habitat that is not subject to maintenance dredging under baseline conditions and would be newly disturbed by Proposed Action dredging.

Studies have indicated that even relatively large areas disturbed by dredging activities are usually recolonized by benthic invertebrates within 1 month to 1 year, with original levels of biomass and abundance developing within a few months to between 1 and 3 years (Newell et al. 1998). Recovery in deep water channels may be slower. Following dredging, disturbed areas are recolonized, beginning with mobile and opportunistic species (Oliver et al. 1977, Lenihan and Oliver 1995). Colonizing species composition may be different than prior to dredging, and recolonizing species would likely include nonindigenous species common to San Francisco Bay (USACE and RWQCB 2015).

Benthic habitat can provide important foraging areas for special-status fish species, especially for Green Sturgeon and Longfin Smelt, which primarily forage in the benthos. Steelhead and Chinook Salmon are primarily drift feeders when in the estuarine environment, but also forage in the benthos. Steelhead and Chinook Salmon typically forage in waters less than 30 feet deep, while Green Sturgeon have been observed foraging at depths up to 33 feet.

Benthic habitat in the Action Area is likely of marginal foraging value given existing and historic uses in the navigation channel and adjoining shoreline. Benthos in the Action Area are in a constant state of disruption from large vessel movement and annual maintenance dredging in the existing federal channel. Regular disturbance is reduced outside of the navigation channels and existing turning basins, although still present. The Proposed Action would result in direct temporary impacts to benthic communities in the enlarged turning basin areas. These effects would be similar to those caused by maintenance dredging in the existing navigation channels and turning basins, and dredged areas in the proposed expanded turning basins are expected to recolonize with benthic organisms.

Permanent impacts to benthic habitat would occur from widening the turning basins, which may affect fish foraging. These impacts are discussed in the Habitat Alteration section below.

Impediments to Localized Movement and Migration

The noise and in-water disturbance associated with proposed improvements could cause fish and wildlife species to temporarily avoid the immediate work area when work is being conducted. The Proposed Action would include in-water installation of permanent bulkheads, batter piles, and rock, but would result in a net decrease of in-water structures due to removal of wharf deck support piles and sheet piles to accommodate the IHTB expansion (see Chapter 2, Table 2-2 for details). In consideration of the net decrease in in-water structures and expanding turning basin area, permanent adverse impacts to localized fish movement and migration are not anticipated.

As noted for impacts associated with turbidity and underwater noise, fish species are anticipated to avoid the construction area during dredging and in-water construction. Federal ESA–listed fish species may be temporarily displaced from areas with elevated turbidity during dredging. Underwater noise generated by construction is expected to typically be comparable to ambient noise levels in the harbor, except during the brief duration of potential impact hammer use (approximately 11 days), and noise effects on localized movement and migration are therefore anticipated to be minimal.

The dredge plume area is generally considered to include a 250-meter (820-foot) buffer from the dredge barge, although it may be smaller for the Proposed Action because silt curtains would be employed as warranted to contain and minimize turbidity. The Central Bay serves as a migration corridor for special-status anadromous fish between the Pacific Ocean and spawning habitat, primarily in the Sacramento and San Joaquin River watersheds, but also in a handful of tributaries to San Francisco Bay. Those that use San Francisco Bay as a migration corridor to the Central Valley watersheds rarely stray south of the San Francisco Bay Bridge, although CCC steelhead have been known to spawn in San Leandro Creek, approximately 5 miles southeast of the Action Area (Goals Project 2000). Construction of the Proposed Action would occur during the in-water work window, when migrating salmonids are unlikely to be present. In addition, studies using volcanic ash to simulate suspended sediment levels demonstrated that adult male Chinook Salmon were still able to detect natal waters through olfaction even when subjected to 7 days of total suspended sediment levels of 650 mg/L (Whitman and Miller 1982).

In consideration of the Proposed Action avoidance and minimization measures, existing ambient underwater noise levels, and demonstrated salmonid tolerance of high suspended sediment levels during migration, the Proposed Action is not anticipated to result in substantial adverse effects to federal ESA–listed fish species related to localized movement and migration.

Invasive Species

Dredging vessels may come from outside of the Bay Area. There is the potential that nonnative species could be introduced into the Action Area. Invasive species most commonly arrive in larval forms transported to San Francisco Bay and released in ballast water. The United States Coast Guard and State of California have mandatory regulations in effect that require ships carrying ballast water to have a ballast water management and reporting program in place; and without jeopardizing the safety of the crew, must exchange ballast water with mid-ocean water or use an approved form of ballast water treatment prior to releasing any ballast water in a port in the United States. Dredge equipment or other construction vessels would comply with these regulations, as applicable. In consideration of these regulations, project activities would not be expected to substantially increase the spread of invasive nonnative aquatic species associated with ballast water.

Additionally, the act of removing soft-bottom sediments and their associated biotic assemblages during dredging creates an area of disturbance that is susceptible to recolonization by invasive species, often resulting in the displacement of native species. As a result, dredging can increase both the number of new invasive species entering the bay and the distribution and abundance of existing invasive species in the bay. Expansion of the IHTB and OHTB would result in larger areas of benthic habitat disturbance where invasive species could recolonize following dredging, primarily in the Outer Harbor. These expansion areas are, however, relatively small in the context of the greater San Francisco Bay. Furthermore, the LTMS has concluded that only a few projects occurring under its oversight would entail deepening in the San Francisco Bay Estuary, and the benthos would be similar to existing conditions (USACE et al. 2009).

Habitat Alteration

The Proposed Action would permanently deepen subtidal waters in the IHTB and OHTB expansion areas. Expansion of the IHTB would also permanently convert approximately 10 acres of terrestrial land into intertidal or subtidal habitat.

Creation of additional subtidal and intertidal waters from enlarging the IHTB is anticipated to result in a long-term benefit to aquatic species and habitats by expanding the area of available aquatic habitat. This includes 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, and marine mammals. Newly created waters would, however, receive periodic disturbance (e.g., by vessel traffic and maintenance dredging) and would not be of the quality of undisturbed benthic habitat. Rather, it is anticipated to be comparable in quality to existing or adjoining habitat in the IHTB and navigation channel.

Expanding the IHTB and OHTB would permanently convert shallow water to deeper water, which may adversely affect habitat for ESA–listed fish species. Green Sturgeon and Longfin Smelt predominantly forage in the benthos, at observed depths up to 33 feet for Green Sturgeon. Proposed deepening to expand the turning basins may affect Green Sturgeon and Longfin Smelt foraging, although there is little or no available data pertaining to foraging by these species at depths of -50 feet MLLW. Salmonids show preference for sit-and-wait foraging in the water column, and foraging effects from permanent deepening are therefore anticipated to be minimal. Benthic habitat quality in the Action Area is likely marginal, given regular disturbance associated with large-vessel traffic and maintenance dredging.

Effects of permanent channel deepening on federal ESA-listed fish species are anticipated to be minimal when considering the relative low value of benthic foraging habitat impacted, and the benefits provided by converting upland industrial habitat to subtidal and intertidal habitat.

North American Green Sturgeon Southern DPS

There is no established in-water work window for Green Sturgeon. This species is assumed present in the Action Area during construction, and therefore may be subject to the temporary effects described in Sections 6.11 and 6.1.2, including effects related to entrainment during dredging, increases in turbidity and suspended sediment, mobilization of contaminants of concern, temporary benthic habitat disturbance, underwater noise, and impediments to localized movement and migration. Potential impacts to Green Sturgeon and other aquatic organisms from accidental discharges, upland stormwater management alterations, and invasive species would be avoided through adherence to applicable regulations and federal, state, and local oversight.

Direct take of Green Sturgeon through entrainment is unlikely to occur. There is no spawning or rearing habitat for Green Sturgeon in the Action Area. It is anticipated that juvenile and adult Green Sturgeon, if present, would be motile enough to avoid entrainment during dredging.

As with other fish species, Green Sturgeon may be temporarily affected by increased turbidity and underwater noise, if present. These impacts would be short-term and minor, and comparable to conditions associated with existing activity at the Inner and Outer Harbors. The Proposed Action includes avoidance and minimization measures, such as the use of bubble curtains or similar attenuation systems during impact pile driving, to ensure that impactive noise exceeding the 187 dB threshold is minimized. Vibratory pile extraction and installation and impact driving may generate underwater noise above the 150 dB RMS threshold over the distances presented in Table 6-2. This underwater noise may disrupt or temporarily prevent Green Sturgeon from foraging in the Action Area. Other construction noise levels (such as dredging) would likely be similar or less than background noise from large vessel use in the harbor. Localized turbidity impacts to fish are generally not regarded as major, and dredging BMPs would be implemented to minimize increases in turbidity.

Green Sturgeon could experience temporary foraging impacts from benthic habitat disturbance during dredging and in-water construction, because Green Sturgeon are reported to feed on benthic invertebrates, including shrimp, amphipods, and occasionally small fish. However, benthic habitat in the Action Area is likely of marginal value to Green Sturgeon and other species that forage in the benthos because the aquatic areas proposed for new dredging occur at the margins of the existing navigation channels and turning basins, which are regularly disturbed by maintenance dredging and deep-draft vessel traffic.

Green Sturgeon could be affected by mobilization of chemicals of concern during dredging; however, these effects would likely be minimal and limited to the duration of construction. As detailed in Section 6.1.2, LTMS-directed studies demonstrated that short-term effects on sensitive fish by contaminants associated with dredging plumes are minor. Sediments would be tested prior to dredging, and the results would be reviewed by the DMMO prior to dredging and placement, including evaluation of the potential for water quality impacts. In consideration of the low likelihood for exposure to toxins during dredging; avoidance and minimization measures described in Section 2.3 to protect water quality; and in consideration of DMMO procedures, the Proposed Action is unlikely to result in substantial adverse impacts to Green Sturgeon from mobilization of contaminants of concern. Furthermore, removal of sediments potentially containing contaminants of concern would result in a long-term benefit to the aquatic environment.

Permanent Green Sturgeon foraging effects may also occur from deepening the expanded turning basin area and from converting upland terrestrial habitat to intertidal and subtidal waters. Tagged adults and sub-adults in San Francisco Bay and the Delta have been observed occupying waters with shallow depths of less than -33 feet MLLW, either swimming near the surface or foraging along the bottom. Deepening existing waters to -50 feet MLLW may therefore reduce suitability for Green Sturgeon foraging. However, as noted for temporary benthic habitat disturbance, high levels of existing vessel activity in the Inner and Outer Harbors likely reduces the suitability for Green Sturgeon foraging under existing and proposed conditions. Converting approximately 10 acres of uplands to open water habitat would have a beneficial effect on Green Sturgeon by increasing the area of available habitat, including foraging habitat at the margins of the IHTB expansion area or along seawalls where depths of less than -33 feet MLLW would be present.

Impediments to Green Sturgeon localized migration and movement would be minimal when considering the mobility of these species and the Proposed Action avoidance and minimization measures. Displacement from turbid areas would be short-term. Conversion of uplands to open water habitat would have a long-term benefit on localized movement of Green Sturgeon, which would further compensate for any potential temporary displacement.

Green Sturgeon are presumed to be present year-round. Construction-related impacts to this species are anticipated to be reduced through implementation of avoidance and minimization measures; however, underwater noise and disturbance may cause behavioral effects in Green Sturgeon if they are present in the Action Area during pile removal and installation. Long-term adverse impacts from loss of benthic foraging habitat are likely to be minimal, given the quality of habitat in the Action Area, and in consideration of long-term benefits from habitat creation associated with converting upland habitat in the IHTB to open water. Therefore, the Proposed Action *may affect, but is unlikely to adversely affect,* Green Sturgeon.

Salmonids (Steelhead, CCC DPS; Steelhead, Central Valley DPS; Chinook Salmon, Sacramento Winter-Run ESU; and Chinook Salmon, Central Valley Spring-Run ESU)

Dredging and in-water construction would occur during the established June 1 to November 30 work window for salmonids, including federally listed steelhead and Chinook Salmon potentially present in the Action Area. The Chinook Salmon preferred migratory pathway through Raccoon Straight and north of Yerba Buena Island further precludes their likely presence. By complying with this existing work window, salmonid impacts from construction would likely be avoided. Long-term effects would occur as a result of deepening waters in the proposed expanded turning basin areas, although minimal adverse effects from deepening would be offset by converting approximately 10 acres of upland terrestrial habitat to open water.

In the unlikely event of special-status salmonid presence in the Action Area during construction, direct take through entrainment is unlikely to occur. No rearing habitat occurs in the Action Area, and there is no potential for presence of salmonid fry or smolts in the Action Area. Juvenile and adult salmonids would likely be motile enough to avoid entrainment.

As with other fish species, special-status salmonids (if present) may be temporarily affected by increased turbidity and underwater noise. These impacts would be short-term and minor, and comparable to conditions associated with existing activity at the Inner and Outer Harbors. The Proposed Action includes avoidance and minimization measures, such as the use of bubble curtains or similar attenuation systems during impact pile driving, to ensure that impactive noise exceeding the 187 dB threshold is minimized. Both vibratory and impact driving may generate underwater noise above the 150 dB RMS threshold over the distances presented in Table 6-2. Other construction noise levels (such as dredging) would likely be similar to or less than background noise from existing large vessel use in the Action Area. Localized turbidity impacts to fish are generally not regarded as major, and dredging BMPs would be implemented to minimize increases in turbidity, including, but not limited to, use of silt curtains and water quality monitoring.

If present, special-status salmonids could experience temporary foraging impacts from benthic disturbance during dredging and in-water construction, although these species are primarily drift feeders, and would generally avoid the dredge and in-water construction areas if present.

Salmonids could be affected by mobilization of chemicals of concern during dredging; however, these effects would likely be minimal and would be limited to the in-water construction window when salmonids are unlikely to be present. As detailed in Section 6.1.2, LTMS direct studies demonstrated that short-term effects on sensitive fish by contaminants associated with dredging plumes are minor. Sediments would be tested prior to dredging, and the results would be reviewed by DMMO prior to dredging and placement, including evaluation of the potential for water quality impacts. In consideration of the low likelihood for exposure to toxins during dredging; avoidance and minimization measures described in Section 2.3 to protect water quality; dredging during the in-water work window; and in consideration of DMMO procedures, the Proposed Action is unlikely to result in substantial adverse impacts to salmonids from mobilization of contaminants of concern.

Permanent special-status salmonid effects may occur from deepening the expanded turning basin area and from converting approximately 10 acres of upland terrestrial habitat to intertidal and subtidal waters. Salmonids are suspected to forage in Central Bay shallow water areas (less than 30 feet deep) during in-migration and out-migration transit and deepening existing waters to -50 feet MLLW may therefore reduce their suitability for salmonid foraging. However, high levels of existing vessel activity in the Inner and Outer Harbors likely reduces the suitability for salmonid foraging under existing and proposed conditions. Conversion of uplands to open water habitat would have a beneficial effect on salmonids by increasing the area of available habitat, including foraging habitat at the margins of the expansion areas or along seawalls where depths of -50 feet MLLW may not be achieved.

Impediments to salmonid localized migration and movement would be minimal when considering the mobility of these species and the Proposed Action avoidance and minimization measures. These impacts would primarily be avoided by adhering to the June 1 through November 30 in-water work window, when special-status salmonids are unlikely to be present. Conversion of uplands to open water habitat would have a long-term benefit on localized movement of salmonids, which would further compensate for any potential temporary displacement.

In summary, the Proposed Action would principally avoid temporary construction impacts to federally listed salmonids through adherence to the established June 1 through November 30 construction window, and would likely result in net permanent benefits through conversion of uplands to open water habitat. In consideration of the analysis detailed above, temporary effects in the unlikely event of salmonid presence during construction would be minimal and unlikely to result in adverse effects. Therefore, the Proposed Action *may affect, but is unlikely to adversely affect,* steelhead (CCC and Central Valley DPS) or Chinook Salmon (Sacramento winter-run and Central Valley spring-run).

<u>Longfin Smelt</u>

Longfin Smelt may occur in the Central Bay during spring and summer months, but are unlikely to be present during the fall and winter period. The abundance of Longfin Smelt in San Francisco Bay and the Delta has steadily declined since about 2000, and Longfin Smelt have been predominantly observed in observation stations in or upstream of San Pablo and Suisun Bays during Bay Surveys. Although an in-water work window for Longfin Smelt has not been established, these trends and observations suggest a low potential for this species to occur in the Action Area.

Similar to Green Sturgeon, Longfin Smelt are presumed present, and therefore may be subject to the temporary adverse effects described in Sections 6.11 and 6.1.2, including effects related to entrainment during dredging, increases in turbidity and suspended sediment, mobilization of contaminants of concern, temporary benthic habitat disturbance, underwater noise, and impediments to localized movement and migration. Potential impacts to Longfin Smelt from accidental discharges, upland stormwater management alterations, and invasive species would be avoided through adherence to applicable regulations and federal, state, and local oversight.

Direct take of Longfin Smelt through entrainment is unlikely to occur. Spawning adults congregate at the upper end of Suisun Bay and in the lower and middle Delta, especially in the Sacramento River channel and adjacent sloughs, and Central Bay occurrence of Longfin Smelt is likely limited to juvenile and adult life stages. It is anticipated that juvenile and adult Longfin Smelt, if present, would be motile enough to avoid entrainment during dredging.

As with other fish species, Longfin Smelt may be temporarily affected by increased turbidity and underwater noise, if present. These impacts would be short-term and minor, and comparable to conditions associated with existing activity at the Inner and Outer Harbors. The Proposed Action includes avoidance and minimization measures, such as the use of bubble curtains or similar attenuation systems during impact pile driving, to ensure that impactive noise exceeding the 187 dB threshold is minimized. Both vibratory and impact driving may generate underwater noise above the 150 dB RMS threshold over the distances presented in Table 6-2. Other construction noise levels would likely be similar or less than background noise from large vessel use in the harbor. Turbidity impacts to fish are generally not regarded as major, and dredging BMPs would be implemented to minimize increases in turbidity.

Longfin Smelt could experience temporary foraging impacts from benthic disturbance during dredging and in-water construction, because they mostly prey on species that inhabit the benthos, primarily opossum shrimp, copepods, and other crustaceans. However, benthic habitat in the Action Area is likely of marginal value to Longfin Smelt and other species that forage in the benthos; benthic habitat proposed for new dredging occurs at the margins of the existing navigation channel and turning basins, and is regularly disturbed by maintenance dredging and deep-draft vessel traffic. Furthermore, adult Longfin Smelt's primary prey, opossum shrimp, is not known to occur in the Action Area.

Longfin Smelt could be affected by mobilization of chemicals of concern during dredging; however, these effects would likely be minimal and would be limited to the in-water construction window. As detailed in Section 6.1.2, LTMS directed studies demonstrated that short-term effects on sensitive fish by contaminants associated with dredging plumes are minor. Sediments would be tested prior to dredging, and the results would be reviewed by the DMMO prior to dredging and placement, including evaluation of the potential for water quality impacts. In consideration of the low likelihood for exposure to toxins during dredging; avoidance and minimization measures described in Section 2.3; and in consideration of DMMO procedures, the Proposed Action is unlikely to result in substantial adverse impacts to Longfin Smelt from mobilization of contaminants of concern. Furthermore, removal of sediments and upland fills potentially containing contaminants of concern would result in a long-term benefit to the aquatic environment.

Permanent Longfin Smelt foraging effects may also occur from deepening the expanded turning basin area and from converting approximately 10 acres of upland terrestrial habitat to intertidal and subtidal waters. Although there is little available evidence on the depth of

Longfin Smelt foraging, this species is primarily associated with the middle and lower portion of the water column. Therefore, deepening existing waters to -50 feet MLLW could affect suitability for Longfin Smelt foraging. However, as noted for temporary benthic habitat disturbance, high levels of existing vessel activity in the Inner and Outer Harbors likely reduces the suitability for Longfin Smelt foraging under existing and proposed conditions. Conversion of uplands to open water habitat would have a beneficial effect on Longfin Smelt by increasing the area of available habitat, including foraging habitat and lower and middle water column habitat.

Temporary impediments to Longfin Smelt localized migration and movement during construction would be minimal when considering the mobility of these species and the Proposed Action avoidance and minimization measures. Conversion of uplands to open water habitat would have a long-term benefit on localized movement of Longfin Smelt, which would further compensate for any potential temporary displacement.

In summary, there is low potential for Longfin Smelt to be present in the Action Area, and construction-related impacts to this species are anticipated to be minimal when considering the quality of habitat in the Action Area; implementation of proposed avoidance and minimization measures; and the mobility of Longfin Smelt life stages that could be present. Long-term adverse impacts from loss of benthic foraging habitat are likely to be minimal, given the quality of habitat in the Action Area, and in consideration of long-term benefits from habitat creation associated with converting upland habitat in the IHTB to open water. In consideration of the analysis detailed above, temporary effects in the unlikely event of Longfin Smelt presence during construction would be minimal and unlikely to result in adverse effects. Therefore, the Proposed Action *may affect, but is unlikely to adversely affect,* Longfin Smelt.

6.2 Critical Habitat

North American Green Sturgeon Critical Habitat

The Proposed Action may affect Green Sturgeon estuarine PCEs. This includes PCEs related to food resources, water quality, and depths. The Action Area does not include any freshwater systems or nearshore coastal marine areas, and those PCEs for Green Sturgeon would therefore be unaffected. The Proposed Action would not impede migration, because impediments to movement would only be temporary and confined to the dredging area.

Temporary disturbance of benthic foraging habitat could reduce prey resources important for Green Sturgeon, and permanent foraging impacts could occur from deepening waters to -50 feet MLLW to construct the IHTB and OHTB expansions. As described in Section 6.1.2, benthic habitat in the Action Area is likely of low value to Green Sturgeon, given its location at the margins of the existing channels and turning basins, where regular disturbance maintenance dredging and deep-draft vessel traffic occurs. Impacts to marginal foraging habitat would be offset through converting approximately 10 acres of existing upland habitat to open water habitat through IHTB expansion. This would potentially include suitable Green Sturgeon foraging habitat at the margins of the IHTB expansion area, where depths would be shallower than -50 feet MLLW.

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 of new open water habitat in the IHTB expansion area. Temporary impacts would also be minimized through implementation of avoidance and minimization measures described in Section 2.3. Therefore, the Proposed Action *may affect, but is not likely to adversely modify*, the capability of designated critical habitat in the Action Area North American Green Sturgeon to support the survival and recovery of this species.

Steelhead, CCC DPS Critical Habitat

Construction would temporarily affect estuarine habitat for steelhead, including through obstructions in the navigation channel from dredging equipment, increased turbidity, and possibly noise. However, adult and juvenile salmonids are expected to generally avoid sediment plumes during construction, using clearer open waters adjacent to the plumes. Following construction, these obstructions would be eliminated. There would be no long-term impacts to PCEs for steelhead, although creation of new open water habitat in the IHTB expansion area would likely improve the quality of critical habitat for steelhead.

The Proposed Action would not affect any freshwater habitat, and would have little or no effect on salinity intrusion. Studies have shown that placement of dredged material from clamshell-bucket dredges into the water column does not cause substantial short- or long-term changes in temperature, salinity, or pH (USACE 1976a, 1976b). A USACE study (USACE 1976a) found that changes in these parameters were localized and short in duration during all types of dredging (hydraulic and mechanical); ambient concentrations of these parameters were usually regained within 10 minutes following material release (USACE 1998).

Therefore, the Proposed Action *may affect, but is not likely to adversely modify*, the capability of designated critical habitat in the Action Area for CCC DPS Steelhead to support the survival and recovery of this species.

6.3 Terrestrial Special-Status Species and Resource Effects

Terrestrial special-status species potentially present in the Action Area include the California least tern. Potential impacts to California least tern would be limited to temporary foraging impacts during construction resulting from water quality impacts (e.g., suspended sediments and turbidity), airborne noise, and reduced availability of prey species. Upland habitat permanently altered by project construction is not used for California least tern foraging, nesting, or breeding, and permanent alteration of these areas (i.e., converting uplands to open water) would therefore not adversely impact this species. Proposed deepening to expand the IHTB and OHTB would mostly affect moderately deep waters, whereas the California least tern is generally described as preferring shallow waters for foraging. Deepening would occur to -50 feet MLLW, which is within the 60-foot depth range expected to be suitable for California least tern foraging. Therefore, deepening in the ITHB and OHTB expansion areas is not anticipated to substantially affect this species.

There may be a nominal long-term benefit to California least tern foraging by converting a portion of the existing hardened shoreline at the inner harbor turning basin into intertidal and subtidal aquatic habitat where foraging could occur.

California Least Tern

Dredging or other construction noise may potentially cause avoidance of foraging locations and can interfere with vocalizations between individuals during group foraging (ESA 2017). However, the noise associated with construction of the Proposed Action would not be expected to substantially impact California least terns, due to the ambient noise levels associated with current operations at the Port (H.T. Harvey and Associates 2012).

Dredging and shoreline construction can temporarily increase turbidity, which can also affect California least tern foraging. Increased turbidity may decrease foraging success by decreasing prey abundance or making it more difficult for birds to detect prey. Increased turbidity during dredging is generally expected to occur within a 250-meter (820-foot) radius of active dredging, and use of silt curtains would likely further limit this distance. Turbidity impacts would be mostly confined to existing moderately deep waters or shoreline areas currently occupied by marine structures proposed for removal. Impacts to shallow water habitat would be limited, and would not occur in waters adjacent to known California least tern colonies at the former Alameda Naval Air Station or known foraging and roosting habitat in the MHEA. Mapped eelgrass areas in the Oakland Harbor are more than 250 meters (820 feet) from the proposed IHTB expansion footprint. One small patch of eelgrass is approximately 167 meters (548 feet) northeast of the proposed OHTB expansion footprint (Merkel and Associates 2021). As evidenced by pre- and post-dredging surveys of eelgrass conducted in the Oakland and Richmond harbors before and after maintenance dredging, dredging is not anticipated to adversely affect existing eelgrass populations (Merkel and Associates 2011 and 2012; USACE and RWQCB 2015). Furthermore, this alternative includes implementation of eelgrass-related minimization measures such as pre- and post-construction surveys in the project area, evaluation of project impacts, and as-needed compensatory mitigation in compliance with the California Eelgrass Mitigation Policy and Implementation Guidelines.

Adverse water quality impacts such as accidental spills of contaminants or mobilization of chemicals of concern could adversely affect fish, and thereby affect California least tern foraging. As described for aquatic special-status species, the potential for these water quality impacts is considered minimal, given federal, state, and local oversight, and the Proposed Action avoidance and minimization measures.

Noise from construction activities would not substantially disrupt foraging activities of California least tern. Birds currently residing in the vicinity are accustomed to varying levels of ambient noise emanating from existing human activities in the project area, including truck and train traffic, ferry operations, heavy metal recycling activities at the Schnitzer Steel site, and Port shipping operations that occur throughout the day. Bird disruption from visual or noise disturbance varies, but typically, birds will avoid disturbance areas and move to more preferable environments; the species would be able to forage in similar shoreline waters elsewhere in the Oakland-Alameda Estuary distanced from construction activities.

Temporary construction effects may discourage prey fish from entering the Oakland-Alameda Estuary from San Francisco Bay, thereby decreasing the supply of available fish during dredging and construction activities. This includes effects to water quality, turbidity, and suspended sediments, underwater noise, and other effects. As detailed in Section 6.1, these effects to fish are anticipated to be temporary and minimal, and therefore are unlikely to substantially affect California least tern foraging. Therefore, the Proposed Action *may affect, but is unlikely to adversely affect,* California least tern.

CHAPTER 7: CONCLUSION AND DETERMINATION OF EFFECTS SUMMARY

This section summarizes the BA conclusions formulated using the preceding discussion of species presence, habitat conditions, and effects of the Proposed Action. As described in Chapter 6, avoidance and minimization measures are proposed that would avoid and minimize, to the maximum extent practicable, the Proposed Action's potential impacts to federal ESA–listed species and critical habitat. The Proposed Action also includes creation of new open water habitat in the IHTB expansion area and would beneficially reuse suitable dredged material. With the implementation of these measures, and in consideration of Proposed Action habitat benefits, the following determinations for ESA threatened or endangered species and critical habitats were made: .

- The Proposed Action ***may affect, but is not likely to adversely affect,*** North American Green Sturgeon, steelhead (Central Valley DPS and CCC DPS) and Chinook Salmon (Sacramento River winter-run and Central Valley spring-run).
- The Proposed Action would not appreciably diminish the value of designated critical habitat, and ***may affect, but is not likely to adversely modify***, the capability of designated critical habitat in the Action Area for CCC DPS Steelhead and North American Green Sturgeon to support the survival and recovery of these species.
- The Proposed Action ***may affect, but is not likely to adversely affect,*** California least tern.

Longfin Smelt is currently proposed for listing as endangered and is expected to be formally listed in the near future. Based on recent survey data, as discussed in Section 5.2.6, this species has a low potential of occurring in the Action Area, and the avoidance and minimization measures provided in Section 2.3 would also serve to protect this species if it is present. The information presented in Section 6.1.5 indicates that the Proposed Action ***may affect, but is not likely to adversely affect,*** Longfin Smelt.

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Appendix A Oakland Harbor FY 2021 Maintenance Dredging Pre-Dredge Eelgrass Survey

Appendix B Federally Listed Wildlife Species that May Occur in the Action Area

Table B-1
Federally Listed Wildlife Species that May Occur in the Action Area

Species	Federal	State	Habitat Association	Potential to Occur
Invertebrates				
Monarch (*Danaus plexippus*)	C	—	Closed-cone coniferous forest, needs nectar and water sources	No potential to occur. Habitat not present.
Amphibians				
California tiger salamander (*Ambystoma californiense*)	T	T	Cismontane woodland; meadow and seep; riparian woodland; valley and foothill grassland	No potential to occur. Habitat not present.
California red-legged frog (*Rana draytonii*)	T	—	Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation	No potential to occur. Habitat not present.
Birds				
California least tern (*Sternula antillarum browni*)	E	E	Alkali playa, wetland, sand beaches, landfills, or paved areas	Known to occur at Former Alameda Naval Air Station on Alameda Island and at Oakland Middle Harbor Enhancement Area; may forage in Action Area.
California Ridgway's rail (*Rallus obsoletus obsoletus*)	E	E	Saltwater and brackish marshes traversed by tidal sloughs in the vicinity of San Francisco Bay	No potential to occur. Habitat not present.
Western snowy plover (*Charadrius nivosus nivosus*)	T	SSC	Sandy beaches, salt pond levees, and shores of large alkali lakes	No potential to occur. Habitat not present.
Mammals				
Salt-marsh harvest mouse (*Reithrodontomys raviventris)*	E	E	Dense pickleweed salt marsh in and west of Suisun Bay	No potential to occur. Habitat not present.
Fish				
Green Sturgeon – Southern DPS (*Acipenser medirostris*)	E	—	Aquatic; estuary	Moderate potential to occur.
Delta Smelt (*Hypomesus transpacificus*)	T	E	Aquatic; estuary	No potential to occur. Habitat not present.
Steelhead – Central California Coast DPS (*Oncorhynchus mykiss irideus*)	T	—	Aquatic; Sacramento/San Joaquin flowing waters	Moderate potential to occur; very low potential to occur during in-water construction work window.
Steelhead – Central Valley DPS (*Oncorhynchus mykiss irideus*)	T	—	Aquatic; Sacramento/San Joaquin flowing waters	Moderate potential to occur; very low potential to occur during in-water construction work window.

Species	Federal	State	Habitat Association	Potential to Occur
Chinook Salmon – Central Valley spring-run ESU (*Oncorhynchus tshawytscha*)	T	—	Aquatic; estuary	Moderate potential to occur; very low potential to occur during in-water construction work window.
Chinook Salmon – Sacramento winter-run (*Oncorhynchus tshawytscha)*	E	E	Aquatic; estuary	Moderate potential to occur; very low potential to occur during in-water construction work window.
Longfin Smelt (*Spirinchus thaleichthys*)	P	T; SSC	Aquatic; estuary	Low to moderate potential to occur.
Tidewater Goby (*Eucyclogobius newberryi*)	E	—	Brackish water habitats, shallow lagoons, lower stream reaches	No potential to occur. Habitat not present.
Reptiles				
Alameda whipsnake (*Masticophis lateral euryxanthus*)	T	T	Typically found in chaparral and scrub habitats, but will also use adjacent grassland, oak savanna and woodland habitats	No potential to occur. Habitat not present.
Green sea turtle (*Chelonia mydas*)	T	—	Marine, needs adequate supply of seagrasses and algae	No potential to occur. Habitat not present.
Plants				
Beach Layia (*Layia carnosa*)	E	E; 1B.1	Coastal dunes, coastal scrub	No potential to occur. Habitat not present.
California seablite (*Suaeda californica*)	E	1B.1	Marshes and swamps	No potential to occur. Habitat not present.
Robust spineflower (*Chorizanthe robusta var. robusta*)	E	1B.1	Cismontane woodland, coastal dunes, coastal scrub, chaparral	No potential to occur. Habitat not present.
Santa Cruz tarplant (*Holocarpha macradenia*)	T	E; 1B.1	Coastal prairie, coastal scrub, valley and foothill grassland	No potential to occur. Habitat not present.

Notes:

C: candidate
E: endangered
P: proposed
T: threatened
SSC: state species of special concern
DPS: Distinct Population Segment
ESU: Evolutionary Significant Unit
Rare Plant Rank 1B.1 – rare, threatened, or endangered in California and elsewhere; seriously threatened in California (more than 80 percent of occurrences threatened/high degree and immediacy of threat)

Sources: California Natural Diversity Database Rarefind 5 search of Oakland Harbor navigation channel, turning basins, and shoreline; USFWS Information for Planning and Consultation (IPaC) report search of Oakland Harbor navigation channel, turning basins, and shoreline.

Appendix C Hydroacoustic Analysis Worksheets