Oakland Harbor Turning Basins Widening

Essential Fish Habitat Assessment

May 2024

PORT OF OAKLAND

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Port of Oakland

U.S. Army Corps of Engineers

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ACRONYMS

bgs	below ground surface
BMP	best management practice
°C	degrees Celsius
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
DMMO	Dredged Material Management Office
EFH	Essential Fish Habitat
EPA	United States Environmental Protection Agency
°F	Fahrenheit
-50-Foot Project	Oakland Harbor Navigation Improvement Project Study
FMP	Fishery Management Plan
HAPCs	Habitat Areas of Particular Concern
IHTB	Inner Harbor Channel and Inner Harbor Turning Basin
LTMS	Long Term Management Strategy
mg/L	milligrams per liter
MLLW	Mean Lower Low Water
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NTUs	nephelometric turbidity units
OBM/MS	Old Bay Mud/Merritt Sand
OHTB	Outer Harbor Channel and Outer Harbor Turning Basin
PCB	polychlorinated biphenyl
Port	Port of Oakland
PSUs	practical salinity units
RWQCB	Regional Water Quality Control Board
SAP	Sediment Analysis Plan
SEL	sound exposure level
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service

Chapter 1. Introduction

This Essential Fish Habitat (EFH) Assessment is intended to comply with Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) for EFH and Habitat Areas of Particular Concern (HAPCs). This EFH Assessment will support consultation with National Marine Fisheries Service (NMFS) for effects to EFH, including HAPCs from the Oakland Harbor Turning Basins Widening Project, as required under Section 305(b) of the MSA. The MSA is designed to protect waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

The document is organized as follows:

- **Chapter 1: Introduction.** This section provides the project location and background.
- **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: Essential Fish Habitat in the Action Area.** This section identifies EFH in the Action Area and provides their respective descriptions. Habitat types in the Action Area are also described.
- **Chapter 4. Effects Assessment.** This section provides a description of effects to EFH and HAPCs from the Proposed Action.
- **Chapter 5. Conclusion and Determination of Effects Summary.** This section summarizes the conclusions and determinations of effects to EFH, including HAPCs.

1.1. Location and Background

The Port of Oakland (Port), 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.

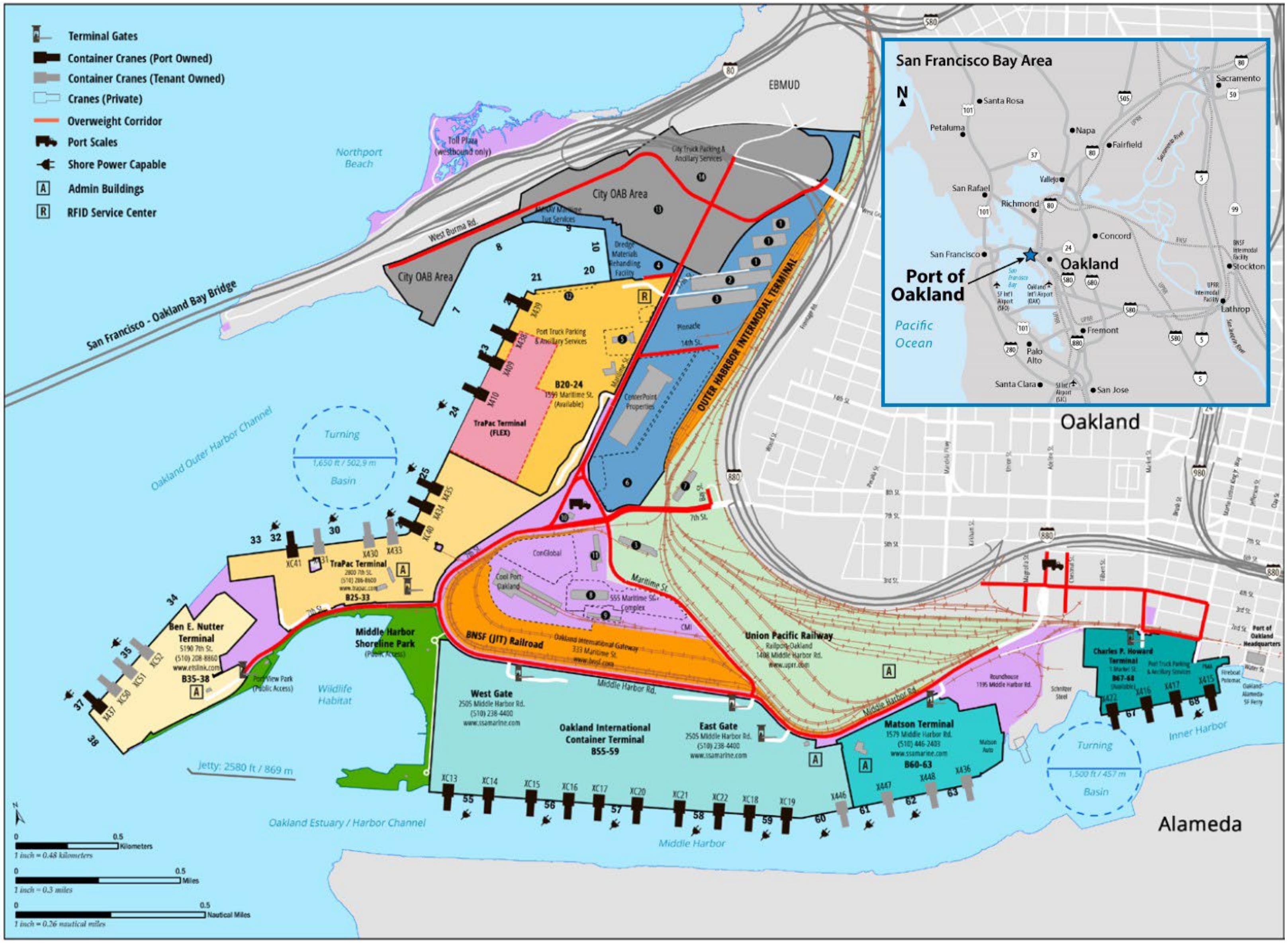

Figure 1-1 Current Port of Oakland Navigation Features

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 the projected overall volumes of freight that would come into the Port.

2.1. Expansion of Inner Harbor Turning Basin

The Expansion of Inner Harbor Turning Basin 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.

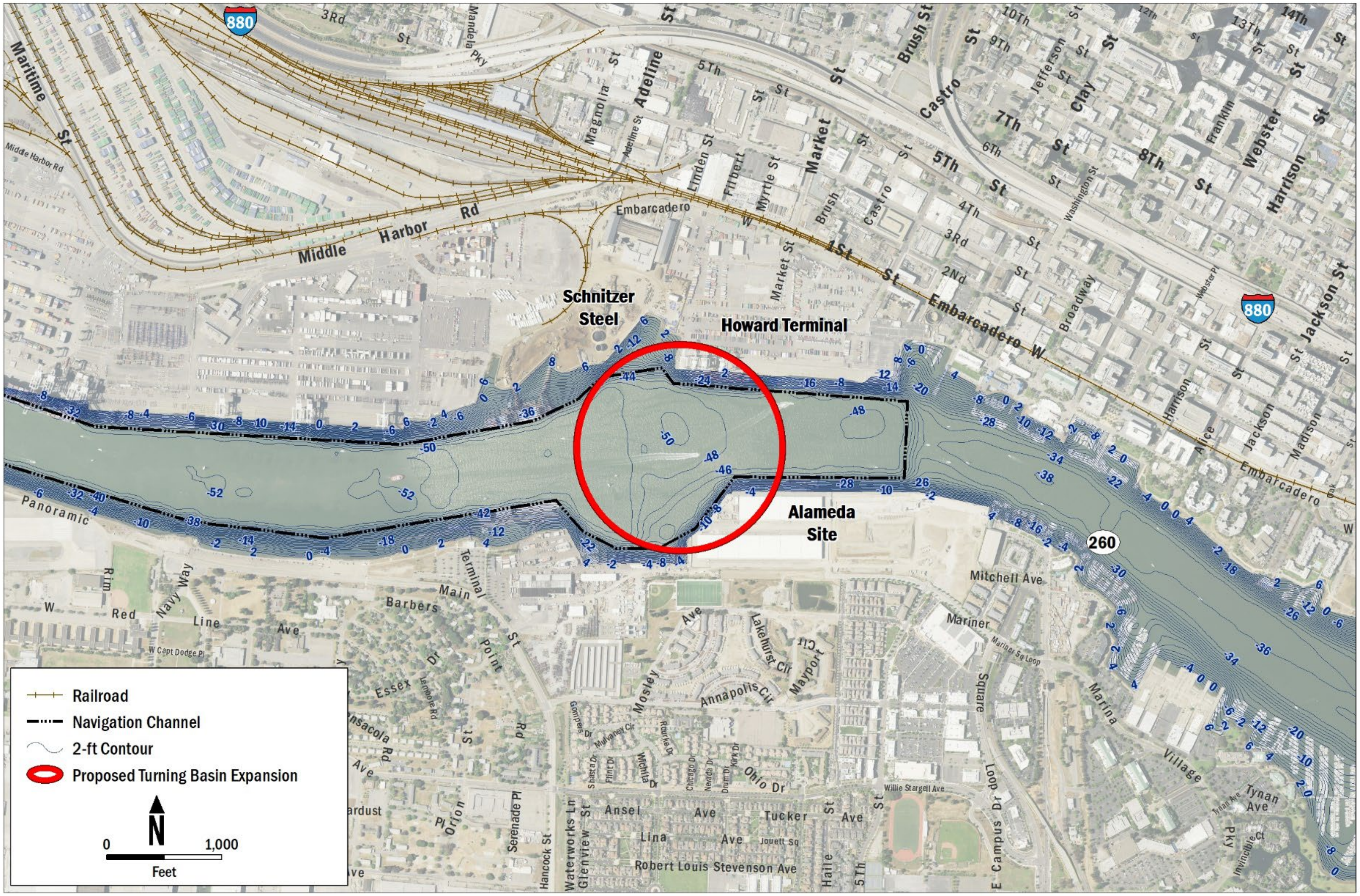

Figure 2-1 Proposed Expansion of Inner Harbor Turning Basin

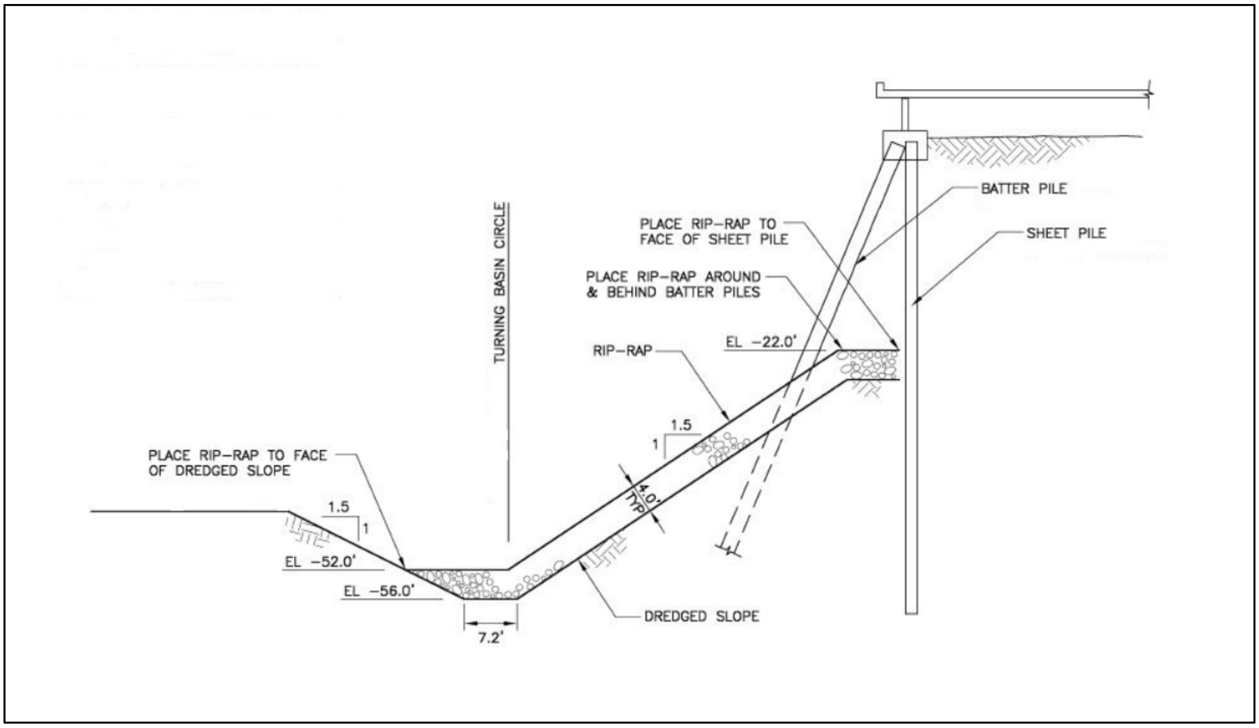

Figure 2-2 Preliminary Bulkhead Wall Cross-Section

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

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

Howard Terminal		
Location	Approximate Cubic Yards[1]	Trips[2]
Class I landfill	2,900	290
Class II landfill	25,800	2,580
Recycler	22,900	2,290
Alameda		
Location	**Approximate Cubic Yards[1]**	**Trips[2]**
Class I landfill	8,000	800
Class II landfill	151,900	15,190
Recycler	101,600	10,160
Inner Harbor Sediments		
Location	**Approximate Cubic Yards[1]**	**Trips[2]**
Class II landfill	9,700	970
Total		
Location	**Approximate Cubic Yards[1]**	**Trips[2]**
Class I landfill	10,900	1,090
Class II landfill	187,400	18,740
Recycler	124,500	12,450
All	322,800	32,280

Notes:

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

Howard Terminal		
Action	**Approximate Quantity[1]**	**Unit**
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		
Action	**Approximate Quantity[1]**	**Unit**
Bulkhead installation – in water	330	linear feet
Batter pile installation – in water	34	each
Rock installation	6,000	cubic yards
Alameda Site		
Action	**Approximate Quantity[1]**	**Unit**
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)		
Action	Approximate Quantity[1]	Unit
Dredging	143,300	cubic yards
Impacted area (submerged land)	370,600	square feet
Total		
Action	**Approximate Quantity[1]**	**Unit**
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

Notes:

[1] Quantities include 10 percent contingency

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.

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 eight 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.

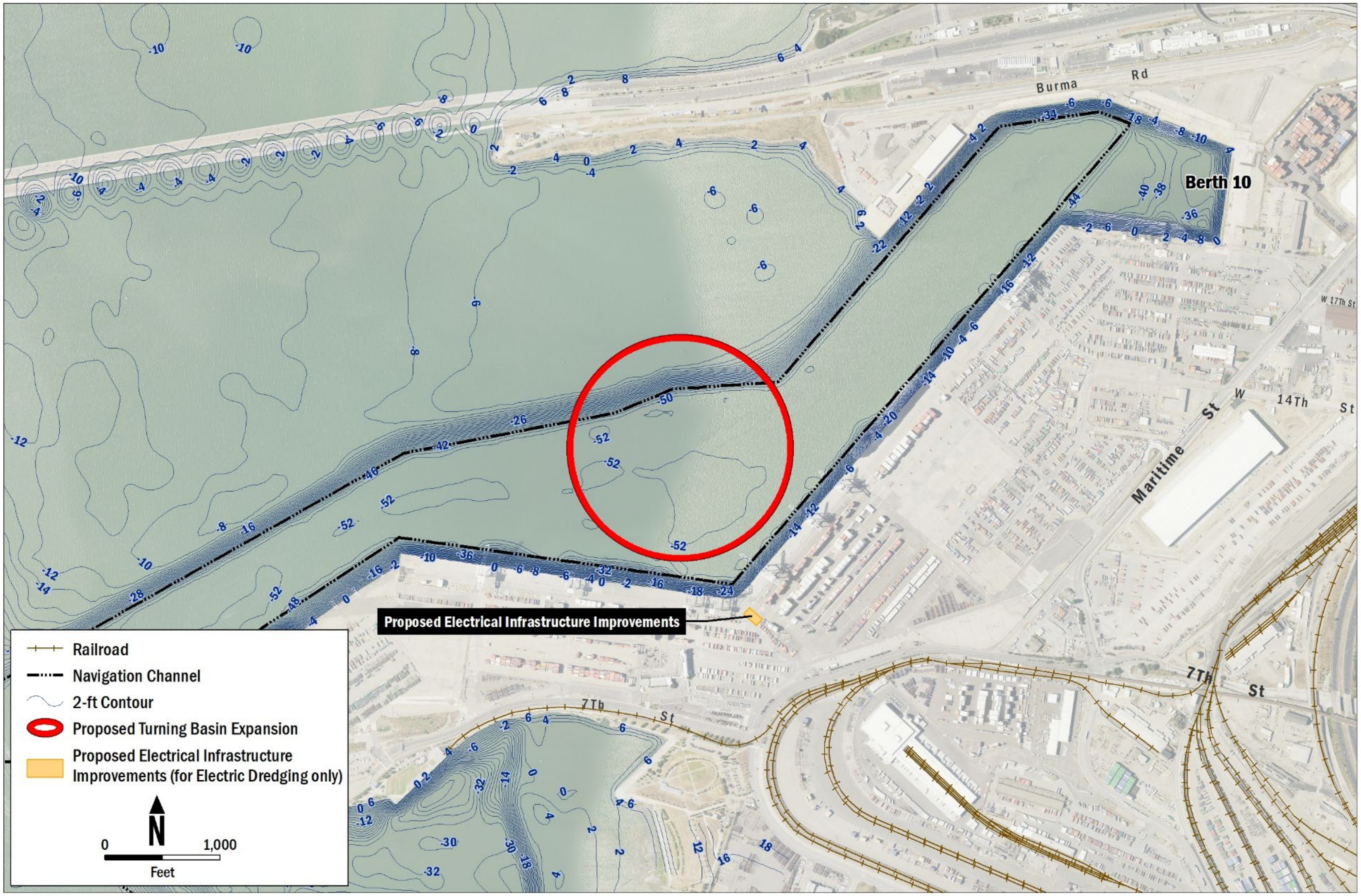

Figure 2-3 Proposed Expansion of Outer Harbor Turning Basin

Table 2-3 Outer Harbor Sediments

Type of Soil (Dredging)	Approximate 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.

2.3.1. 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.

2.3.2. Dredging-Related 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.

2.3.3. Pile-Driving-Related 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.

2.3.4. 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. Essential Fish Habitat in the Action Area

3.1. Introduction and Overview

The MSA was enacted to maintain healthy populations of commercially important fish species. Under the MSA, eight regional Fishery Management Councils are responsible for developing Fishery Management Plans (FMPs) to manage these species. The 1996 amendments to the MSA included protecting the habitats of species for which there is a FMP; these habitats are designated as EFH.

EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 United States Code 1802.10). EFH can consist of both the water column and the underlying surface (e.g., seafloor) of a particular area, and it includes those habitats that support the different life stages of each managed species. A single species may use many different habitats throughout its life to support breeding, spawning, nursery, feeding, and protection functions. The Central San Francisco Bay (Central Bay), including the Action Area, is designated EFH for assorted fish species managed under the following FMPs:

- Pacific Coast Groundfish
- Coastal Pelagic Species
- Pacific Salmon

In the San Francisco Bay-Delta region, NMFS has designated three HAPCs, which are a subset of EFH; these areas are rare, particularly susceptible to human-induced degradation, especially ecologically important, and/or located in an environmentally stressed area. They include:

- Eelgrass beds (*Zostera marina*)
- Olympia oyster beds (*Ostrea lurida*)
- Pacific Groundfish FMP estuary

Small patches of eelgrass are present in both the Inner and Outer Harbor, as shown on Figures 1 and 2 of Appendix A. The nearest patch at the Outer Harbor is approximately 167 meters (548 feet) northeast of the proposed OHTB expansion footprint. 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).

The Olympia oyster (*Ostrea lurida*), also known as the "native oyster," is native to most of western North America, and it was a key component of the San Francisco Bay marine ecosystem prior to overharvesting and increased siltation from hydraulic mining in the mid-nineteenth century (NOAA 2008). Thought to have gone extinct in San Francisco Bay, Olympia oysters have been observed slowly reestablishing their presence in San Francisco Bay. In their natural state, Olympia oysters form sparse to dense beds in coastal bays and estuaries, and in drought conditions will move up into channels and sloughs, dying off when wetter conditions return. Individual oysters are expected in rocky intertidal, subtidal habitats of the Action Area such as piles beneath the IHTB expansion area, although not in dense quantities that would qualify as oyster beds. Native oyster beds are not known or expected to occur in the IHTB or OHTB expansion area footprints, or in nearshore waters. Native oyster beds would therefore not be affected by the Proposed Action and are not discussed further.

The Pacific Groundfish FMP designates the San Francisco Bay as estuary HAPC (NMFS 2010). Estuary HAPC in San Francisco Bay extends from the Golden Gate to the upstream reaches where ocean-derived salts measure less than 0.5 part per thousand during the period of average annual low flow (NMFS 2021). Salinity averages in the Outer Harbor can vary during the summer between approximately 27 practical salinity units[1] (PSUs) and 28 PSUs during weekly cycles, with less variance and a typical salinity level closer to 26 PSU in the Inner Harbor (NOAA 2021). Potential impacts to fish that could occur to this HAPC include entrainment by dredging equipment, impediments to fish movement by construction activity, and effects to prey availability due to benthic habitat disturbance. Potential impacts to the physical environment within this HAPC include the risk of accidental discharge es from construction equipment, turbidity, elevated suspended sediment concentrations, release of contaminants to the water column, introduction of poor water quality due to stormwater inflow, and noise generated impacts from dredging and piledriving equipment. These are discussed below in Chapter 4.

3.2. Fishery Management Plans

3.2.1. Pacific Coast Groundfish

The Pacific Coast Groundfish FMP covers the groundfish fishery in California, Oregon, and Washington, and protects habitat for dozens of species of sharks and skates, groundfish (such as lingcod and whiting), rockfish, and flatfish. The extent of Pacific Coast Groundfish EFH includes all waters and substrates with depths less than or equal to 3,500 meters (approximately 11,500 feet) to MHHW level, or the upriver extent of saltwater intrusion in estuaries (defined as upstream and landward to where ocean-derived salts measure less than 0.5 part per thousand during the period of average annual low flow). Areas designated as HAPCs for Pacific Coast Groundfish include estuaries, canopy kelp and seagrass habitats, rocky reefs, and all seamounts, including Gumdrop, Pioneer, Guide, Taney, Davidson, and San Juan seamounts; Mendocino Ridge; Cordell Bank; Monterey Canyon; specific areas in the federal waters of the Channel Islands National Marine Sanctuary; and specific areas of the Cowcod Conservation Area. The entirety of the San Francisco Bay Estuary below MHHW is designated as EFH for Pacific Coast Groundfish.

The Pacific Coast Groundfish FMP manages at least 89 species over a large, ecologically diverse area covering the entire West Coast of the continental United States. Although groundfish are those fish considered demersal (fish that live on or near the seabed), they occupy diverse habitats at all stages in their life histories. Pacific Coast Groundfish FMP species rarity in all or parts of the Central Bay makes it unlikely that most FMP species would occur in the Action Area. Fifteen

[1] Salinity values in practical salinity units and parts per thousand are nearly equivalent.

species managed under this FMP have species distributions in the Central Bay, as identified in Table 3-1 (NMFS 2001).

Table 3-1 Pacific Coast Groundfish FMP Species Occurring in the Central Bay

Common Name	Scientific Name
English Sole	*Parophrys vetulus*
Starry Flounder	*Platichthys stellatus*
Brown Rockfish	*Sebastes auriculatus*
Pacific Sanddab	*Citharichthys sordidus*
Lingcod	*Ophiodon elongatus*
Sand Sole	*Psettichthys melanostictus*
Leopard Shark	*Triakis semifasciata*
Spiny Dogfish	*Squalus acanthias*
Big Skate	*Raja* ssp.
Pacific Whiting (hake)	*Merluccius productus*
Kelp Greenling	*Hexagrammos decagrammus*
Soupfin Shark	*Galeorhinus galeus*
Curlfin Sole	*Pleuronichthys decurrens*
Bocaccio	*Sebastes paucispinis*
Cabezon	*Scorpaenichthys marmoratus*

Source: NMFS 2001

3.2.2. Coastal Pelagic Species FMP

The Coastal Pelagic FMP protects and manages four species of fish, one species of squid, and all krill species that occur in the West Coast exclusive economic zone.[2] Coastal Pelagic Species EFH includes all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington; offshore to the limits of the exclusive economic zone; and above the thermocline, where sea surface temperatures range between 10 and 26 degrees Celsius (°C) (50 and 79 degrees Fahrenheit[°F]). The southern boundary is the United States-Mexico maritime boundary, and the northern boundary is the position of the 10°C (50°F) isotherm, which varies both seasonally and annually due to the seasonal cooling of the sea surface temperature. Within that area, several estuaries, including San Francisco Bay, are designated as EFH. The entirety of the San Francisco Bay Estuary below MHHW is designated as EFH for Coastal Pelagic Species.

Pelagic species can generally be found anywhere in the water column from the surface to a depth of 3,300 feet. The Coastal Pelagic Species FMP includes four finfish (Pacific sardine, Pacific [chub] mackerel, northern anchovy, and jack mackerel) and the invertebrate market squid. All

[2] The U.S. exclusive economic zone extends 200 nautical miles offshore, encompassing diverse ecosystems and vast natural resources, such as fisheries and energy and other mineral resources.

except for Pacific mackerel and market squid are likely to occur in the Central Bay (NMFS 2001), as listed in Table 3-2.

Table 3-2 Coastal Pelagic Species FMP Species Occurring in the Central Bay

Common Name	Scientific Name
Northern Anchovy	*Engraulis mordax*
Jack Mackerel	*Trachurus symmetricus*
Pacific Sardine	*Sardinops sagax*

Source: NMFS 2001

3.2.3. Pacific Salmon FMP

The Pacific Coast Salmon FMP guides the management of commercial and recreational Salmon fisheries off the coasts of Washington, Oregon, and California, and includes Chinook Salmon (*Oncorhynchus tshawytscha*) and Coho Salmon (*Oncorhynchus kisutch*). Pacific Coast Salmon freshwater EFH includes all rivers or creek currently or historically occupied by Chinook Salmon or Coho Salmon. Estuarine and marine areas such as San Francisco Bay are also included in this EFH designation. Areas upstream of impassible dams are excluded from Pacific Coast Salmon EFH. In estuarine and marine areas, Pacific Coast Salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone offshore of California, north of Point Conception. The Pacific Coast Salmon FMP also defines five HAPCs for the Pacific Coast Salmon EFH: complex channels and floodplain habitats, thermal refugia, spawning habitat, estuaries, and marine and estuarine submerged aquatic vegetation.

Among the Pacific Salmon FMP species, only Chinook Salmon have the potential to occur in the Action Area. Coho Salmon have been classified as species extirpated from San Francisco Bay by NMFS. The population of Chinook Salmon in San Francisco Bay is composed of three distinct races: winter-run, spring-run, and fall/late fall-run. These races are distinguished by the seasonal differences in adult upstream migration, spawning, and juvenile downstream migration. Chinook Salmon are anadromous fish, spending 3 to 5 years at sea before returning to fresh water to spawn. These fish pass through San Francisco Bay waters to reach their upstream spawning grounds in the upper reaches of the Sacramento and San Joaquin Rivers. In the Action Area, an in-water work window of June 1 through November 30 has been established for Chinook Salmon; in-water project activities would occur during this period.

3.3. Habitat Areas of Particular Concern

3.3.1. Eelgrass

Eelgrass is designated as EFH for various federally managed fish species in the Pacific Coast Groundfish and Pacific Coast Salmon FMPs. Eelgrass is also considered an HAPC for various species in the Pacific Coast Groundfish FMP. As noted, HAPCs are a subset of EFH; these areas are rare, particularly susceptible to human-induced degradation, especially ecologically important, and/or located in an environmentally stressed area. Eelgrass colonies provide an important and highly productive habitat in San Francisco Bay and serve as important nursery and feeding grounds to many species of wildlife that inhabit the estuary. Due to the climate and depths of light penetration in the Bay, eelgrass beds in San Francisco Bay are generally limited to a depth range of approximately +1 to -6 feet MLLW (USACE, EPA, and LTMS, 2009).

In the vicinity of the IHTB and OHTB, there are some small patches of eelgrass. 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). These conditions were documented during the most recent eelgrass survey, conducted in April of 2021(Appendix A).

3.4. Existing Conditions in the 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 Code of Federal Regulations [CFR] Section 402.02). For the purposes of the analysis, the Action Area extends beyond the direct project footprint provided 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. 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 EFH. While technically part of the Action Area, the haul routes will not be discussed further in this assessment since none of the impacts discussed in relation to the construction area apply

The effect assessments provided in this document are made in consideration of potential underwater noise or dredging effects in the Action Area; for some potential effects, the area of effect is limited to the smaller 250-meter (820-foot) buffer surrounding the dredge boundary (e.g., turbidity and suspended sediment effects from dredging).

3.4.1. General Characteristics and History

The Port of Oakland is situated on the eastern shoreline of central San Francisco 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.

Figure 3-1 Action Area

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, 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 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.

3.4.2. Pelagic Open Water

Pelagic (open water) habitat includes waters between the water's surface and the seafloor in the Action Area. The physical conditions of the open-water environment change constantly with tidal flow and season. 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.

The majority 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.

3.4.3. 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.

3.4.4. 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*), the bay shrimp (*Crangon franciscorum*), Dungeness crab (*Metacarcinus magister*), and the 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.

3.4.5. Sediment Quality

Dredging may resuspend constituents of concern in the water column if they are present in the surface sediments, and sediment quality in the Action Area is therefore relevant to this EFH assessment and considered an element of the Action Area.

For the Howard Terminal and Alameda portions of the Inner Harbor Turning Basin 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 (OBM/MS) and Posey Formations 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 of Oakland 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 sediment quality 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).

3.4.6. Eelgrass

As described in Section 3.3.1, there are small patches of eelgrass in the vicinity of the IHTB and OHTB. 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).

Chapter 4. Effects Assessment

This section discusses the direct, indirect, temporary, and permanent effects of the Proposed Action on aquatic species and habitats present or potentially present in the Action Area, including EFH and associated species. 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 Section 3.4 is inclusive of areas where direct and indirect effects to EFH are likely to occur.

4.1. Aquatic Species and Habitat Effects

Aquatic species and habitats present or potentially present in the Action Area may experience temporary construction impacts related to dredging and installation or removal of in-water structures. These temporary construction impacts may include entrainment, 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; deepening of existing aquatic habitat; and in-water fill, such as piles, sheet piles, and rock riprap. A general description of these impacts and their effects on aquatic species and habitats is provided in this section. Conclusions and determination of effects on EFH present in the Action Area is provided in Chapter 5.

4.1.1. 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 FMP-managed fish species is 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.

Direct removal of eelgrass is not anticipated to occur as a result of the Proposed Action, because eelgrass is not present or likely to be present with the expanded dredge footprints at IHTB and OHTB.

4.1.2. 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 accidental discharges during construction to adversely affect aquatic species and habitat.

4.1.3. 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, including EFH.

4.1.4. 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 determines 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.

As described in Section 3.3.1, small eelgrass populations have been mapped as close as approximately 167 meters (540 feet) from the outer harbor turning basin expansion area dredge footprint, which is within the 250-meter (820-foot) buffer that accounts for potential dredge plume effects on the aquatic environment. Increased turbidity from dredging has the potential to reduce water clarity and, therefore, the light reaching eelgrass plants (USACE, EPA, and LTMS 2009). Reduction in eelgrass abundance could reduce primary production, foraging habitat, prey species, refugia and habitat for egg and larvae development for several life stages of FMP species. Additionally, loss of eelgrass habitat could result in increased silt load due to reduction in sediment trapping, and increased erosion of bottom sediments, which could affect other important intertidal and subtidal habitats used by EFH-managed species. However, decreases in levels of light penetration and dissolved oxygen would occur only within a few hundred feet of the dredging site and would end several hours after cessation of dredging activities, making a permanent decline in aquatic primary productivity unlikely (NAVFAC 2020). Eelgrass has not been mapped within the dredge footprints of the immediate turning basin expansion areas, and conditions within the dredge footprints likely preclude eelgrass presence.

Examination of pre- and post-dredging surveys of eelgrass conducted in the Oakland and Richmond harbors indicate that there does not appear to be any adverse effect to, or decline in, eelgrass habitat from annual maintenance dredging activities. Pre- and post-dredging surveys of eelgrass conducted at Oakland Harbor in 2010 and 2011 found an increase in eelgrass habitat area and in the density of existing beds, in comparison with several reference sites (Merkel and Associates 2011 and 2012; USACE and RWQCB 2015). At the Richmond Harbor, surveys performed over the 15 years indicate that eelgrass has persisted in essentially the same locations and densities following dredging (USACE and RWQCB 2015). Furthermore, the Proposed Action includes use of silt curtains where specific site conditions demonstrate that they could minimize turbidity and further reduce the potential for impacts to eelgrass.

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 FMP 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; dredging during the established in-water work window; and complying with the CEMP to ensure no net loss of eelgrass habitat function. 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, lack of eelgrass within the dredge footprints, the brief duration and relatively small area of effect, background turbidity levels in San Francisco Bay, and with implementation of avoidance and minimization measures, the Proposed Action is unlikely to substantially affect EFH from increased turbidity.

4.1.5. 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 3.4.5 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 3.4.1, 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 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 EFH from mobilization of contaminants of concern.

4.1.6. Temporary Benthic Habitat Disturbance

Dredging would directly impact 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 species, especially for groundfish species, which are primarily associated with the benthos. Chinook Salmon are primarily drift feeders when in the estuarine environment, but also forage in the benthos, typically in waters less than 30 feet deep. Northern anchovy and Pacific sardine typically feed on floating plankton (NOAA n.d. [a], n.d. [b]), while jack mackerel primarily feed on large zooplankton, juvenile squid, and anchovy (UC San Diego 2017).

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 deepening the proposed turning basin expansion area, which may affect fish foraging and suitability for eelgrass. Proposed in-water structures such as piles, sheet piles, and rock riprap, as well as removal of existing features, would also constitute a permanent change to benthic, intertidal, or subtidal habitats. These impacts are discussed in the Habitat Alteration section below. Permanent impacts to benthic species composition from potential recolonization by invasive species in areas newly proposed for dredging are discussed in the Invasive Species section below.

4.1.7. Underwater Noise

Project construction would result in underwater sound pressure waves, due to noise generated by mechanical dredging and from shoreline construction at the IHTB. The scientific knowledge of the effects of underwater noise and sound waves on fishes is limited, and varies depending on the species. Effects may include behavioral changes, neurological stress, and temporary shifts in hearing thresholds, depending on the intensity and characteristics of the noise. Studies on the effects of noise on anadromous Pacific coast fishes are primarily related to pile-driving activities. The interagency Fisheries Hydroacoustic Working Group has established interim criteria for noise impacts from pile driving on fishes. A peak sound exposure level (SEL) of 206 dB is considered injurious to fishes. Cumulative SELs (cSEL) of 187 dB for fishes greater than 2 grams, and 183 dB for fishes below that weight, are considered to cause temporary shifts in hearing, resulting in temporarily decreased fitness (i.e., reduced foraging success and reduced ability to detect and avoid predators; Caltrans 2020). Because larvae, juveniles, and adults of some fish species managed under the relevant FMPs may be present in the Inner Harbor, both the 183 dB criterion for fish of less than 2 grams and the 187 dB criterion for fish greater than 2 grams would apply to the Proposed Action. NMFS uses 150 dB as the behavioral effect threshold. Behavioral effects may include fleeing and the temporary cessation of feeding or spawning behaviors.

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 (492 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 160 to 180 dB produced by small boats and ships at 1 meter (3.3 feet) (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).

The Proposed Action involves installing sheet piles, concrete piles, steel pipe piles, and other in-water structures in the Oakland Inner Harbor, both into and outside of the water column. The installation of piles into and immediately adjacent to water has the potential to generate underwater noise. Extraction of existing sheet piles, piles (concrete and steel), or other in-water structures would also generate underwater noise, though at lower sound pressure levels than would be experienced during pile installation. Sheet pile installation and removal of sheet piles and piles would be performed using a vibratory driver. 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. There are no established injury criteria for fish for vibration pile driving, and resource agencies are less concerned that vibration pile driving would result in injury or other adverse effects on fish (Caltrans 2020). Installation of piles using an impact hammer may be required under the Proposed Action, which could generate underwater noise that exceeds SEL thresholds during construction.

In support of the Proposed Action, an underwater noise analysis was performed to assess underwater sound pressure levels using reference observation data from the Caltrans Technical

Guidance for the Assessment of Hydroacoustic Effects of Pile Driving on Fish (Caltrans 2020) and NMFS hydroacoustic worksheets. Table 4-1 identifies the distance over which underwater noise thresholds may be exceeded during installation and removal of piles and sheet piles under the Proposed Action.

Table 4-1 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 Site, 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

Notes:

[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

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

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. 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 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. The Proposed Action also includes "soft-start" techniques if impact pile driving is required, to allow aquatic species to disperse from the pile driving area. Therefore, no physical injury to fish (barotrauma) is expected.

In areas where the 187 dB and 183 dB cSEL thresholds would be exceeded, fish could experience temporary shifts in hearing thresholds. These effects would be confined to the relatively small 86-meter (282-foot) radius from the source and the 11 estimated work days identified in Table 4-1 for installation of steel pipe piles. 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. Due to the limited potential impact area and short duration of this activity, this is not considered a substantial disruption. In addition, the Proposed Action includes the general and pile-driving-related avoidance and minimization measures detailed in Section 2.3—such as confining in-water work to the June 1 through November 30 salmonid construction window (or consulting with NMFS if this is infeasible); monitoring; preferential use of vibratory hammers for pile installation; and use of a bubble curtain during impact pile driving—that would further minimize the potential for impacts to fish and EFH.

Behavioral effects that could occur during pile removal or installation include the temporary cessation of feeding or movement out of the area of effect during active pile driving. As detailed in the preceding analysis of dredging noise effects on EFH, background underwater noise levels in Inner Harbor are elevated due to frequent ship traffic, and 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).

In consideration of this analysis, injury to FMP-managed fishes from peak noise (e.g., rupture of swim bladder) is not expected to occur, but confined temporary shifts in hearing and behavioral effects (e.g., changes in feeding behavior, fleeing, and startle responses) could occur. Temporary shifts in hearing would be confined to the relatively small 86-meter (282-foot) radius from pile driving for a duration of only 11 days. In consideration of this small area and brief duration, and with implementation of avoidance and minimization measures, this is not anticipated to result in a substantial adverse impact to FMP-managed fishes or EFH. Behavioral effects would likely be similar to those experienced under existing conditions, which include ambient noise levels that exceed behavioral thresholds.

4.1.8. Impediments to Localized Movement and Migration

The noise and in-water disturbance associated with proposed improvements could cause fish 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 Inner Harbor Turning Basin 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 (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 localized movement and migration to fish species associated with EFH present in the Action Area.

4.1.9. Invasive Species

Work barges and 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, EPA, and LTMS 2009).

4.1.10. 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 marginally affect Chinook Salmon foraging, but is unlikely to affect other EFH species. Salmonids show preference for sit-and-wait foraging in the water column, observed to occur at depths shallower than -30 feet. Deepening therefore may impact the potential for Action Area waters to provide Chinook Salmon foraging habitat. However, foraging habitat in the Action Area is likely marginal, given regular disturbance associated with large vessel traffic and maintenance dredging. Groundfish inhabit a variety of depths, ranging from intertidal and nearshore to waters as deep as 3,500 meters (11,500 feet; NOAA n.d. [c]), and Coastal Pelagic species most likely present in the Action Area are associated with a variety of depths, including several hundred meters deep. Therefore, species associated with these FMPs are unlikely to be affected by deepening.

Effects of permanent channel deepening on fish species associated with EFH present in the Action Area are anticipated to be minimal when considering the relative low value of habitat impacted, the general use of pelagic and deep-water habitats by fish species associated with EFH present in the Action Area, and when considering the benefits provided by converting upland industrial habitat to subtidal and intertidal habitat.

Expansion of the OHTB and IHTB would deepen some areas where water depths may be suitable for eelgrass (+1 to -6 feet MLLW). This deepening would occur in areas where eelgrass has not been mapped as occurring, and in habitat that is likely marginally suitable for submerged vegetation, given the existing levels of vessel traffic in adjoining areas. In consideration of the lack of eelgrass in the proposed IHTB and OHTB expansion footprints and the relative quality of potential habitat affected, eelgrass is unlikely to be adversely affected by permanent habitat alteration.

As noted for impediments to localized movement and migration, although the Proposed Action entails installation of permanent in-water bulkhead, batter piles, and rock, there would be a net decrease in in-water structures associated with pile and sheet pile removal to accommodate the IHTB expansion. Although reductions in in-water structures may result in a commensurate decrease in available habitat for encrusting organisms and associated EFH foraging, these impacts are anticipated to be negligible, given the habitat benefits provided by the creation of additional subtidal and intertidal waters that are comparable in quality to existing habitat in or adjoining the IHTB and navigation channel.

Chapter 5. Conclusion and Determination of Effects

Adverse effect under the MSA "means any impact that reduces quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH" (50 CFR Section 600.810).

5.1. Pacific Coast Groundfish EFH

The Proposed Action *may affect Pacific Groundfish EFH*. This would occur due to the removal of sediment and benthic organisms with a clamshell dredge, which is unavoidable; due to temporary hearing shifts during impact pile driving, if impact hammer pile driving is unavoidable; and due to fish behavior or other adverse effects from increased turbidity during dredging, pile driving, and other in-water construction activities. Although essentially all of the effects of the Proposed Action may be considered temporary, the recolonization of disturbed areas by benthic invertebrates is thought to require several months at a minimum. The expanded OHTB and IHTB footprints could also provide additional opportunity for recolonization by invasive species. Impact pile driving would occur over a maximum of 11 days, during which temporary hearing shifts could occur. During impact pile driving, a bubble curtain would be used to attenuate underwater sound levels. Silt curtains would be used where specific site conditions demonstrate that they would be practicable, and effectively minimize any potential adverse effects from increased turbidity. Other effects, such as underwater noise from vibratory drivers, would cease immediately when active in-water construction stops, and may be avoided or minimized by fish (including prey fishes) exhibiting avoidance behavior.

The disturbance of soft-bottom habitat and removal of sediment containing benthic invertebrates from dredging may be partially offset by the conversion of approximately 10 acres of terrestrial land into intertidal or subtidal habitat that would be subject to maintenance dredging disturbance and comparable in quality to existing habitat in or adjoining the IHTB and navigation channel.

5.2. Coastal Pelagic Species EFH

The Proposed Action *may affect Coastal Pelagic Species EFH*. This would occur due to temporary hearing shifts during impact hammer pile driving if impact hammer pile driving is unavoidable. Impact hammer pile driving would occur over a maximum of 11 days, during which temporary hearing shifts could occur. Fish behavior or other adverse effects may also occur from increased turbidity during dredging, pile driving, and other in-water construction activities. Silt curtains would be used where specific site conditions demonstrate that they would be practicable, and effectively minimize any potential adverse effects from increased turbidity. During construction, the Proposed Action has the potential to temporarily increase noise from vibratory drivers and suspended sediment in the surrounding water column. However, these impacts would be minimal, localized, and would not permanently affect Coastal Pelagic Species EFH. Permanent deepening and loss of benthic habitat following dredging and during recolonization would not substantially affect Coastal Pelagic Species, because these species primarily forage in the water column and are associated with a wide range of water depths.

Coastal Pelagic Species EFH would incur a long-term benefit through converting approximately 10 acres of terrestrial land into intertidal or subtidal habitat that would be subject to maintenance dredging disturbance and comparable in quality to existing habitat in or adjoining the IHTB and navigation channel.

5.3. Pacific Salmon EFH

The Proposed Action would temporarily affect water quality, benthic habitat, and pelagic habitat during dredging and other in-water construction activities (e.g., sheet pile installation). Construction impacts to Chinook Salmon would largely be avoided by adhering to the established June 1 through November 30 in-water work window. If present, Chinook Salmon are likely to exhibit avoidance behavior from the construction area. Furthermore, underwater noise or turbidity plumes would cease immediately or within minutes or hours of when in-water construction stops, and may be avoided or minimized by fish (including prey fishes) exhibiting avoidance behavior.

Permanent effects on migration by Chinook Salmon would be minimal given the relatively small size of the IHTB and OHTB expansion areas, and given the preferred migratory routes of this species outside of the Action Area. Deepening may marginally affect the suitability of habitat for Chinook Salmon foraging, although existing activity in the Action Area likely precludes substantial foraging activity. Change in benthic habitat species compositions (e.g., recolonization by invasive species) and loss of potential encrusting habitat are anticipated to have negligible effects on Chinook Salmon foraging because this species consists primarily of drift feeders. These minimal effects to Pacific Salmon EFH would be offset by converting approximately 10 acres of terrestrial land into intertidal or subtidal habitat that would be subject to maintenance dredging disturbance and comparable in quality to existing or adjoining habitat within the IHTB and navigation channel.

In consideration of this analysis, the Proposed Action *may affect Pacific Salmon EFH*.

5.4. Eelgrass HAPC

The Proposed Action would not directly remove any mapped eelgrass areas, though eelgrass populations have been mapped within the 250-meter (820-foot) buffer that accounts for potential dredge plume effects on the aquatic environment. 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. Furthermore, the Proposed Action includes pre- and post-construction surveys in the Action Area, evaluation of project impacts, and as-needed compensatory mitigation in compliance with the CEMP, although mitigation is not anticipated to be required for the Proposed Action.

The ITHB and OHTB expansion areas are predominantly in waters that are too deep to support eelgrass. Although some areas with depths potentially suitable for eelgrass would be deepened to -50 feet MLLW, these areas have not been colonized by eelgrass, and habitat suitability is likely minimal, given existing vessel traffic and maintenance dredging disturbance in the adjoining navigation channel.

Chapter 6. References

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