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Biological Assessment for Marine Resources at Chevron Eureka Terminal

Project #3606-07

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Executive Summary

The purpose of this document is to provide an evaluation of the impacts on biological resources of proposed repairs to the Chevron Eureka Terminal (Terminal) and for defining appropriate mitigation measures and monitoring requirements. The Terminal is located in Eureka, California, on the eastern shoreline of the Entrance Bay region of Humboldt Bay, bordering the North Bay Channel. Mudflats north and south of the Terminal's trestle support native eelgrass (*Zostera marina*).

Chevron is proposing to perform repairs to the Terminal wharf and trestle, which supports a system of fuel pipelines on the south side. In 2017, a retrofit project for the Terminal was completed to bring it into compliance with California Building Code Chapter 31F, Marine Oil Terminals and support the fuel transfer pipeway during a seismic event. In 2025, Chevron is proposing to make additional repairs and upgrades to the Terminal, including replacement of piles and pile bracing, guide piles and guides, and a beam on the working platform. The Terminal repairs will require construction activities that may affect protected species adjacent to the project site. All in-water work will be conducted during a work window from July 1-October 15. The project will occur in three discrete project areas: replacement of piles and pile bracing on the dock causeway at Bents 8, 20, 21, 22, and 23; replacement of guide piles and guides at the floating dock; and replacement of the beam at the working platform. All piles identified in Bents 8, 20, 21, 22, and 23 are located in eelgrass habitat; eelgrass impacts and mitigation are analyzed in a separate document (H. T. Harvey & Associates 2025).

Background information on the project location and the project goals are provided in addition to a description of the project in its current design phase. Existing conditions on key ecological communities, species and habitats present are outlined in detail that allows for a sufficient evaluation of potential project impacts.

This analysis evaluates the effects of construction and habitat change associated with the project on species listed as endangered or threatened under the Federal Endangered Species Act and their federal designated critical habitat, species proposed for listing under the Federal Endangered Species Act, and the Magnuson-Stevens Fishery Conservation and Management Act. Impacts on eelgrass and eelgrass restoration will be addressed in a separate analysis (H. T. Harvey & Associates 2025). Appropriate avoidance and minimization measures are provided.

Based on the present analysis, implementation of the proposed project may affect, and is not likely to adversely affect listed bird, fish, or invertebrate species in the action area or their designated critical habitat. Similarly, the proposed project is not likely to adversely affect Essential Fish Habitat (EFH). While potentially adverse effects exist, including increased underwater noise and sediment suspension, such impacts are short-term and insignificant or discountable. These effects are offset through compensatory eelgrass mitigation and pile removal that will provide a new benefit to these species, and Best Management Practices (BMPs) to avoid and minimize impacts. As a result, the project will adequately mitigate its contribution to cumulative adverse effects on the species covered in this BA/EFHA.

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Abbreviated Terms

Key terms used throughout this document are defined here. These definitions are also incorporated contextually throughout this document.

- *The Project*—The Chevron Pier Terminal Improvements Project. Chevron is proposing to make additional repairs and upgrades to the Terminal, including replacement of piles and pile bracing, guide piles and guides, and a beam on the working platform.
- *Project Site*—Location within Humboldt Bay where aquatic-related Project activities will occur.
- *Action Area*—Region within Humboldt Bay where there may be direct and/or indirect effects on species listed under the Federal Endangered Species Act. This includes the terminal wharf structure and an additional 45 meters (150 feet) surrounding the Terminal. The Project site is located at the west end of Truesdale Street, in the city of Eureka along the east shore of Humboldt Bay, and west of Highway 101. The Project is surrounded by Humboldt Bay to the west and the city to the east.

Abbreviation	Definition
BA	Biological Assessment
BMPs	Best Management Practices
CC	California Coastal
CDFW	California Department of Fish and Wildlife
CESA	California Endangered Species Act
cm	Centimeters
dB	Decibels
DPS	Distinct Population Segment
ECS	Ecosystem Component Species
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EFHA	Essential Fish Habitat Assessment
ESU	Evolutionarily Significant Unit
FESA	Federal Endangered Species Act
FHWG	Fisheries Hydroacoustic Working Group
FL	Fork Length
FMP	Fisheries Management Plan
ft	Feet
g	gram
HAPC	Habitat Areas of Particular Concern
in	inch

Abbreviation	Definition
km	Kilometers
m	Meters
mi	Miles
mm	millimeter
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NC	Northern California
nDPS	Northern Distinct Population Segment
NMFS	National Marine Fisheries Service
p.	Page
PBF	Physical or Biological Feature
PFMC	Pacific Fishery Management Council
RMS	Root-Mean-Square
sDPS	Southern Distinct Population Segment
SEL	Sounds Exposure Levels
SONCC	Southern Oregon-Northern California Coastal
SSC	Suspended Sediment Concentrations
SSWS	Sea Star Wasting Syndrome
Terminal	Chevron Eureka Terminal
TL	Total Length
USFWS	U.S. Fish and Wildlife Service

Section 1.0 Introduction

The purpose of this Biological Assessment/Essential Fish Habitat Assessment (BA/EFHA) is to review proposed activities for the improvements to the Chevron Eureka Terminal (Terminal) in sufficient detail to ensure the proposed action is in compliance with Section 7(c) of the Federal Endangered Species Act (FESA) of 1973, as amended. It presents technical information about the Terminal improvements and assesses the extent to which the proposed action may affect (a) any threatened, endangered, or candidate species regulated by the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS); (b) designated critical habitat; and (c) Essential Fish Habitat (EFH) as defined by the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

The Terminal consists of a timber trestle and wharf situated on the tidelands on Humboldt Bay, California, and bulk fuel storage facility on an adjacent upland parcel in the city of Eureka, Humboldt County. The Terminal is T-shaped with an approximately 182.9-meter (m)-long trestle connected to an approximately 45.7-m-long wharf. Five mooring dolphins are connected to the wharf by timber catwalks. The overall length of the wharf and the catwalks is approximately 131.1 m. The Terminal trestle and wharf extend westward from shore through shallow waters to the margin of the North Bay Channel. The trestle is located approximately 365.8 m north of the present mouth of Elk River. The Terminal serves fuel barges that arrive once every 10–12 days to deliver bulk fuel products. The fuel products are transferred from the barges to the bulk fuel storage facility through the unloading platform on the wharf and the fuel transfer pipeway on the trestle.

In 2017, a retrofit project for the Terminal was completed to bring it into compliance with California Building Code Chapter 31F, Marine Oil Terminals and support the fuel transfer pipeway during a seismic event. In 2025, Chevron is proposing to make additional repairs and upgrades to the Terminal, including replacement of piles and pile bracing, guide piles and guides, and a beam on the working platform. The Terminal repairs will require construction activities that may affect marine resources in Humboldt Bay, California. H. T. Harvey & Associates' biologists analyzed the potential for listed species to occur in the action area, and the potential effect of the project on said species, designated critical habitat, and EFH. The federally threatened, endangered, or candidate species that were determined to be potentially in the action area include:

- Marbled murrelet (*Brachyramphus marmoratus*);
- Western snowy plover (*Charadrius alexandrinus niyosus*);
- Coho salmon (*Oncorhynchus kisutch*), Southern Oregon-Northern California Coastal (SONCC) Evolutionarily Significant Unit (ESU);
- Chinook salmon (*Oncorhynchus tshawytscha*), California Coastal (CC) ESU;
- Northern California (NC) steelhead (*Oncorhynchus mykiss*);

- North American green sturgeon (*Acipenser medirostris*), southern Distinct Population Segment (DPS);
- Eulachon (*Thaleichthys pacificus*), southern DPS (sDPS);
- Tidewater goby (*Eucyclogobius newberryi*); and
- Sunflower seastar (*Pycnopodia helianthoides*)

Background information on these species and the potential impacts associated with Terminal repairs and upgrades are addressed in Sections 4 and 6. The proposed action also occurs in designated critical habitat and EFH, which are further described and analyzed in Sections 5 and 6. Impacts on eelgrass are addressed in a separate analysis (H. T. Harvey & Associates 2025).

Section 2.0 Humboldt Bay and Description of Project Area

2.1 Humboldt Bay Overview

The coastal zone of Humboldt County typically experiences very wet, cool winters and dry, mild foggy summers. In winter, temperatures range from highs of 40–59°F (4.4–15°C) to lows of 32–49°F (0–15°C). Coastal summers are cool to mild, with average highs of 60–69°F (15.6–20.6°C) and frequent fog. The Humboldt Bay area averages 38 inches (in) of rain (96.5 centimeters [cm]), mostly falling from November through March. Humboldt Bay is located along the NC coast, is semi-enclosed, and spans approximately 14 miles (mi) (22.5 kilometers [km]) long and 4.5 mi (7.2 km) wide at its widest point; the surface area is 38.8 mi^2 (62.4 km^2) at mean high tide and 17.4 mi^2 (28.0 km^2) at mean low tide. The bay is made up of three subbasins: South Bay, North (Arcata) Bay, and Entrance Bay (Figure 1). The Terminal is located in the margins of North Bay Channel close to the Entrance Bay. The entrance to the ocean is approximately in the middle of Humboldt Bay, which has a 359 mi^2 (578 km^2) drainage area from watersheds of the Coast Range (Barnhart et al. 1992). The Elk River is the largest freshwater source (Schlosser and Eicher 2012); the present mouth of the Elk River sits approximately 366 m south of the Terminal.

Humboldt Bay is relatively shallow, with the majority of the bay comprised of tidal flats that are exposed during low tide (Costa 1982 as cited *in* Northern Hydrology and Engineering 2015). The mud flats are predominately in North and South Bays, and only Entrance Bay and the lower portions of North Bay Channel maintain an approximate constant surface area over a tide cycle (Northern Hydrology and Engineering 2015). The sediments in Humboldt Bay vary, but they correlate to the bay floor types: mudflats, tidal channels, salt marshes that are located primarily by the tidal elevations. Currents leave coarser sediments in the channels and finer sediments in the mudflats (Barnhart et al. 1992). The nearby Eel River is a major source of sediment. Humboldt Bay habitats were evaluated by Schlosser and Eicher (2012), with 31% of the bay comprised of eelgrass or patchy eelgrass, 28% of the bay comprised of subtidal habitat, 21% unconsolidated sediment, and 12% macroalgae. Each community contributes to the overall function of Humboldt Bay, provides a set of ecological services and supports a different species assemblage.

2.2 Project Site and Action Area

The Terminal trestle and wharf are located in Humboldt Bay in the city of Eureka, Humboldt County, California (Figure 2). Fuel products are transferred from delivery barges to the bulk fuel storage facility through the unloading platform on the wharf and the fuel transfer pipeway on the trestle. Nearly all of the fuel used by the greater Eureka area is delivered via barge to the Chevron Terminal. Believed to have been originally constructed in the early 1900s, the facility has been expanded, upgraded, and repaired numerous times since. Serving fuel barges only, which provide their own hoses and pumps, the terminal does not have any equipment, rack, towers, or loading arms on the wharf. Construction of the trestle and wharf are typical of a timber structure: wood pilings driven in rows are connected with a 12x12-in timber cap, and stringers span between piling caps and are covered with 4x12-in decking. Wood pilings are primarily creosote-treated, but a number of pressure-treated pilings have been installed over the years during repairs.

For the purposes of FESA Section 7 consultations, the "action area" as defined in 50 CFR 402.02 includes all areas in which federally listed species would be affected directly and indirectly by the proposed action, and where changes from the proposed action are measurable and detectable. The action area is further defined as the geographic extent of the potential physical, biological, and chemical effects of the proposed Project above the baseline conditions and extends to a point where no measurable effects from the proposed activities occur. For the present BA, the action area is defined as the terminal wharf structure and an additional 45 m (150 feet [ft]) surrounding the Terminal (Figure 3). This distance, at which the sound pressure level resulting from proposed pile driving attenuates to a level that is equal to the ambient sound level, was calculated using a background noise level of 160 dB root mean square (RMS; ICF 2020), estimated acoustic impact zones from the present analysis (see Section 6.1.1), and methods outlined in Molnar et al. (2020). The Project site is located at the west end of Truesdale Street, in the city of Eureka along the eastern shore of Humboldt Bay, and west of Highway 101. The Project is surrounded by Humboldt Bay to the west and the city to the east. Chevron leases the tideland portion of the terminal area from the City of Eureka.

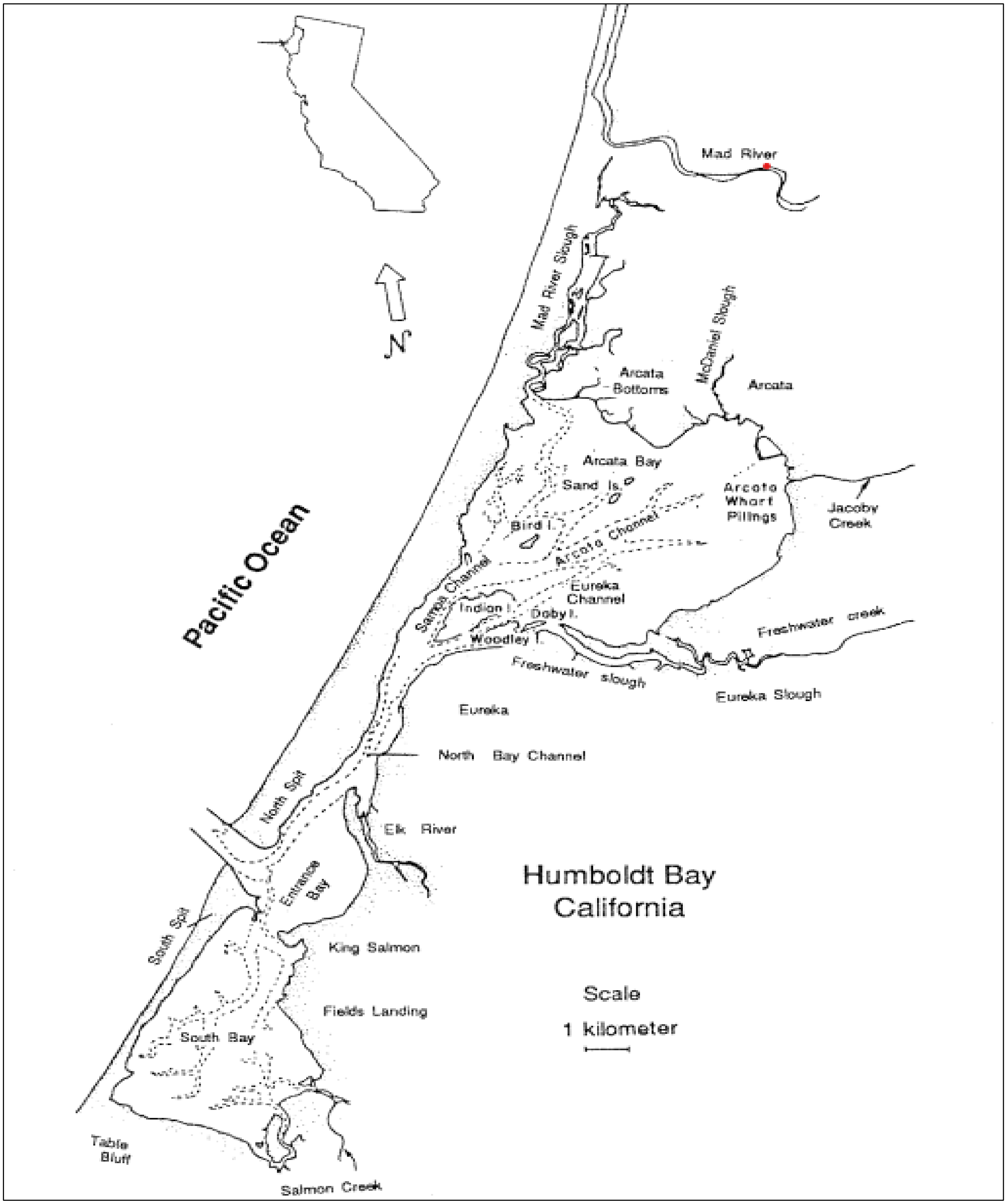


Figure 1. Humboldt Bay Overview

Notes: This map provides a general overview of key geographic features in Humboldt Bay, sourced from Barnhart et al. 1992 and modified from Costa 1982, as cited in Northern Hydrology and Engineering 2015. The Chevron Terminal is located approximately 366 meters north of the present mouth of Elk River.

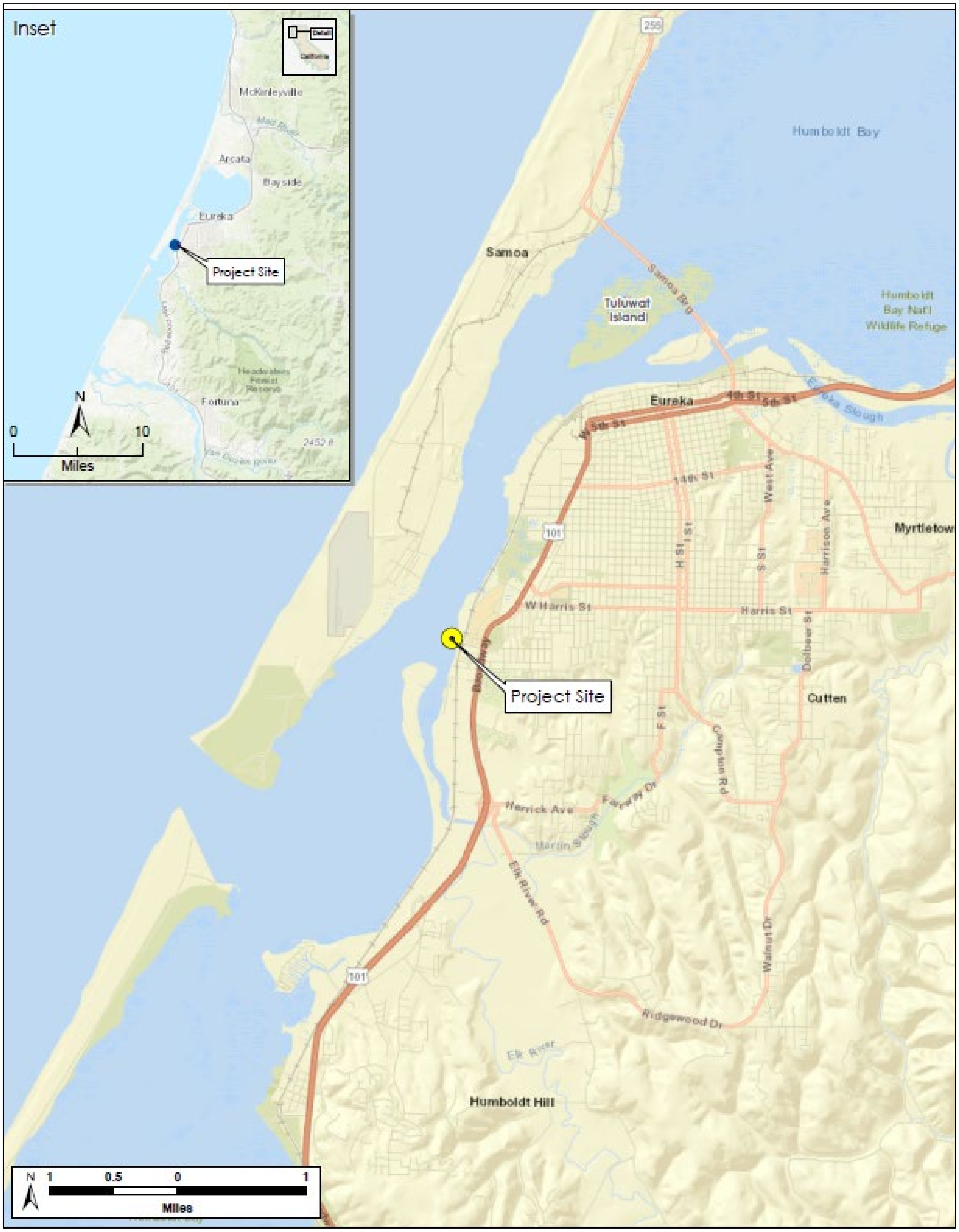


Figure 2. Chevron Eureka Terminal Project Location

Figure 3. Project Action Area

Section 3.0 Project Description

In accordance with Marine Oil Terminal Engineering and Maintenance Standards, Chevron USA is proposing repairs and upgrades to the Terminal. The work will be conducted in a single phase with construction repairs scheduled for the work window between July 1 and October 15, 2025. These repairs and upgrades have potential to affect fish, critical habitat, and/or EFH in the action area and methods are discussed here, as well as various best management practices (BMPs) that will be implemented. The analysis of effects is in Section 6.

3.1 Terminal Repairs and Upgrades

The project will occur in three discrete Project areas: replacement of piles and pile bracing on the dock causeway at Bents 8, 20, 21, 22, and 23; replacement of guide piles and guides at the floating dock; and replacement of the beam at the working platform (Figure 4). Work includes the removal of five timber piles at Bents 8, 20, 21, and 22 and three concrete piles at the floating dock. All piles identified in Bents 8, 20, 21, 22, and 23 are located in eelgrass habitat (Figure 5). Timber piles will first be cut off 1 ft (0.3 m) below the mudline and will then be removed using a crane located on a floating barge; the barge will be anchored in place by setting two 28-in (0.71-m) diameter spud poles. The exact method of removal using the crane will be determined by the contractor. Timber piles (14-in [0.36-m] diameter) will be replaced with 16-in (0.41-m) diameter timber piles, fully coated with polyurea, installed to a depth of 40 ft (12.2 m). New piles located at Bents 8, 20, 21, and 22 on the causeway will be installed in eelgrass habitat. Existing concrete piles anchoring the floating dock will be removed and replaced with two 14-in (0.36 m) diameter steel guide float piles, located outside of eelgrass habitat. Once piles are replaced, new guide systems, bracing systems, and hardware will be installed as required to connect and reinforce the newly installed piles and the causeway.

Construction activities will be performed from a flat-bottomed barge with an approximately 4.9-ft (1.5-m) draft when loaded (e.g., the Moondoor II, a 113.8- by 78.1-ft [34.7- by 23.8-m] long barge). The barge will be powered and maneuvered into position by a push boat (e.g., the *Joseph George*). The barge will approach the trestle from the south side and will be repositioned as needed to access work locations. A crane (e.g., Kobelco CK1000-III Crawler Crane with a 120.4-ft [36.7-m] boom) will be positioned on the barge and will be used to install and remove piles and other components. Work in eelgrass habitat will be limited to times of the day when tidal heights are sufficient to allow the barge to float over the substrate. Grounding of the barge will be avoided, the only contact with the substrate will be from anchoring spud poles.

All steel and timber piles will be driven to tip elevation or refusal using a crane and a vibratory hammer. If refusal occurs before tip elevation is reached, an impact pile-driving hammer will be used to drive the piles to the required tip elevation, completing the installation. Timber piles will be removed using a crane, with the method to be determined by the contractor. It is not known how long it will take to perform pile installation and removal procedures; however, because the work will occur only during high tides, the barge will not be in any given position long enough to affect eelgrass through shading. After they are removed, piles will be placed on the barge in a containment area.

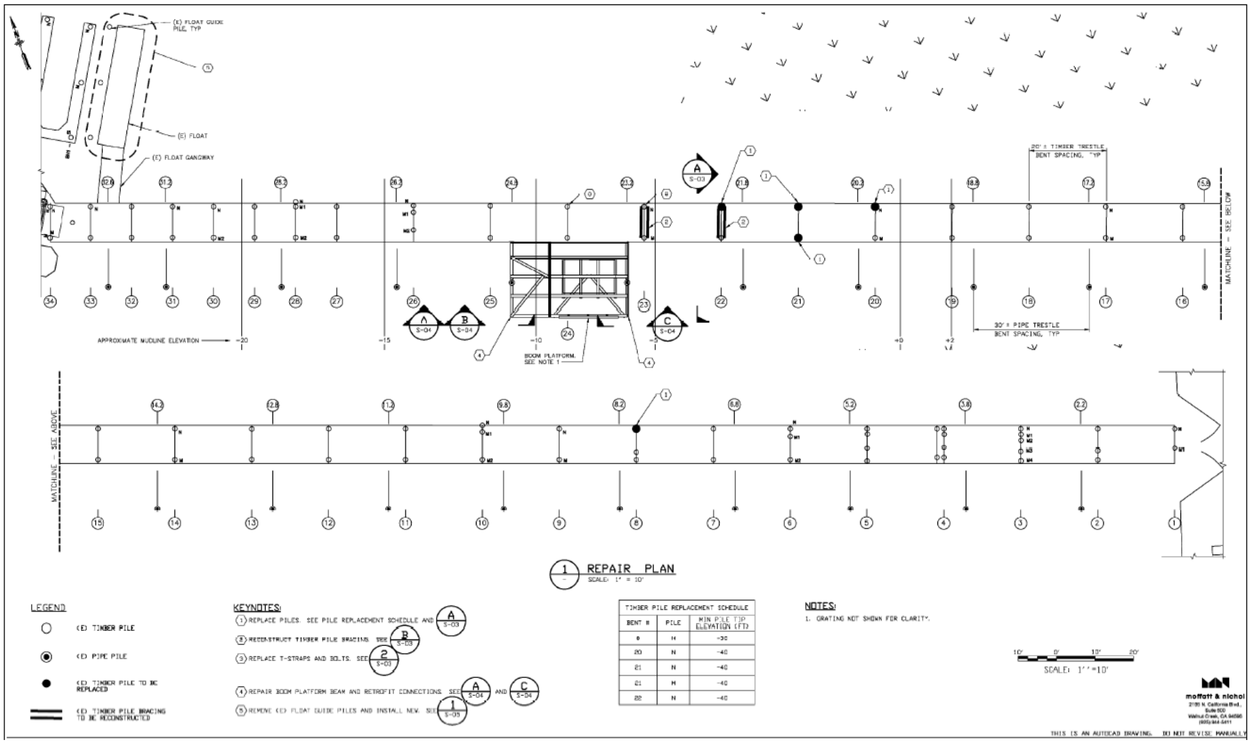


Figure 4. General Plans for 2025 Causeway Upgrades and Repairs at the Chevron Eureka Terminal

Figure 5. Location of Eelgrass in the Vicinity of the Chevron Eureka Terminal Project Site

3.2 BMPs

The removal of piles and cross beams will be consistent with the recommendations of the *Humboldt Bay Eelgrass Comprehensive Management Plan* (Merkel & Associates 2017) and is divided into two parts. The first part requires a Humboldt Bay Harbor, Recreation, and Conservation District staff or designated representative to be present to ensure that these BMPs are adhered to. Part two of the management plan and BMPs require that:

- Neither the barge nor the tug will anchor during the project. The barge may attach to existing piles to maintain its position;
- During the barge method, piles will be removed at a tide of sufficient elevation to float the barge and tugboat adjacent to the piles being removed without scarring the mudflats or injuring eelgrass;
- Grounding of the barge will not be permitted;
- A floating containment boom will surround each pile being removed to collect any debris. To collect debris that floats below the surface but does not sink to the bottom, weighted plastic mesh (similar to orange construction fencing) will be attached to the boom and extended across the area surrounding the pile. If debris sinks to the bottom, then it will be removed by a diver;
- All equipment will be checked before use to minimize risk of petroleum product releasing to the bay. A spill response kit, including oil absorbent pads will be onsite to collect any petroleum product that is accidentally released;
- The crane and tug operators will be experienced with vibratory pile removal;
- The crane operator will break the soil/pile bond prior to pulling to limit pile breakage and sediment adhesion;
- All work should be confined to within the floating containment boom;
- Piles will be removed slowly to limit sediment disturbance;
- Piles will not be hosed off, scraped, or otherwise cleaned once they are removed from the sediment;
- Piles will be placed in a containment area on the barge to capture sediment attached to the piles;
- The containment area will be lined with plastic sheeting to not allow sediment or residual water to reenter the bay;
- Sawdust or woody debris generated from pilings that are cut 1 ft below the mudline using a saw are to be retrieved and placed in the containment area;
- Holes left in the sediment by the pilings will not be filled. They are expected to naturally fill;
- Piles and debris will be removed from the barge carefully and moved to a designated site for disposal preparation. Prior to disposal, the piles and debris will be stored on a paved surface, covered with tarps, and surrounded be an erosion boom, straw waddle, or hay bale perimeter;

- All removed piles or portions of piles will be disposed of at an authorized facility. No piles or portions of piles will be re-used in Humboldt Bay or along shoreline areas; and
- Land operations will not be conducted in wetlands in proximity to the staging site.

In addition to the BMPs described above, the following sound level minimization techniques and protection measures would minimize the risk of Project-related impacts to threatened and endangered species and their proposed and designated critical habitat:

- A biological monitor or team will be present onsite during work hours when and if impact hammer pile driving occurs, during work in the eelgrass area, to staff the hydroacoustic monitoring equipment, and record marine mammal use with the action area. The monitor(s) will be responsible for ensuring that all pile driving work is conducted according to permit terms and conditions. In addition, contractor will consult with the biological monitor(s) to ensure that any changes to means and methods are in compliance with permit conditions relating to the protection of estuarine resources;
- A bubble curtain will be placed around each pile during in-water pile driving activities that use an impact hammer to reduce noise levels to less than would result in injury or mortality of fish species. The bubble curtain will reduce the noise levels by up to 15 decibels (dB);
- Cushion pads will also be used if an impact hammer is required to finish driving any piling that refuses during vibratory pile driving. The cushion pads will reduce noise levels by 4 to 5 dB;
- All impact pile driving activities will incorporate a "soft start" approach whereby the pilings are lightly tapped before the full hammer strength is applied. The first few taps of the hammer on the piling should deter fish away from the pilings before full impact hammer strength is applied, reducing the potential for fish to be present and exposed to potential injury during full hammer strikes;
- Hydroacoustic monitoring will be conducted at 10 m from all pile driving activities if an impact hammer is used to set the pilings. Impact hammer pile driving will cease for at least 12 hours if the cumulative sound exposure levels reach 186.5 dB at 10 m regardless of the number of strikes;
- Permanent and temporal impacts on eelgrass will be mitigated. The amount of mitigation will be determined from pre-construction and post-construction eelgrass survey data and prescribed mitigation ratios. Impacts and potential mitigation activities are addressed in a separate document (H. T. Harvey & Associates 2025);
- A debris containment structure (i.e., floating boom) will be installed in Humboldt Bay outside of the pile driving area to ensure that any floating debris that enters the water will be contained for later collection and disposal; and
- A full complement of oil spill clean-up equipment will be on site and available for immediate deployment should there be an accidental discharge of fuel, lubricant, or hydraulic oils. Chevron will implement their Facility Response Plan, activate the Incident Command System, refer to the Coast Guard Dock Operation Manual, and enact Spill Prevention, Control, and Countermeasures.

Section 4.0 ESA-Listed Species, Critical Habitat

This section provides a summary of species identified as threatened, endangered, candidate, or proposed for ESA listing and critical habitats, as defined by the FESA 16 USC § 1531 et seq. Endangered species and threatened species and critical habitats are defined to include the following:

- Species listed as threatened or endangered under the FESA;
- Areas or communities identified as critical habitat under the FESA;
- Candidate species for listing as threatened or endangered under FESA; and
- Species proposed for listing as threatened or endangered under the FESA.

Federally listed, proposed, and candidate species regulated by NMFS and USFWS that could potentially occur within the action area were identified by reviewing relevant tools and literatures, including federal registers, technical reports, and peer-reviewed literature. Species and habitat information was also obtained from the NMFS EFH Mapper (NMFS 2021a) and the USFWS Information for Planning and Conservation (USFWS 2020). The potential for occurrence (present, possible, unlikely, absent) in the action area were determined using this information. The nine federally listed or proposed for listing species that could potentially be affected by the proposed project and have potential to occur within the action area include:

- Marbled murrelet;
- Western snowy plover;
- Coho salmon, SONCC ESU;
- Chinook salmon, CC ESU;
- NC steelhead;
- North American green sturgeon, sDPS;
- Eulachon, sDPS;
- Tidewater goby; and
- Sunflower sea star.

In addition, critical habitat is present in Humboldt Bay for five species of fish and one bird species. Table 1 provides a summary of these taxa. Background information on each of the listed species, critical habitat, as well as likelihood of occurrence, timing and distribution, and foraging behavior are provided. The species analyzed in this section were limited to species that could reasonably be expected to occur within the action area and potentially affected by the project.

Table 1. Endangered Species Act-Listed Species with Potential to Occur within the Action Area

Common Name	Scientific Name	Federal Status	State Status	Potential for Occurrence	Habitat	Timing/Comments
Marbled murrelet	*Brachyramphus marmoratus*	T[1]	E[1]	U	Breeds in lower montane coniferous forest. Feeds coastal near-shore. Nests in old-growth redwood-dominated forests, up to 6 miles inland, often in Douglas-fir.	Forages primarily in nearshore coastal ocean waters. Breeds in old growth redwood/Douglas-fir along the coast and inland (Harris 2006). Formerly occurred in small numbers (primarily in the late summer and fall) to forage in open bays and subtidal channels, and nearshore waters of Humboldt Bay (Harris 2006). These older records were primarily along the Samoa Peninsula and at the mouth of Humboldt Bay. There have been none-to-few recent records for the Bay (Fowler pers. comm. 2022). Designated critical habitat encompasses old growth forests inland, well outside of the action area.
Western snowy plover	*Anarhynchus nivosus nivosus*	T[1]	CSSC[1]	Po	Nearshore, sandy beaches on Humboldt Bay, including Clam Island.	Uncommon year-round, but numbers may increase during the winter. Historically, they could be found along the North Spit and near Samoa, but use has significantly declined (Harris 2006). Critical habitat is nearby, but not in the action area.
Coho salmon - Southern Oregon/ Northern California Coastal (SONCC) ESU	*Oncorhynchus kisutch*	T	T	Pr*	Humboldt Bay and its tributaries and slough channels, coastal/oceanic.	Juveniles outmigrate through Humboldt Bay to the ocean from March through June (Pinnix et al. 2013, NMFS 2016a), and reenter in the fall as adults to spawn in tributaries to Humboldt Bay (October to January). All tidally influenced areas of Humboldt Bay, up to the elevation of mean higher high water and including the action area, are within designated critical habitat.
Chinook salmon – California coastal ESU	*Oncorhynchus tshawytscha*	T	None	Pr*	Humboldt Bay and its tributaries and slough channels, coastal/oceanic.	Juveniles outmigrate through Humboldt Bay to the ocean April through May. Adults migrate through Humboldt Bay to spawn in Humboldt Bay tributaries in the fall (October toJanuary).

Common Name	Scientific Name	Federal Status	State Status	Potential for Occurrence	Habitat	Timing/Comments
						All tidally influenced areas of Humboldt Bay, up to the elevation of mean higher high water and including the action area, are within designated critical habitat.
Steelhead – northern California DPS	*Oncorhynchus mykiss irideus*	T	C: Summer run only	Pr*	Humboldt Bay and its tributaries and slough channels, coastal/oceanic.	Juveniles outmigrate through Humboldt Bay to the ocean in March through May (NMFS 2016a). Adults move through Humboldt Bay to spawn in tributaries in fall and winter. All tidally influenced areas of Humboldt Bay, up to the elevation of mean higher high water and including the action area, are within designated critical habitat.
Green sturgeon -southern DPS	*Acipenser medirostris*	T	None	Pr*	Humboldt Bay, coastal	Southern DPS adults and subadults originate from San Francisco Bay and enter Humboldt Bay in April to feed and depart in Oct/Nov. Federal listing includes only southern DPS, for all spawning populations south of the Eel River. All tidally influenced areas of Humboldt Bay, up to the elevation of mean higher high water and including the action area, are within designated critical habitat.
Eulachon – southern DPS	*Thaleichthys pacificus*	T	None	U	Found in Klamath River, Mad River, Redwood Creek, and in small numbers in Smith River and Humboldt Bay tributaries, coastal.	Federal listing refers to this southern DPS, which spawns between from the Mad River in California to the Skeena River in Canada. Spawn in lower reaches of coastal rivers with moderate water velocities and bottom of pea-sized gravel, sand, and woody debris. Critical habitat does not include Humboldt Bay or its tributaries.
Tidewater goby	*Eucyclogobius newberryi*	E	None	U	Relatively shallow muted tidal sloughs fringing Humboldt Bay	Present year-round along margins of Humboldt Bay in sloughs and high marsh channels. Designated critical habitat is located in these fringing habitats only, not in Humboldt Bay proper (USFWS 2013), and outside of the action area.

Common Name	Scientific Name	Federal Status	State Status	Potential for Occurrence	Habitat	Timing/Comments
Sunflower sea star	*Pycnopodia helianthoides*	P	None	U	Humboldt Bay Entrance Bay; rocky substrates	Prefer rocky substrates that occur near the bay mouth; presence has not been documented past Entrance Bay. Only one single observation in Humboldt County since the onset of sea star wasting syndrome in 2013/2014. Critical habitat has not been designated.

Federal Status: Listing status under the Federal Endangered Species Act: E (endangered); T (threatened); C (candidate); P (proposed).

California Status: Listing status under the California state Endangered Species Act: E (endangered); T (threatened); C (candidate); and California Department of Fish and Wildlife (CDFW) Species of Special Concern (CSSC). CDFW Watch List (CDFW_WL) and CDFW Fully Protected (CDFW_P).

Potential for Occurrence in the project area: A (Absent), U (Unlikely), Po (Possible), Pr (Present). * indicates there is a seasonality component to occurrence.

Other table notes:

[1] CSSC, CDFW_WL, T, E, D species during breeding only

DPS = Distinct population segment; ESU = Evolutionarily Significant Unit; NMFS = National Marine Fisheries Service

Source: NMFS (2021a), USFWS (2020)

4.1 Marbled Murrelet

Marbled murrelets are small alcids listed in 1992 as threatened under FESA (USFWS 1992) and are endangered under the California Endangered Species Act (CESA). They occur along the Pacific coast from Alaska to California, foraging nearshore in marine subtidal and pelagic habitats for small fish and invertebrates (USFWS 1992). In California, nesting primarily occurs in Del Norte and Humboldt counties, but this species breeds as far south as Santa Cruz County. Marbled murrelets breed in redwoods greater than 200 years old and in Humboldt County, they are almost exclusively found in coastal redwoods (Harris 2006). Peak densities in northern California occur within 1 mi (1.6 km) of shore, and they are rare but consistently present beyond 2.5 mi (4 km) from shore (Hébert and Golightly 2008, Falxa and Raphael 2016); however, a majority of sightings (in central California) occur within 6.2 mi (10 km) of shore (Ainley et al. 1995). Marbled murrelets are most commonly observed in May through September, and less likely to be observed throughout late fall, winter and early spring (Harris 2006). Critical habitat was designated in 1996 (revised in 2011), encompassing old-growth coniferous forests required for nesting and marine foraging areas adjacent to these forests (USFWS 1996, 2011).

Marbled murrelets nest on naturally occurring branch platforms high in old-growth coniferous trees (Nelson 1997). For nesting, they generally require old-growth coniferous forest located close to ocean waters (typically within 50 mi [81 km]), with abundant near-shore food resources (Nelson and Singer 1994). The breeding season extends from late March through early September. Nesting begins between early April and early July. During the breeding season, marbled murrelets form congregations at dawn and dusk near the shore close to the breeding grounds (Nelson 1997).

During the summer, most marbled murrelets on the west coast are found within 3 mi (5 km) of shore in water less than 197 ft (60 m) deep (Piatt et al. 2007). Their abundance tends to drop substantially with distance from shore (Piatt et al. 2007). Offshore surveys for marbled murrelets have been conducted along the west coast, usually for the purposes of estimating local, regional, or coast-wide populations because inland surveys for marbled murrelets are difficult and there is much potential for error. Such surveys have provided data on marbled murrelet offshore distribution—where murrelets feed and rest during both the breeding and nonbreeding seasons. The offshore distribution of marbled murrelets varies within their range; in California computer simulations based on 10 years of surveys indicated that 95 percent of marbled murrelets are found within about 2 mi (3 km) of shore (Ralph and Miller 2002). At-sea abundance has been strongly correlated with proximity to inland areas containing contiguous old-growth forest with suitable nesting habitat (Raphael et al. 2016). They appear to have some degree of fidelity to their marine feeding areas, being found in the same areas year after year (Carter 1984, Sealy and Carter 1984, Carter and Sealy 1990, Lank et al. 2003, Kuletz 2005; all as cited *in* Piatt et al. 2007). Such forage site fidelity may reflect local prey distribution; familiarity with feeding areas from year to year may be one factor influencing their offshore distribution (Piatt et al. 2007).

Marbled murrelets feed closer to shore than most other members of the alcid family, usually within 2 mi (3.2 km) of shore, and may also be found in bays, lagoons, and coves (Nelson 1997). They often preferentially forage either near kelp beds or at the mouths of streams. Murrelets may also forage along the ocean bottom when diving closer to shore (Carter pers. obs., as cited *in* USFWS 1997). They feed primarily on invertebrates and fish (Miller and Ralph 1995). Little data on food preferences are available for the California coast, but sand lance (*Ammodytes hexapterus*) is believed to be one of the most commonly taken prey items. Other fish taken include the Pacific herring (*Clupea harengus*), northern anchovy (*Engraulis mordax*), osmerids, and sea perch (*Cymoatogaster aggregata*). In the southern end of the marbled murrelet's range, sardines (*Sardinops species*) and rockfish (*Scorpaenidae*) may be important.

Historically, marbled murrelets occurred in small numbers near the entrance to Humboldt Bay as foragers, particularly in the late summer and fall (Barnhart et al. 1992). They have been observed in the subtidal entrance portion of the bay between King Salmon and the entrance to the bay (Fowler pers. comm. 2022). However, although anchovy and herring are found in Humboldt Bay, their patchy presence and lower overall biomass contrast with nearshore coastal waters (Barnhart et al. 1992, Schlosser and Eicher 2012) and other key murrelet prey (such as sand lance, juvenile rockfish, and sardine) are absent or negligible within the bay; thus, marbled murrelets generally avoid the enclosed estuary. Marbled murrelets that use the offshore ocean waters for foraging may fly over the action area during their daily movements between nesting and foraging sites.

4.2 Western Snowy Plover

Western snowy plovers are small, precocial shorebirds that breed on coastal beaches, dunes and salt evaporation ponds from Washington south to Baja California, Mexico. There are larger concentrations of breeding birds in the south along the Pacific coast, and much of their coastal distribution is in southern California (Rodriguez et al. 2011). They occur along the Pacific Coast from Damon Point, Washington to Bahia Magdalena, Baja California, Mexico (USFWS 2007). Nesting western snowy plovers have been federally threatened as of 1993 due to loss of nesting habitat and declines in breeding populations and listed as a California State Species of Special Concern (USFWS 1993, CNDDB 2023). Critical habitat was revised in 2012 and there are critical habitat units in California, Oregon, and Washington, including the South Spit of Humboldt Bay (USFWS 2012), which is outside of the action area.

The breeding season for the western snowy plover is from March through September, and they nest on sand spits, dune-backed beaches, beaches at creek and river mouths, and salt pans at lagoons and estuaries from southern Washington to Baja California (USFWS 2007). The nesting on the California coast is initiated as early as the first week of March and peaks from mid-April to mid-June (Warriner et al. 1986, Page et al. 1995, Powell et al. 1997). Chicks hatch between early April and mid-August and reach fledging age approximately 1 month after hatching (Powell et al. 1997). Some western snowy plovers remain in their coastal breeding areas year-round while others migrate south or north for winter, and most inland-nesting plovers migrate to the coast for the winter (USFWS 2007).

The western snowy plover feeds on invertebrates in wet sand within the intertidal zone, in dry sand above high tide, on salt pans and spoil sites, and along the edges of salt marshes, salt ponds, and lagoons. Small numbers of plovers have been documented nesting on gravel bars of the Eel River and can be seen (rarely) attempting to nest on the Elk River Channel, although these attempts have produced variable and often low reproductive success (Colwell et al. 2011, Fowler pers. comm. 2022). Nonbreeding western snowy plovers infrequently occur inside of Humboldt Bay (Colwell 1994 as cited *in* Humboldt Bay Harbor, Recreation, and Conservation District 2015). Snowy plovers are generally uncommon year-round in the Humboldt Bay region.

When present, nonbreeders are mostly in the South Bay on sandier substrates, rather than on softer substrates associated with mudflats in North Bay (Harris 2006). Foraging sometimes occurs on sand flats and mudflats on the bay side of the South Spit (Fowler pers. comm. 2022). Although nesting may occur on nearby sandy beaches on the outer coast, western snowy plovers are unlikely to be present in the action area.

4.3 Southern Oregon/Northern California Coastal Coho Salmon

Coho salmon are a widespread Pacific salmonid distributed across northern temperate latitudes (Moyle et al. 2008). They occupy most river basins in Northern California and spawn in streams from California to Alaska. Coho salmon from the SONCC ESU include naturally spawned coho salmon originating between Cape Blanco, Oregon and Punta Gorda, California, that spawn between Elk River, Oregon, south through Mattole River, California (NMFS 2005a, 2014a, 2016b). Thus, the ESU encompasses Humboldt Bay and its watersheds and overlaps with the action area. The SONCC coho salmon ESU also includes those from the Cole Rivers Hatchery, Trinity River Hatchery, and Iron Gate Hatchery. There are several different functionally independent populations of SONCC coho salmon, and the Humboldt Bay population is one of the largest remaining populations (NMFS 2005a, Moyle et al. 2008, NMFS 2014b). The SONCC coho salmon ESU is listed as threatened under both the ESA and CESA (NMFS 2005a). Critical habitat was designated in 1999 to encompass reaches of all rivers throughout the range of the SONCC ESU, including the water, substrate, and adjacent riparian zones of estuaries, thus overlapping with the action area (NMFS 1999a).

4.3.1 Timing and Distribution

Coho salmon typically exhibit a 3-year life history (NMFS 2014), split between freshwater and saltwater phases. There are two basic life history strategies for juvenile coho salmon in Humboldt Bay tributaries (Wallace and Allen 2007). The first strategy includes those that rear in the upper estuary (near salt marsh habitat) for the summer and migrate back upstream to over-winter, and the second strategy includes those that rear in the lower estuary (e.g., intertidal habitat of Humboldt Bay) before migrating to the ocean.

Adults typically begin their freshwater spawning migration from October to late December, spawn primarily between November through January, and then die within 10-14 days following spawning (NMFS 2014). Adult females lay eggs in redds (gravel pits excavated by females) and the eggs incubate for 1.5 to 4 months prior to hatching as alevins (a larval life stage where there is still dependency on food in the yolk sack) (NMFS 2014). Alevins emerge from redds and following yolk sac absorption, become fry (juveniles). Juveniles rear in freshwater for up to 15 months. Their downstream migration as smolts typically begins between April and May and continues into June (NMFS 2014). The exact timing depends on the size of the fish, flow conditions, water temperature, dissolved oxygen, and food availability.

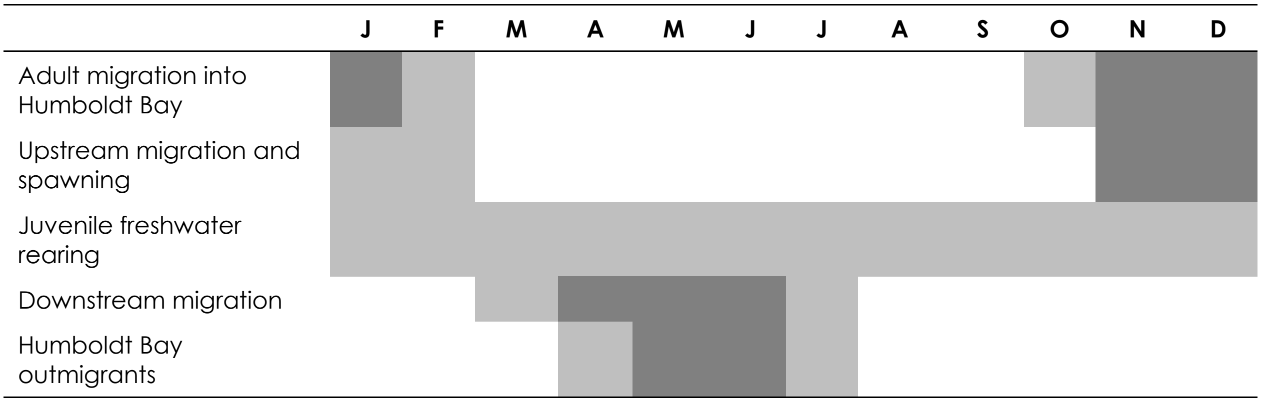
Once juveniles reach the estuary, they spend variable amounts of time completing their juvenile-to-smolt transformation. Growth rates in estuaries are generally higher than in freshwater habitats, and depending on the opportunity and capacity, will spend a few days to a few weeks in the estuary (Miller and Sadro 2003, Clements et al. 2012, Pinnix et al. 2013, Jones et al. 2014, all as cited *in* NMFS 2014). The migrating smolts enter the ocean in spring to late summer (NMFS 2014). Adult SONCC coho salmon generally spend two growing seasons (years) at sea prior to returning to their native stream to spawn (NMFS 2014). The upstream migration to spawning areas typically occurs from October to March, with peaks between November and January, but the exact timing depends mostly on stream flow (CDFG 2004).

4.3.2 Use of Humboldt Bay

SONCC coho salmon may be present year-round in fresh water tidal creeks and sloughs, deep and shallow tidal channels, and creeks and rivers in and around Humboldt Bay. SONCC coho salmon migrate through Humboldt Bay twice throughout their life cycle: once on their migration out to sea as smolts and once on their spawning migration upstream as adults. Coho salmon smolts are found in Humboldt Bay between April through the first week of July, but primarily move through the bay in May and June (Table 2, Pinnix et al. 2013) to feed throughout the north Pacific. Juveniles (85-240 millimeters [mm] fork length [FL]) use the brackish portion of the bay as a nursery (Pinnix et al. 2013), and in the summer, the adults may make brief movements into Humboldt Bay entrance with incoming tides to feed on schools of forage fish. Juvenile SONCC coho salmon have been collected in deep channel, tidal channel, and subtidal habitats in Humboldt Bay, including the Samoa Channel (Cole 2004, NMFS 2016b). Adults are expected to begin entering freshwater tributaries to spawn in mid-October.

Coho salmon are likely to be present in the action area when adults are returning to spawn and when smolts are outmigrating to the Pacific Ocean. Extensive fish surveys conducted in most of the habitat types in Humboldt Bay from September 2000 through November 2001 used a variety of gear types, including minnow traps, pole seines (sampling shallow water, mostly intertidal, habitats near jetties, and in mud flats), beach seines (sampling intertidal and subtidal habitats from shore), and epibenthic otter and beam trawls (sampling deeper water/channels near the bottom; Cole 2004). A total of 67 fish species from 25 families were collected in Humboldt Bay using all methods: the 10 most abundant species accounted for 94.75% of the total catch; the three most abundant made up over 55% (threespine stickleback [*Gasterosteus aculeatus*], shiner surfperch [*Cymatogaster aggregata*], and topsmelt [*Atherinops affinis*]; Cole 2004). Only five juvenile coho salmon were captured, contributing to <0.1% of the total number of individual fish captured (Cole 2004). Two juvenile coho salmon were captured in estuarine, subtidal, unconsolidated and sand bottom habitat measuring 98 and 105 mm total length (TL), one in estuarine, intertidal, unconsolidated and mud shore habitat measuring 127 mm TL, and two in estuarine, intertidal habitat with emergent and persistent vegetation measuring 93 and 99 mm TL (Cole 2004). Notably, none were captured in eelgrass habitat (Cole 2004).

Table 2. Southern Oregon/Northern California Coast Coho Salmon Life History Timing



Note: Peak timing indicated by dark grey.
Source: Pinnix et al. (2013)

More detailed information on residence time and habitat use of coho salmon within Humboldt Bay proper stems from acoustic telemetry studies specifically designed to monitor the movement of outmigrating smolts from freshwater habitats, through the estuary, into Humboldt Bay and into the ocean (Pinnix et al. 2013). A total of 32 and 48 smolts were captured and acoustically tagged at the head of Freshwater Slough in 2007 and 2008, and monitored via fixed receiver networks and mobile tracking. The acoustically tagged juvenile coho salmon smolts leaving freshwater and estuarine habitats were found to occur in Humboldt Bay proper for 15-22 days prior to entering the Pacific Ocean (Pinnix 2008, Pinnix et al. 2013). They were rarely detected near structures such as pilings or docks inside Humboldt Bay, but preferred the deeper channels of Central Humboldt Bay, adjacent to the Project site (Pinnix et al. 2013). Therefore, although coho salmon have been documented by receivers adjacent to the action area, juveniles outmigrating to the sea are only present in Humboldt Bay for a short time period (Pinnix et al. 2013).

4.3.3 Foraging Behavior

In their freshwater stages, coho salmon feed on plankton and insects, then switch to a diet of small fishes as adults in the ocean. The most important period of growth and survival for juvenile coho salmon is marked by a shift from a mixed diet of smaller invertebrates and fish to a more piscivorous diet dominated by larger fishes in coastal waters (Daly et al. 2009). Based on stomach content analysis, the smallest documented prey for juvenile coho salmon collected in coastal marine waters of the northern California Current are juvenile rockfish and sculpins, roughly 5 mm in length, and prey length increases with growth (Daly et al. 2009). However, these smallest prey items likely provide a relatively low contribution to the energetic intake required for rapid growth; rather their feeding intensity peaks between 141-160 mm FL, at which point juvenile coho salmon shift towards eating larger forage fish such as northern anchovies, *Clupeidae* spp., and smelt (Daly et al. 2009). These fish provide the highest caloric quality food (Davis et al. 1998). The increase in piscivory by juveniles in coastal marine waters is also evident by the percent of fish in the diets of juvenile coho salmon increasing from 30.1% for small individuals between 100–120 mm FL to over 90% in individuals over 376 mm (Daly et al. 2009). Given the increases in piscivory and availability of larger fish in coastal waters, Humboldt Bay (and the action area) serves primarily as a migratory corridor as opposed to optimal feeding and foraging habitat.

4.4 California Coastal Chinook Salmon

Like all salmon species, the Chinook salmon is anadromous and semelparous (dies after spawning only once); however, adults differ morphologically than other salmon species due to their large size. The California Coastal (CC) Chinook salmon ESU includes 15 independent populations of fall-run and six independent populations of spring-run Chinook salmon. This ESU encompasses all Chinook salmon that naturally spawned from Redwood Creek in Humboldt County through the Russian River in Sonoma and Mendocino Counties and has been listed as federally threatened since 1999, then updated in 2014 (NMFS 1999b, 2014b). The CC Chinook salmon ESU also includes fishes from Freshwater Creek, Yager Creek, Redwood Creek, Hollow Tree, Mattole Salmon Group, and Mad River Hatchery fall-run Chinook hatchery program. Critical habitat was designated in 2005 and includes most river reaches from Redwood Creek to the Russian River , and all tidally-influenced waters of Humboldt Bay itself (NMFS 2005b).

4.4.1 Timing and Distribution

The CC Chinook salmon is an anadromous salmonid species that generally spend two to three years at sea before returning to freshwater rivers and streams to spawn. There is natural variability in the timing of their spawning runs due to changes in precipitation and its influence on stream flows and passage. They are an ocean-type salmon (opposed to the stream-type, which spends longer residence in freshwater) that reside in estuaries for longer periods as fry and fingerlings, than stream-type yearlings (NMFS 2016a, 2024). In addition, ocean-type salmon spend a short time in freshwater as juveniles and migrate to sea during their first year of life, normally within three months after emerging from the spawning gravel. Generally, the CC Chinook salmon ESU spawns and rears in coastal and interior rivers in northern California and southern Oregon, and forages in vast nearshore and marine zones of the Northern Pacific Ocean.

Juvenile CC Chinook salmon may spend from 3 months to 2 years in freshwater before migrating to estuarine areas as smolts and then into the ocean to feed and mature. Historically, estuaries with summer access to the ocean are favorable habitat for juveniles because it gives them greater flexibility to leave or remain in the estuaries until storms disperse them into the ocean (Moyle et al. 2008). CC Chinook salmon typically spend two growing seasons in the ocean before returning to their natal streams to spawn as three-year-olds, typically between August/September and early November, after the first winter storms (Moyle et al. 2008). Some males (referred to as jacks), however, return to spawn after only three months at sea (NMFS 2016a, 2016b). Adult CC Chinook salmon spend most of their lives in the open ocean.

4.4.2 Use of Humboldt Bay

CC Chinook salmon are known to spawn and rear in the Eel and Mad rivers and in tributaries of Humboldt Bay such as Freshwater Creek, Elk River and Salmon Creek (Schlosser and Eicher 2012). Adults migrate through Humboldt Bay to freshwater tributaries to spawn in the fall, and juveniles migrate through Humboldt Bay to the Pacific Ocean during their seaward migration in the spring and summer. Unlike coho salmon and steelhead, juvenile Chinook salmon rear only a short time in freshwater habitats (they do not overwinter as juveniles in freshwater) and quickly move into brackish and marine habitats (NMFS 2016a).

While juvenile Chinook salmon migrate through Humboldt Bay on their way to the ocean, there is no specific information on residence time in Humboldt Bay because they are too small when they depart the freshwater/brackish ecotone to be implanted with acoustic tags. However, in analogous habitats in San Francisco Bay, juvenile Chinook salmon were captured by midwater trawl from river kilometer 68 and through the bay to the Gulf of the Farallones from late April to mid-July and averaged 89 mm FL with a range from 68 to 113 mm FL (MacFarlane and Norton 2002). These juveniles spent approximately 40 days migrating along the 65 km length of the estuary, traveling approximately 1.625 km per day (MacFarlane and Norton 2002). In comparison, the distance between Freshwater Slough and the entrance to Humboldt Bay is approximately 10 km, which would make residence time within Humboldt Bay on the order of 16 days, which is similar to acoustically tagged juvenile coho salmon (Pinnix et al. 2013). Based on studies in the freshwater/brackish ecotone in Freshwater Slough, PIT-tagged sub-yearling Chinook salmon were captured from April through June (Table 3) during which time their monthly mean length increased from 44 mm FL in April to 56–62 mm FL in May and to 72 mm FL in June (Wallace et al. 2018).

Cole (2004) did extensive fish surveys in Humboldt Bay as noted above and captured 89 juvenile Chinook salmon. Eighty-seven were captured in estuarine, subtidal, unconsolidated and sand bottom habitats with an average TL of 96 mm, ranging from 70 to 119 mm TL, and two juveniles were captured in regularly flooded intertidal mud habitat that measured 102 and 104 mm TL. Notably, none were captured in eelgrass habitat (Cole 2004). Conditions in the Humboldt Bay estuarine habitat are considered fair for adults, pre-smolts and smolts (NMFS 2016a). This area is used for staging prior to freshwater migration, estuarine rearing, and as a transitional environment between freshwater and marine environments. While there is potential for estuarine rearing, the structure and function of habitats around Humboldt Bay have altered from natural conditions (e.g., retreat and fragmentation of eelgrass resources, altered hydrology) and reduced the quality of it as rearing habitat (NMFS 2024). Juveniles and adults are likely to be present in the action area for select brief periods during their migration between freshwater and ocean habitats.

4.4.3 Foraging Behavior

During their outmigration from freshwater to marine habitats, juvenile Chinook salmon in San Francisco Bay shift their prey from invertebrates to fish larvae (MacFarlane and Norton 2002). More specifically, amphipod crustaceans and insects represented the highest index of relative importance in stomach contents of those juveniles captured directly downstream of riverine freshwater habitats. As the juvenile Chinook salmon entered the central portions of the bay, fish larvae and crustaceans had the highest index of importance in their diet. Once entering coastal waters, they feed on early life stages of euphausiids, decapods, and fish (McFarlane and Norton 2002).

Research suggests that juvenile Chinook salmon are more dependent on coastal ocean waters for food than embayment habitats. This is evident in that their most critical feeding and growth occurs outside of estuaries

(MacFarlane 2010). MacFarlane and Norton (2002) also support the notion that coastal waters are primary sites for growth and energy gain, as body condition declined over time in San Francisco Bay, then improved (along with increases in feeding intensity) in marine coastal waters. As juvenile Chinook salmon grow, they obtain the highest caloric quality food from fish and gradually increase the proportional contribution of fishes in their diet (by weight) from 55% to 95% (Daly et al. 2009).

Table 3. California Coastal Chinook Salmon Life History Timing

	J	F	M	A	M	J	J	A	S	O	N	D
Adult migration into Humboldt Bay												
Upstream migration and spawning												
Rearing and downstream smolt migration												
Humboldt Bay outmigrants												

Note: Peak timing indicated by dark grey.
Source: Wallace et al. (2018)

4.5 Northern California Steelhead

Steelhead are taxonomically structured on a geographic basis, and several DPSs are recognized by NMFS. The Northern California (NC) steelhead DPS has potential to occur in the action area. The NC steelhead DPS includes those naturally spawned in CC river basins from Redwood Creek in Humboldt County southward to, but not including the Russian River in Sonoma and Mendocino counties (NMFS 2006a). This DPS has been federally threatened since 2000 (NMFS 2000), and NC Summer steelhead were listed endangered under the CESA in 2022 (14 CCR 670.5). Critical habitat consists of river reaches between Redwood Creek south to Point Arena on the Mendocino coast (NMFS 2005b).

4.5.1 Timing and Distribution

Steelhead can be divided into two basic reproductive ecotypes based on their state of sexual maturity at the time of river entry and the duration of their spawning migration: these two ecotypes are termed “stream maturing” and “ocean maturing” (NMFS 2005b). The stream-maturing (summer-run) steelhead enter freshwater in a sexually immature condition and require several months to mature and spawn. The ocean-maturing (winter-run) steelhead enter freshwater with well-developed gonads and spawn shortly after river entry. NC Summer steelhead are found in watersheds outside of Humboldt Bay, thus only the winter-run NC steelhead have the potential to be present in the action area. Winter-run steelhead enter Humboldt Bay tributaries to spawn in the late fall and winter months when there are higher flows and lower water temperatures and spawn soon after reaching their spawning grounds (NMFS 2016a).

After hatching in freshwater, juvenile steelhead typically remain in their natal streams for at least their first summer (Barnhart 1991 *in* Stillwater Sciences 2006). Young-of-the-year steelhead tend to use riffles with cover, while older juveniles use deeper water (such as pools) as rearing habitat. However, steelhead may also use estuaries as rearing habitat (Stillwater Sciences 2006, Bond et al. 2008). For example, a study of steelhead in Waddell Creek in Santa Cruz County, California found that some of the steelhead remained in Waddell Creek lagoon or the lower portions of the stream for a whole season before migrating to the sea (Shapovalov and Taft 1954). Juvenile steelhead typically rear in freshwater for one to three years before migrating to the ocean (Moyle 2002). Because of this multi-year rearing period, steelhead generally spawn in tributaries that maintain suitable temperature and other water quality parameters year-round.

Most downstream smolt migration takes place between February and June, with peak periods in April and May (NMFS 2016a). Fukushima and Lesh (1998) report that the peak timing of steelhead smolt outmigration in Central California occurs in March, April, and May, while others report most steelhead smolts in California enter the sea in March and April. Studies have shown that salmonids (broadly, not limited to steelhead) that rear in estuaries grow faster compared to fish reared in fully riverine habitats (NMFS 2016a, 2016b).

In California, steelhead generally reside in marine waters for one to two years, with a small fraction spending three to four years, prior to returning to their natal stream to spawn at four or five years old (NMFS 2016a, 2016b). "Half-pounders," which are sexually immature steelhead that return to freshwater after spending less than a year in the ocean, are unique to this ESU. Unlike other Pacific salmonids, steelhead are iteroparous and capable of spawning more than once before they die; adults may survive and return to the ocean after spawning, coming back to spawn for one or more additional seasons (Moyle 2002). However, it is unlikely that steelhead spawn more than twice in a lifetime (NMFS 2005b). Spawning occurs between December and April for summer and winter-runs, and peak spawning occurs between January and March (NMFS 2005b). Outmigration of spawned adults can occur as late as June, but typically occurs no later than May in most watersheds (Moyle et al. 2008).

4.5.2 Use of Humboldt Bay

Northern California steelhead are known to rear in tributaries of Humboldt Bay and migrate through the bay itself on their seaward migration as juveniles. NC steelhead smolts are relatively large (150–200 mm), remain in relatively deep water, and move rapidly through the estuary to the ocean in late spring and summer (Emmett et al. 1991, Wallace 2006). After reaching the ocean in the spring, juvenile steelhead tend to move offshore quickly rather than use nearshore waters. Adults also migrate through Humboldt Bay to reach their tributaries to spawn in winter and early spring. Generally, winter-run NC steelhead enter estuaries and rivers between September and March, and begin spawning between December and early April, though favorable wet conditions may lengthen the spawning period into May (page [p.] 45 *in* Moyle et al. 2008). Upon leaving their freshwater/brackish ecotone (such as Freshwater Creek), juvenile steelhead move directly through Humboldt Bay into the ocean. Notably, only 1 juvenile steelhead measuring 126 mm TL was captured by Cole (2004) in extensive fish surveys in estuarine subtidal unconsolidated and sand bottom habitat. Migratory individuals are likely to occur throughout the action area for short periods of time while in transit.

4.5.3 Foraging Behavior

While information is limited on the foraging behavior of NC steelhead in and around Humboldt Bay, results from studies in analogous habitats serve as a proxy for the foraging behavior of NC steelhead in the action area. Juvenile steelhead collected inside the Columbia River estuary (along the Oregon-Washington border) and those in marine waters outside of the brackish, estuarine water plume exhibit clear shifts in their feeding behavior and physiology. Those in marine waters offshore ate more, grew faster, and had improved body condition metrics (Daly et al. 2014), suggesting that their most important foraging and energetic gains are outside of estuaries and bays. Those in estuarine waters consumed far less food (primarily amphipods) and had decreased body condition and stomach fullness metrics (Daly et al. 2014). Any loss of prey from the Terminal improvements is unlikely to represent a significant loss of food resources because juvenile steelhead are more dependent on coastal waters for energetic gains that are essential to their survival. Their reliance on marine waters for growth is evident by the fact that juvenile steelhead move quickly from coastal marine waters to water further offshore (Daly et al. 2014).

Table 4. Northern California Winter-Run Steelhead Life History Timing

	J	F	M	A	M	J	J	A	S	O	N	D
Adult migration into Humboldt Bay	grey	grey	grey						grey	grey	grey	grey
Upstream migration (river entry) and spawning	dark grey	dark grey	dark grey	grey	grey							grey
Downstream kelt migration		grey	grey	grey								
Juvenile rearing	grey	grey	grey	grey	grey	grey	grey	grey	grey	grey	grey	grey
Downstream smolt migration		grey	grey	grey	dark grey	dark grey	dark grey	grey	grey	grey	grey	grey
Humboldt Bay outmigrants				grey	dark grey	dark grey	dark grey	dark grey	grey			

Note: Peak timing indicated by dark grey.
Source: Wallace et al. (2018)

4.6 Green Sturgeon

Green sturgeon are long-lived anadromous fish and are considered the most marine-oriented of all the sturgeon species in North America (Lindley et al. 2011). Green sturgeon are present along the U.S. West Coast, found in nearshore marine waters, bays and estuaries ranging from Mexico to the Bering Sea, Alaska (NMFS 2009), although their consistently inhabited range is much smaller, primarily concentrating in the coastal waters of California, Washington, Oregon, and Vancouver Island. North American green sturgeon are divided into two DPSs: the northern and southern DPS (nDPS and sDPS, respectively). The non-spawning adult and subadult populations coexist in marine and estuarine waters from Mexico through Alaska for most of their lives (NMFS 2009, 2018). The DPSs are differentiated by their spawning locations. The nDPS spawns in the Rogue River in Oregon south to the Klamath River in California (NMFS 2009, 2018), but are not federally listed as threatened or endangered. The sDPS is federally threatened, and they spawn in the Sacramento River (NMFS 2006b, 2009, 2018, 2021b). Both DPSs are seasonally present inside Humboldt Bay and the action area, but neither use tributaries of Humboldt Bay for spawning (NMFS 2021b). Critical habitat was designated for sDPS green sturgeon as of 2009 and includes certain bays and estuaries, including all tidally influenced waters of Humboldt Bay (NMFS 2009).

4.6.1 Timing and Distribution

Green sturgeon use riverine, estuarine, and marine habitats throughout the U.S. West Coast and spend substantial portions of their lives in marine waters (NMFS 2018). Since green sturgeon do not spawn in tributaries of Humboldt Bay and are only present in Humboldt Bay as subadults and adults, the discussion on their timing and distribution in this section is limited to their adult stage. Adults (>75 cm TL) and subadult green sturgeon can broadly be found moving within nearshore coastal waters from Monterey Bay through Alaska. They make extensive coastal migrations in depths shallower than 80 m (Moser et al. 2016) and spend most of their lives in coastal marine waters. In the summer months specifically, subadult and adult green sturgeon may aggregate and hold in estuaries of non-natal rivers, including Grays Harbor and Willapa Bay in Washington and Humboldt Bay in California (Adams et al. 2007, Moser and Lindley 2007, Lindley et al. 2008, and Heublein et al. 2009 as cited *in* Lindley et al. 2011). These aggregations in non-spawning estuaries (e.g., Humboldt Bay) occur during summer and early fall months (primarily May to October; NMFS 2006b) and are part of their larger migratory patterns between spawning rivers, overwintering habitat in marine waters, and summer-holding and feeding habitats (Lindley et al. 2008, 2011). Adults enter their natal rivers to spawn every three to five years, and their migration to freshwater typically begins in late February.

4.6.2 Use of Humboldt Bay

While sDPS green sturgeon are present in Humboldt Bay, they are found in many other estuaries and coastal regions. Green sturgeon likely forage in Humboldt Bay, in addition to using the area as a thermal refuge (Moser and Lindley 2007, NMFS 2021b). Adult and subadult sturgeon have been observed in Humboldt Bay in large concentrations during the summer and fall (NMFS 2021b), specifically between April and October, though there have been peaks in detection from January to October (Lindley et al. 2011). An effort to tag 355 green sturgeon on their spawning grounds and non-spawning aggregation sites found that in comparison to other west coast estuaries, fewer green sturgeon are found within Humboldt Bay (Lindley et al. 2011), further suggesting that Humboldt Bay may not be as important as other estuaries and coastal habitats for green sturgeon. Adults and subadults are regularly observed in deeper channels of Humboldt Bay, channel margins and mudflats when the tide flats are inundated during high tide, and around Sand Island in North Bay. Acoustic tag detections suggest that green sturgeon move in deep channels, and 97% of observations occurred at two detection locations: Arcata Channel and North Bay Main Channel near the Samoa Bridge (Pinnix 2008). Tracking studies in San Francisco Bay suggest that sturgeon detections are associated with either movement or feeding activity and that directional movement of sturgeon is rapid. Taken together, these observations suggest that the large number of detections near the extreme north end of Arcata Channel likely represents an area where feeding is occurring.

An analysis of green sturgeon acoustic monitoring in Humboldt Bay between 2005 and 2007 highlight patterns in their residency (Pinnix 2008). The acoustic array included hydrophones through Entrance Bay, two in South Bay, one in the Main Channel and then scattered throughout North Bay (e.g., near Samoa Bridge, Sand Island, and the Mad River). Those detected in Humboldt Bay were primary tagged in either the Sacramento River or San Pablo Bay and thus part of the sDPS, but there were others coming from more northern regions (Pinnix 2008). Generally, green sturgeon entered Humboldt Bay in late spring (between April and June) and resided until September or October, supporting the idea that Humboldt Bay is a location for summer-holding. Detections were more frequent in North Bay than the South Bay; however, there were also more hydrophones deployed in North Bay (Pinnix 2008).

During studies of tagged coho salmon throughout 2006 and 2007, approximately 30 tagged green sturgeon per year were observed in North Bay and elsewhere throughout Humboldt Bay; as a follow up, USFWS and NMFS staff employed a directional acoustic receiver to track their movements (Goldsworthy et al. 2016). The acoustic receivers drifted for two approximate-60 minute transects, and the general location, number, and context of behavior was recorded from individuals detected. Those detected were individuals previously tagged in the Sacramento River, confirming those present in Humboldt Bay are part of the sDPS (Goldsworthy et al. 2016).

While green sturgeon have been observed in mudflats and along eelgrass margins, depending on distance from a main channel, they do not frequent shallow habitats and it does not appear to be their preferred habitat. Green sturgeon are likely to utilize the channel in the action area during construction, but only for short periods during their movements to and from marine and upper bay habitats in the summer/fall months and they are not fully dependent on Humboldt Bay (see content on foraging behavior, below).

4.6.3 Foraging Behavior

The foraging behavior of green sturgeon (and the other ESA-listed fishes) is an important consideration to sufficiently evaluate the effects of the proposed Terminal improvements because it informs whether and how the potential loss of prey items impacts their survival. Additional details on the effects analysis can be found in Section 6.2.2.4. Compared to the ESA-listed salmonids, there is relatively little information on the foraging behavior of green sturgeon. In the San Francisco Bay Estuary, juvenile green sturgeon feed on shrimp, amphipods, isopods, and other benthic species (NMFS 2018). In coastal bays and estuaries, adults and subadults rely on soft substrate (Moser et al. 2016) to feed on benthic invertebrates such as shrimp, mollusks, amphipods, and sometimes small fishes (NMFS 2018, 2021b). While no explicit foraging study has been conducted inside Humboldt Bay, foraging adult and subadult sturgeon in San Francisco Bay tend to frequent areas less than 33 ft (10 m) deep, foraging in the benthos and moving on and off mudflats with tidal fluctuations (Kelly et al. 2007, Moser et al. 2016).

Green sturgeon likely use Humboldt Bay to forage (Kelly et al. 2007, Moser and Lindley 2007, Lindley et al. 2011). As discussed above, during studies of tagged coho salmon throughout 2006 and 2007, approximately 30 green sturgeon per year were observed in North Bay and elsewhere throughout Humboldt Bay; as a follow up, USFWS and NMFS staff employed a directional acoustic receiver to track their movements (Goldsworthy et al. 2016). Based on the body positioning of individuals visibly seen during this effort, along with observed high abundances and avoidance behavior of northern anchovy, it appeared as though green sturgeon were actively feeding on northern anchovy in Arcata Channel. While subadult and adult green sturgeon hold and forage inside Humboldt Bay, they are not fully dependent on Humboldt Bay. They move in and out of other estuaries along their migration, and rely on feeding in coastal oceanic waters. Their presence in the action area is likely in passing on their way to hold in North Bay.

4.7 Eulachon

Eulachon are distributed from northern California through the Bering Sea in Alaska. In 2010, the sDPS, which spans from the Mad River in California to the Skeena River in Canada, was listed as federally threatened (NMFS 2010). The nearest designated critical habitat to Humboldt Bay is in the mainstem Mad River (NMFS 2011). California Department of Fish and Wildlife (CDFW) considered eulachon to be possibly extirpated from the Mad River until recent surveys and genetic testing indicated they were present in 2020 (Halligan pers. comm. 2022). Prior to 2020, the last recorded observation of eulachon in the Mad River was in April 1976 (Gustafson et al. 2010). Humboldt Bay is just south of the known distribution of eulachon, so their presence is unlikely. There is low potential (unlikely) for the sDPS of eulachon to occur within the action area.

4.8 Tidewater Goby

The tidewater goby is a small fish that is discontinuously distributed in bay and lagoon habitats along the California coastline (USFWS 1994). They are federally endangered and designated critical habitat occurs along the margins of Humboldt Bay, outside of the action area (USFWS 1994, 2013). These upper sloughs and high marsh areas separated from the bay by tide gates or other flow barriers provide habitat, despite threats from habitat fragmentation (McCraney et al. 2010). Tidewater gobies are restricted to the upper margins of tidal bays near the entrance of freshwater tributaries and coastal lagoons, and require brackish water, occupying relatively shallow sloughs fringing Humboldt Bay. They have been documented in Elk River, adjacent to the action area (McCraney et al. 2010), but are rarely captured in the marine environment and appear to enter the ocean only when flushed out of lagoons, estuaries, and river mouths by storm events or human-caused breaches of sand bars (Swift et al. 1989). They are generally associated with quiescent water less than 2 m deep, are present year-round, and their reproduction peaks in April and May (USFWS 2013). Tidewater gobies are unlikely to occur in the action area, due to their dependence on low salinity brackish water during their early larval life stage and their preference for low-flow, shallower waters.

4.9 Sunflower Sea Star

The sunflower sea star was proposed for listing as a threatened species under the ESA on March 16, 2023 (NMFS 2023a). It was first petitioned to be listed in August 2021, and may potentially be listed as threatened within the timeline of the proposed project. The sunflower sea star is a large, fast-moving sea star (echinoderm) that can exceed 1 m in diameter. Its documented range is from the Aleutian Islands, Alaska south to Baja

California, Mexico (Lowry et al. 2022, NMFS 2023a); however, they are most commonly present between Monterey, California and the Alaska Peninsula, thus encompassing the action area (NMFS 2023a).

Sunflower sea stars are habitat generalists, lacking clear associations with specific habitat types and/or features. They occupy a range of benthic substrate, from intertidal zones up to depths of 435 m, although are most common in waters less than 25 m deep (p. 16214 *in* NMFS 2023a). Sunflower sea stars can also be found along outer coasts, inside waters including glacial fjords, sounds, and tidewater glaciers, but they tend to prefer more temperate waters. In these temperate waters, sunflower sea stars tend to inhabit kelp forests and low rocky intertidal zones. Prior to the onset of sea star wasting syndrome (SSWS), it was relatively common throughout its range. Sunflower sea stars are keystone mesopredators and are generally solitary and competitive with conspecifics (Lowry et al. 2022).

Sunflower sea stars are similar to other sea stars in that they have separate sexes that are indistinguishable externally. Each ray on an adult contains a pair of gonads. Their gonads are elongated, branched sacs. Sunflower sea stars are broadcast spawners, and observations from similar species suggest they are synchronous aggregate spawners (p. 16215 *in* NMFS 2023a). Fertilization thus occurs externally, and fertilized larvae develop through pelagic planktotrophic stages. Food availability, temperature, photoperiod, salinity, and the lunar cycle control the seasonality of their reproductive cycles. The exact timing for spawning is thus variable and they may form seasonal aggregations for spawning (Lowry et al. 2022). Information on size at first maturity, fecundity, reproductive seasonality, and how these parameters vary throughout the species' range is limited, thus making it difficult to accurately predict reproductive output and evaluate resiliency (NMFS 2023a).

4.9.1 Use of Humboldt Bay

Sunflower sea stars are not commonly observed inside Humboldt Bay, and information on their distribution and abundance in the bay is scant. Barnhart et al. (1992) provides a detailed overview of the estuarine profile of Humboldt Bay, including species present. Appendix B in Barnhart et al. (1992) lists the abundance (qualitatively) and habitat preference of invertebrates in Humboldt Bay. Sunflower sea stars were considered to be occasionally present on a scale of being abundant, common, occasional or rare. Their preferred habitat type is rocky substrates that occur primarily near the bay mouth (p. 96 *in* Barnhart et al. 1992). Even though sunflower sea stars have not been documented near the Terminal, their presence is possible because of their generalist behavior and use of embayments. As broadcast spawners, it is also possible that larvae occur within the action area. However, they are typically found in kelp forest and low rocky intertidal and subtidal zones in California, as opposed to shallow bays such as Humboldt Bay.

The Multi-Agency Rocky Intertidal Network's long-term monitoring program conducts surveys in rocky intertidal areas along the California coast. Their database of records indicates that sunflower sea stars had not been documented in the intertidal zone in California since before the onset of SSWS in 2013/2014. Even in subtidal zones, where they are typically more common, sunflower sea stars had not been reported since 2018. In November 2021 and July 2022, there were observations in Mendocino and Humboldt County (Multi-Agency

Rocky Intertidal Network 2023). The sunflower sea star is unlikely to be found along the shore within the action area since their presence within Humboldt Bay has not been documented past Entrance Bay.

Section 5.0 EFH

The MSA established procedures designed to identify, conserve, and enhance EFH for those species regulated under a federal fisheries management plan (FMP). Under section 205(b) of MSA, federal agencies are required to consult with the Secretary of Commerce (represented on this issue by NMFS) on any actions that may adversely affect EFH. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). NMFS has further added the following interpretations to clarify this definition:

- "waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate;
- "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities;
- "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and
- "spawning, breeding, feeding, or growth to maturity" covers the full lifecycle of a species (50 CFR 600.10).

The Pacific Fishery Management Council (PFMC) has designated EFH for four FMPs covering groundfish, coastal pelagic species, Pacific coast salmon, and highly migratory species.

Habitat Areas of Particular Concern (HAPC) are described as subsets of EFH, and are identified based on one or more of the following considerations:

- Importance of the ecological function provided by the habitat;
- Extent to which the habitat is sensitive to human-induced environmental degradation;
- Whether and to what extend development activities are, or will be stressing the habitat type; and
- The rarity of the habitat type.

This EFHA determines whether the proposed action "may adversely affect" designated EFH for relevant commercial, federally-managed fisheries species within the action area, and reviews the potential effects on HAPC. To determine the potential extent of EFH in the action area in accordance with the MSA, all approved West Coast FMPs were reviewed, and the species regulated by West Coast FMPs were assessed for potential occurrence. NMFS's EFH mapper was also reviewed when determining the locations of designated EFH and HAPC (NMFS 2021a).

The action area contains EFH as designated under the MSA with Pacific coast groundfish, coastal pelagic, and Pacific coast salmon FMPs. Eelgrass and estuaries are HAPC in the action area.

5.1 Pacific Coast Groundfish EFH

EFH for Pacific coast groundfish is defined as the aquatic habitat necessary to allow groundfish production to support long-term sustainable fisheries for groundfish and for groundfish contributions to a healthy ecosystem. The northern California coast provides groundfish habitat from the nearshore mean higher high water or the upstream extent of saltwater intrusion, to deep water areas (less than or equal to 3,500 m) seaward to the boundary of the U.S. Exclusive Economic Zone (EEZ), seamounts in depths greater than 3,500 m as mapped in the EFH assessment, and areas designated as HAPCs (PFMC 2022). The groundfish FMP groups EFH into seven composite units, each of which represent a major habitat type. One of the seven components is estuarine EFH, defined as waters, substrates and associated biological communities in bays and estuaries of the U.S. EEZ, from mean higher high water to the outer boundary of the estuary.

The PFMC made more than 400 EFH designations for 83 groundfish species, and Pacific coast groundfish represent a large number of resident species along the U.S. West Coast. The PFMC further defined important habitat by species and life stage. Within Humboldt Bay, Pacific coast groundfish EFH covers the North Bay, Entrance Bay, and South Bay, thus encompassing the action area. Pacific coast groundfish likely to occur in the Project area include flatfishes (e.g., starry flounder [*Platichthys stellatus]*, speckled sanddab [*Citharichthys stigmaeus*], Pacific sanddab [*C. sordidas*]), rockfishes (e.g., black rockfish [*Sebastes melanops*], blue rockfish [*S. mystinus*]), lingcod (*Ophiodon elongates*), cabezon (*Scorpaenichthys marmoratus*), and kelp greenling (*Hexagrammos decagrammus*). Larvae of several species of groundfish are potentially present as well.

5.2 Coastal Pelagic EFH

Coastal pelagic species live in the water column and are found anywhere from the surface to 3,281 ft (1,000 m) deep. The coastal pelagic EFH covers and actively manages six species/species groups: Northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), Pacific mackerel (*Scomber japonicus*), jack mackerel (*Trachurus symmetricus*), California market squid (*Loligo opalescens*), and krill (PFMC 1998, 2021). The EFH for these species includes all marine and estuarine waters along the coast of northern California and offshore to the EEZ boundary line. Of the six actively managed species/species groups, anchovies, Pacific and Jack mackerel are potentially present inside Humboldt Bay and within the action area.

5.3 Pacific Coast Salmon EFH

In the estuarine and marine environment, EFH for Pacific coast salmon extends from nearshore and tidal submerged environments in state waters to 370.4 km offshore. Pacific salmonids, including coho and Chinook salmon, as well as their prey species (Northern anchovy, Pacific sardine, and Pacific herring) are potentially present within the action area and covered under this EFH. The action area contains EFH for all life stages of

Chinook and coho salmon. Further information on coho and Chinook salmon may be found in Sections 4.3 and 4.4.

5.4 Highly Migratory Species EFH

Highly migratory species are pelagic fish species such as tunas, marlins, and sharks that occur worldwide and are highly mobile. They can be found in both the EEZ region out to 230 mi (370 km) from shore and the high seas; they do not occur in Humboldt Bay nor the action area.

5.5 HAPC

Humboldt Bay (and the action area) is an estuary, which is a HAPC managed under the Pacific Coast Groundfish FMP. Eelgrass beds are also an important habitat type and designated as an EFH HAPC for various fish species within the Pacific Coast Groundfish FMP (PFMC 2008, National Oceanic and Atmospheric Administration 2014). Additional information on eelgrass, which is present on mudflats in the Project area, is provided in a separate analysis (H. T. Harvey & Associates 2025).

5.6 Ecosystem Component Species

In 2016, a selection of forage fish species that were unfished and unmanaged were brought into the FMPs as Ecosystem Component Species (ECS). There are certain ECS shared between all four FMPs. The intention of this action was to define and prohibit directed commercial fishing because the shared ECS are prey of marine mammal, seabird and fish species and because they support the growth and development of predators (NMFS 2016c, 2016d). Future development of fisheries for shared ECS is prohibited as a method to proactively protect unmanaged, unfished forage fish crucial to species managed under the FMPs and the larger California Current. Longfin smelt are one example of a shared ECS that is potentially present in the action area. Pacific herring are also present in the action area and are an ECS covered under the coastal pelagic FMP.

Section 6.0 Review of Effects on Listed Species and Critical Habitat

The "effects of the action" to be analyzed in this BA are defined as the direct and indirect effects of the action, together with the effects of other activities that are interrelated or interdependent with that action. The following information describes the potential direct and indirect effects of the Project on the listed species known to occur, or with the potential or occur, in the action area. The potential marine environmental effects associated with construction for the Project result from removal of timber and concrete piles, and installation of steel and timber piles along the causeway and floating dock. The nature of direct and indirect impacts may be short-term or long-term:

- **Direct Effects**—effects from actions that would immediately remove or destroy habitat, harm (injure or kill) species, or adversely modify designated critical habitat. Direct effects include actions that would potentially remove or destroy habitat, or displace or otherwise influence the species, either positively (beneficial effects) or negatively (adverse effects).
- **Indirect Effects**—those effects that are caused by the proposed action and occur later in time, but are still reasonably certain to occur. Indirect effects may include impacts on food resources, or foraging areas, and impacts from increased long-term human access/activities.
- **Short-Term Effects**—typically only occur during the work activity, have no long-term disturbance or harm to native vegetation/habitat, and the habitat values return to a pre-disturbance state within one year. Disturbance impacts to animals as a result of activities are considered temporary if the animals' behavior and/or spatial use patterns are expected to return to pre-activity conditions shortly after the disturbance ceases, so that daily behaviors necessary to meet life requisites are maintained.
- **Long-Term Effects**—effects that last over one-year, and result from the permanent replacement of natural habitat with structures or materials to developed uses, or shade or permanently convert the habitat to a different habitat/use. Long-term effects would also include vegetation or habitat disturbance where, following the disturbance, the vegetation/habitat cannot recover to its pre-disturbance state within one-year.

To determine the effects of an action, the listed resources potentially exposed to impacts (listed species and designated critical habitat) need to be identified, then the potential stressors associated with the action and the nature of that exposure (effects) need to be determined. The next step requires an examination of the scientific and commercial data available to determine whether and how those listed resources are likely to respond given their exposure. The final step of the analysis is making a determination of risk that the project effects pose to listed resources.

A ”no effect” determination is the appropriate conclusion when the action agency determines that the proposed action will not affect listed species or critical habitat (USFWS and NMFS 1998). A “may affect, not likely to adversely affect” determination is the appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects on the species. Insignificant effects relate to the size of the impact and should never reach the scale where take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) occurs. Discountable effects are those extremely unlikely to occur. Based on best judgement, a person would not: 1) be able to meaningfully measure, detect, or evaluate insignificant effects; or 2) expect discountable effects to occur.

A “may affect, likely to adversely affect” determination is the appropriate conclusion if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial (USFWS and NMFS 1998). In the event that the overall effect of the proposed action is beneficial to the listed species, but also is likely to cause some adverse effects, then the proposed action “is likely to adversely affect” the listed species. If the adverse effect can be detected in any way or if it can be meaningfully articulated in a discussion of the results, then it is not insignificant, it is likely to adversely affect. A “may affect, likely to adversely affect” determination requires formal Section 7 consultation.

The analysis of project-related effects on designated critical habitat is based on the definition of “destruction or adverse modification,” which “means a direct or indirect alteration that appreciably diminished the value of critical habitat for the conservation of a listed species. Such alteration may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features” (USFWS and NMFS 2016). Determinations on destruction or adverse modification are determined by looking at critical habitat as a whole, not just on the areas where the action takes place or has direct impacts.

For the purposes of this BA, impacts to critical habitat would be “likely to adversely affect” if they would result in the following short- and long-term effects: 1) disturbance of any life history stage of a species such that it causes a disruption of breeding, feeding, or sheltering in the short-term; 2) take of any individuals of any life history stage in the short-term; 3) decreased quality of any Physical or Biological Feature (PBF) of critical habitat for any life history stage of a listed species in the short-term; 4) decreased quality and quantity of any PBF of critical habitat for listed species over a large proportion of the available habitat in the long-term; or 5) continuing or worsening conditions that are currently causing a listed species to decline in the long-term.

A summary of the marine effects (using the definitions above) associated with the project is explained in Section 6.1. A more detailed explanation of the effects on given taxa, and whether the mechanism may require mitigation, is provided in Section 6.2. Analysis of effects on critical habitat and EFH are also provided in Sections 6.2 and 6.3.

6.1 Direct and Indirect Effects

Direct and indirect effects are expected to result from construction activities required for Terminal improvements. These may include increased underwater noise and sediment suspension from pile removal and driving. Impacts on habitat loss from pile placing will be insignificant, as habitat will be created as a result of pile removal (see Section 6.2.2.1).

6.1.1 Underwater Noise

Construction for the Terminal improvements involves demolition and replacement of piles and pile bracing on the dock causeway, replacement of guide piles and guides at the floating dock, and replacement of the beam at the working platform. Short-term, direct effects of elevated underwater noise can be expected from pile removal and driving (e.g., from vibrating and impact hammers) and has the potential to result in the injury or mortality of juvenile or adult birds and fish that may be close to the work area.

In general, impacts from noise depend on i) sound frequency relative to the hearing frequency range of the animal and ii) sound source intensity, energy, duration received by an animal and type. The type of sound source determines the appropriate acoustic thresholds for animals. Impulsive sound sources produce sound that is typically transient, brief, broadband, and consist of high peak sound pressure with rapid rise and decay times (NMFS 2023b). Impulsive sounds such as impact pile driving can occur in repetition, or as a single event. In contrast, non-impulsive sounds can be continuous or intermittent, produce sounds that are broadband, narrowband or tonal, and may be brief or prolonged. These sources do not have the high peak sound pressure with rapid rise times that are typical of impulsive sounds. Non-impulsive sound sources may result from vibratory pile driving. Sound may also be continuous (i.e., emit sound with a sound pressure level that remains above ambient sound) or intermittent (i.e., interrupted levels of low or no sound or burst of sound separated by silent periods) (NMFS 2023b).

Underwater sound also has a particle motion component (Nedelec et al. 2016, Popper and Hawkins 2018). Marine mammal hearing is based on detection of sound pressure, whereas fish and invertebrates sense sound using particle motion (other than those fish species with swim bladders that may also be sensitive to sound pressure). Particle motion provides information about their environment (e.g., detection of an approaching predator, the presence of a potential mate), but is also used for communication or navigation.

Exposure to sound can constitute a large area based on the frequency, duration, and magnitude of sound produced and the fact that sound travels far underwater. Acoustic impacts from Terminal improvements will depend on noise generated by construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise sensitive areas. Noise impacts from construction primarily result when construction activities occur in the vicinity of marine animals, in areas next to sensitive habitats, or when construction lasts for extended periods of time (Appendix J *in* GHD 2021).

Underwater sound may result in a range of effects on marine species, from no discernible effect to acute, lethal effects. The effect of noise may have significant impacts (taxa dependent). Impacts to fish are primarily related to effects of sound pressure levels on species with swim bladders (Hawkins et al. 2020). Tissue damage from underwater sound may occur when sound passes through muscle into a gas void (e.g., swim bladder), since gas is more compressible. When exposed to sound pressure, gas in the swim bladder may expand more than the surrounding tissue and may contract during periods of overpressure. This expansion and contraction may result in swim bladder tissue damage and even a ruptured swim bladder (p. 3-4 in Molnar et al. 2020). These physical injuries have short or long-term effects, depending on whether the individual fish can recover. Salmon have ducted swim bladders connected to the esophagus via a thin tube, thus allowing them to expel air from their swim blader and out of the mouth (p. 3-3 in Molnar et al. 2020). Their swim bladders are more distant from the ear and are more sensitive to particle motion, which may protect them from acute sound events (Hawkins et al. 2020).

The Fisheries Hydroacoustic Working Group (FHWG) has developed agreed-upon injury threshold criteria for listed fish species (FHWG 2008). The FHWG identified sounds pressure levels of 206 dB-peak (peak dBs) at 10 m as being injurious to fish. Accumulated sounds exposure levels (SEL) at 10 m of 187 dB for fishes that are greater than 2 grams (g), 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, reduced ability to detect and avoid predators) (FHWG 2008). It is highly unlikely that listed salmonids weighing less than 2 g will be present in the action area during construction.

It must be noted that recent research summarized in Popper et al. (2014) suggests that cumulative SEL thresholds for injury may be well above 200 dB. However, until there is broad agreement on the use of higher thresholds, those in FHWG (2008) should be used. It is very important to recognize that these criteria were developed for impact pile driving only. They should not be used to assess sounds from vibratory pile driving because the injury thresholds for impact driving are likely to be much lower than the injury thresholds for non-impulsive, continuous sounds produced by vibratory drivers. Until injury thresholds are developed for vibratory pile driving, this BA will rely on the comparison of noise information developed for a number of projects that included both impact and vibration hammers.

Impact pile driving is the most commonly used pile driving method. Impact pile drivers are piston-type drivers that use various means to lift a piston (ignition, hydraulics, or steam) to a desired height and drop the piston (via gravity) against the head of the piling in order to drive it into the substrate. In general, an impact hammer driving 14-in steel pipe and timber pilings can be expected to generate peak dB of approximately 199 and 184 dB, respectively, at a distance of 10 m from the piling (Molnar et al. 2020). The single strike SELs during impact driving of 14-in steel pipe and timber pilings have been documented as 169 and 145 dB, respectively, at a distance of 10 me from the piling. However, site conditions in the action area may result in noise levels that are different from those reported by Molnar et al. (2020). Table 5 shows monitoring results for a number of pile driving projects conducted in the western U.S.

Vibratory pile driving, in contrast to impact hammer driving, uses oscillatory hammers that vibrate the piling, causing the sediment surrounding the piling to liquefy and allow penetration. The vibratory hammer produces sound energy that is spread out over time and is generally 10 to 20 dB lower than impact pile driving (Molnar et al. 2020). Peak sound pressure levels for vibratory hammers can exceed 180 dB; however, the sound from these hammers rises relatively slowly. Although peak sound levels can be substantially less than those produced by impact hammers, the total energy imparted can be comparable to impact driving because the vibratory hammer operates continuously and requires more time to install the piling (Molnar et al. 2020). Peak and cumulative SEL noise levels are not likely to exceed injury threshold levels if a vibratory hammer is used to place the pilings.

The most common impact minimization measure used to minimize noise effects on fish from impact pile driving is the installation and operation of a bubble curtain around the piling. The air within the bubble curtain "absorbs" some of the noise generated from pile driving, which reduces the potential impact area. It can be expected that up to 15 dB attenuation can be achieved using a bubble curtain during a slack tide (Molnar et al. 2020). A rapidly incoming or outgoing tide reduces bubble curtain efficacy, since bubbles get carried away from the piling (Molnar et al. 2020). Therefore, this project will use a "stacked" series of bubble extruder rings to surround the piling with bubbles. In addition, to improve the effectiveness of the bubble curtain, the contractor will attempt to finish driving a piling with an impact hammer in the period that extends from an hour before to an hour after slack tide, which would avoid rapid tidal velocities. The contractor is aware that tidal action will make the bubble curtain less effective, which could result in exceeding noise thresholds and shutting down impact pile driving.

During impact pile driving, cushion blocks can be placed between the top of the piling and the hammer. The cushions are typically 1 to 3 in thick and made with wood, nylon, or a polymer material. The cushions are used to absorb and dissipate heat and can protect the top of the piling from damage. The Washington State Department of Transportation conducted a study to evaluate the effectiveness of each of the material types in reducing underwater sound generation (Washington State Department of Transportation 2006, as cited *in* Caltrans 2009) during the driving of 12-in diameter steel pipe pilings. The study results indicated that a wood piling cushion reduced sound levels from 11 to 26 dB. Polymer and nylon piling cushions reduced sound levels from 7 to 8 dB and 4 to 5 dB, respectively.

As stated in Section 3, vibratory pile driving will be used to the greatest extent possible during the Terminal improvements. However, there is the potential that during vibratory pile driving resistant subsurface sediment layers could be encountered, which would result in the piling refusing to go deeper. During this unlikely scenario, the contractor would be required to utilize an impact hammer to finish setting the piling. Sound levels generated by impact hammer pile driving have the potential to reach the FHWG (2008) threshold levels and injure listed fish species in the action area.

Table 5. Various Project-Measured Maximum Sound Pressure Levels at 10 m from Piling, Unattenuated

Project Location	Pile Type	Diameter	Water Depth	Hammer Type	Peak SPL (dB re 1 μPa)	SEL (dB re 1 $\mu Pa^2 s$)
Richmond, CA – San Francisco Bay	Steel pipe	14-in	3–15 m	Diesel impact	199	169
San Rafael, CA – San Francisco Bay	Steel pipe	14-in	>15 m	Diesel impact	198*	170*
San Francisco, CA – Pier 39	Timber	14-in	5 m	Drop	184	145
Benicia, CA – Port of Benicia	Timber	~14-16 in†	10.7 m	Impact	180	148
Oakley, CA – Sand Mound Slough	Steel pipe	16-in	3 m	Drop	182	158
Eureka, CA – Humboldt Bay	CISS Steel pipe	36-in	10 m	Diesel impact	210	183

Notes: lb = pounds; m = meter; in = inches; CISS = castin-steel-shell. Humboldt Bay project included due to location.

* Sound levels measured at a distance of 22 m

† No data given on pile size; diameter estimated from reference photo (pg. I-108 in Molnar et al. 2020)

Source: Molnar et al. (2020)

An analysis was conducted of potential noise impacts of impact hammer pile driving on listed fish species in the action area. The analysis for the 14-in and 16-in piles were based on unattenuated sound data provided by Molnar et al. (2020). Due to a lack of available data, source levels for impact driving of 14-in timber piles at Pier 39 in San Francisco, CA, were used as a proxy for source levels of 16-in timber piles (Molnar et al. 2020). The 14-in and 16-in data were then run through the NMFS (2022) pile driving noise calculation model to determine the distance from the piling where the onset of injury might occur. A second model run was conducted with the same peak and SEL dB data, but adjusted with an attenuation level of 5 dB to account for sound attenuation gained through use of a bubble curtain (-5 dB; Molnar et al. 2020). Although placement of a nylon cushion block between the hammer and piling is planned, no specific sound level reduction credit was applied, following guidance by Molnar et al. (2020). It was assumed that it would take 100 hammer strikes to finish setting a single pile, and one pile would be driven per day. As can be seen from Table 6 and Figure 6attenuation of sounds levels using a bubble curtain result in a significant decrease in the area where a fish may be subject to injury from pile driving sound levels. In predicting injury thresholds, NMFS considers the concept of "effective quiet," at which point the received SEL from an individual pile strike is below a certain level and the accumulated energy from multiple strikes would not contribute to injury regardless of how many pile strikes occur (Molnar et al. 2020). Effective quiet is assumed to be 150 dB; as the single strike SEL for 16-in timber piles is estimated at 145 dB, it is therefore assumed that driving 16-in timber piles will not accumulate to cause injury. According to the model, the 187 dB at 10 m threshold for fish ≥2 g would not be met using an impact hammer and 100 strikes per piling with attenuation.

Under a worst-case scenario, if a significant amount of impact pile driving is necessary due to early refusal, additional strikes with the impact hammer may be needed to reach the desired tip elevation or engineering piling setting criteria in order to complete all in-water work (pile driving and removal) by October 15, 2025. Table 7 illustrates the estimated distance to injury thresholds based on the NMFS (2022) pile driving noise calculator with an additional 325 strikes (425 total) on both 14-in and 16-in pilings (one pile per day). This worst-case scenario could result in the 187 dB threshold for fish ≥2 g being met at 16.6 m for the 14-in pilings with attenuation. However, this worst-case scenario is unlikely to occur, given the short-term nature of the Project relative to the proposed work window.

The vast majority of available information regarding pile driving noise impacts is related to use of impact or vibratory hammers on steel or concrete pilings. No information was found that assessed noise levels for vibratory hammers removing wooden pilings. However, it is expected that use of a vibratory hammer to remove pilings would have lower sound levels and take a shorter period of time than driving in the pilings.

In-water pile driving and removal could result in noise that disturbs listed bird species in the action area. The significance of acoustic disturbance will depend on many factors such as the magnitude and duration of the sound, proximity of birds and their habitats to sound sources, the level (and nature) of background ambient sound, and the ability of birds to habituate to new noise. The primary impact would be on bird behavior. Underwater sounds could disturb foraging behavior or disturb prey that diving birds forage on, or result in auditory and non-auditory injury (Science Applications International Corporation 2011). This may be an indirect effect, but an impact that occurs concurrently with the project activities.

Table 6. Modeled Distance to Injury for Unattenuated and Attenuated Impact Pile Driving Using 100 Strikes with an Impact Hammer

Piling Type	Attenuated with Bubble Curtain (Y/N)	Strike Peak (dB) at 10 m	Strike SEL (dB) at 10 m	Cumulative SEL (dB) at 10 m	Distance (m) to Onset of Physical Injury		
					Peak (206 dB)	Cumulative SEL dB: Fish ≥ 2 g (187 dB)	Cumulative SEL dB: Fish < 2 g (183 dB)
16-in timber	N	184	145	165*	0.3	0.3	0.6
16-in timber	Y	179	140	160*	0.2	0.2	0.3
14-in pipe	N	199	169	189	3.4	13.6	25.1
14-in pipe	Y	194	164	184	1.6	6.3	11.7

Note: Actual measured sounds levels are expected to vary by an unknown degree from those estimated in the National Marine Fisheries Service calculator. dB = decibels; SEL = sound exposure level; m = meters; g =grams.

* See description above of "effective quiet" (150 dB): as single strike SEL for 16-in timber piles is estimated at 145 dB, it is assumed that these pile strikes will not accumulate to cause injury.

Table 7. Modeled Distance to Injury for Unattenuated and Attenuated Impact Pile Driving Using 425 Strikes on 16-in and 14-in Steel Pilings

Piling Type	Attenuated with Bubble Curtain (Y/N)	Strike Peak (dB) at 10 m	Strike SEL (dB) at 10 m	Cumulative SEL (dB) at 10 m	Distance (m) to Onset of Physical Injury		
					Peak (206 dB)	Cumulative SEL dB	
						Fish ≥ 2 g (187 dB)	Fish < 2 g (183 dB)
16-in timber	N	184	145	171*	0.3	0.9	1.7
16-in timber	Y	179	140	166*	0.2	0.4	0.8
14-in pipe	N	199	169	195	3.4	35.7	65.9
14-in pipe	Y	194	164	190	1.6	16.6	30.6

Note: Actual measured sounds levels are expected to vary by an unknown degree from those estimated in the National Marine Fisheries Service calculator. dB = decibels; SEL = sound exposure level; m = meters; g = grams.

* See description above of "effective quiet" (150 dB): as single strike SEL for 16-in timber piles is estimated at 145 dB, it is assumed that these pile strikes will not accumulate to cause injury.

There is not a clear threshold of underwater sound level that will result in behavioral effects for most bird species and the threshold for sounds from various activities may vary among species. For marbled murrelets, guidelines for a threshold for underwater sound (from activities such as pile driving) that results in behavioral effects such as flushing and avoidance is 150 dB root-mean-square pressure (USFWS 2014), and for auditory injury is 202 dB sound exposure level (Science Applications International Corporation 2011).

Noise reduction mitigation (i.e., cushion blocks and bubble curtains) will be implemented if an impact hammer is used during any in-water pile driving work. In addition, hydroacoustic monitoring will occur any time that an impact hammer is used. Impact hammer operations will be shut down if the cumulative SEL reaches 186.5 dB at 10 m from the piling, which is below the sound threshold for fish that weigh ≥2 g, and below auditory injury thresholds for marbles murrelets. The Terminal improvements will occur between July 1 and October 15, when adult and juvenile salmonids are not likely to be in the area. **Therefore, pile driving and removal activities may affect, but are not likely to adversely affect listed fish and bird species**.

Vibratory hammer noise levels generated by removal of wooden pilings are not anticipated to result in injury to fish or birds, but the activity could still result in individuals moving out of the area. Movement away from, or out of, the work area does not rise to the level that there is a likelihood of injury due to disruption of normal behavioral patterns. Any individual salmonids, green sturgeon, or marbled murrelets can resume normal behavioral patterns once out of the annoying range of sound generation. The Terminal improvements will occur between July 1 and October 15, when adult and juvenile salmonids are not likely to be in the area. **Therefore, noise generated by piling removal may affect, but is not likely to adversely affect listed fish and bird species**.

Current NMFS practice regarding exposure of marine mammals to high-level sounds is that mid-frequency cetaceans and pinnipeds exposed to impulsive sounds of 185 SEL or above, have the potential to be injured (i.e., Level A harassment; NMFS 2023b). NMFS (2023b) considers the potential for behavioral (Level B) harassment to occur when marine mammals are exposed to sounds below injury thresholds but at or above 160 dB Root-Mean-Square (RMS) threshold for impulse sounds (e.g., impact pile driving) and 120 dB RMS threshold for continuous noise (e.g., vibratory pile driving).

Figure 6. Injury Zones for Fish Weighing ≥ 2g, 14-Inch Pilings

6.1.2 Suspended Sediment and Water Quality

Elevated suspended sediment concentrations (SSCs) in Humboldt Bay are a relatively frequent occurrence. SSC levels can naturally increase due to wave action on shallow mudflats, storm runoff being delivered from local tributaries, and turbid water from the Eel River entering on incoming tides. It is common for SSC in Humboldt Bay to range from 40 to 100 mg/L or more during the year (Swanson et al. 2012). Spikes in turbidity usually begin to occur in September or October with the onset of the wet season, and peak between December and February (Swanson et al. 2012). However, higher peaks of turbidity in the nearshore, ranging from 50 to 250 nephelometric turbidity units, have been generated during precipitation-related events between March and May (Center for Integrative Coastal Observation, Research and Education 2005, as cited in U.S. Army Corps of Engineers 2021).

Installation and removal of piles will result in increased turbidity and the production of suspended sediment. Excessive SSCs could have a deleterious effect on listed fish species; increased turbidity and suspension of fine sediment reduces dissolved oxygen levels, decreases visibility for foraging, and impairs oxygen exchange by clogging gills. The highest concentrations of suspended sediment will be generated by pile driving, since this activity will take place entirely in the water.

Sediment suspended during pile removal and driving, depending on sediment type, can be dispersed by currents and the resulting turbid plumes may last for hours to days. Effects of elevated SSC on fish is a function of duration and concentration (Newcombe and Jensen 1996). Generally, the higher the concentration, the less time it takes for an effect to be felt by the receptor species. It is estimated that installation of the five 16-in causeway piles and two 14-in guide piles will take a maximum of seven 10-hour working days, with each pile taking one day each, in a worst-case scenario. There will be tidal flushing of the action area before, between, and after each piling is driven. Therefore, it can be assumed that elevated pile driving-related SSC will occur on seven separate occasions and last one day each—a very short duration. In addition, SSC levels will be higher close to the individual piles and rapidly disperse into the bay once the tide begins to ebb or flood, which will significantly reduce the concentration.

There are no available data on how suspended sediment may be generated by driving and pulling pilings. However, the first responses of salmonids and other fish to elevated levels of suspended sediment are alarm, abandonment of cover, and avoidance (Newcombe and Jensen 1996). These anticipated short-term, indirect effects of pile removal and driving on water quality are manageable by employing work windows. The establishment of the work window (July 1 to October 15) and the low likelihood of the occurrence of salmonids during this time makes it highly unlikely that there will be any exposure of these species to elevated suspended sediment levels. In addition, the noise and vibration from pile driving is expected to result in fish leaving the area of disturbance. **Therefore, suspended sediment generated by installing and removing pilings may affect, but is not likely to adversely affect listed fish species**.

Water quality effects from this pile driving and removal are short-term. Water quality effects can also be direct: water quality can be degraded by unintentional spills or contaminants from the sediment, or vessels and other project components, and contaminants can result in death, particularly to vulnerable life stages (e.g., larvae, eggs). Longer-term effects on water quality may be beneficial because demolition will remove creosote treated pilings.

6.2 Effects on Listed Species and Designated Critical Habitat

The effect of the project on the ESA-listed species' critical habitat is based on the constituent elements required to support one or more life history stage(s). Constituent elements are "those physical or biological features that are essential to the conservation of a given species" (NMFS 2005b). For estuarine areas, the conservation function of critical habitat must support the foraging, growth and maturity of juveniles and adults, including forage-related aquatic invertebrates and fishes. These features (among the other constituent elements) are essential to conservation value. Without them juveniles cannot reach the ocean in a timely manner and use the variety of habitat that allow them to avoid predators, compete successfully, and complete the behavioral and physiological changes needed for life in the ocean.

6.2.1 Birds

In-water and above-water construction could result in noise that disturbs special status and protected birds in the project area. The significance of acoustic disturbance will depend on many factors such as the type, magnitude and duration of sound, proximity of birds and their habitats to sound sources, and the levels (and nature) of background ambient sound, and the ability of birds to habituate to new noise.

6.2.1.1 Marbled Murrelet

There is no suitable habitat for marbled murrelets within the action area. Marbled murrelets, however, may fly over the action area at twilight and just before dawn as they migrate from their nest location to forage in the open ocean and back. The proposed action does not preclude night-time work, but any lighting that would be temporarily installed will be directed downward and away from off-site areas. The Chevron Terminal and tank farm is an industrial site and is already well lit. Any marbled murrelets that fly over the site would already be habituated to the existing lighting. They currently forage in regions that have significant existing boat traffic and have likely also become accustomed to additional noise from vessel use. **Therefore, the proposed action may affect, but is not likely to adversely affect marbled murrelets**.

Critical Habitat—Designated critical habitat for the marbled murrelet is located 9.7 km (6 mi) inland from the project area. **Therefore, the proposed action will have no effect on designated critical habitat for this species**.

6.2.1.2 Western Snowy Plover

Western snowy plovers are not likely to be present in the action area, but they may be present along the shoreline of Humboldt Bay near the action area. The proposed action includes activities that could degrade water quality in Humboldt Bay, which could in turn impact western snowy plover. Degraded water quality could result from increased turbidity from disturbance of sediment, hydrocarbon (e.g., gasoline, diesel, lubrication oil, hydraulic fluid, etc.) releases from heavy equipment, or sediment delivery from stockpile areas. This may result in disturbance of essential behaviors or physiological impairment. Implementation of the following measures, which are included in the proposed action, will minimize the risk of impacts on individuals, if present nearby: 1) conformance to Chevron's spill prevention and response plan, 2) conducting all heavy equipment maintenance and refueling in designated locations away from the work areas, and 3) immediate clean-up of any hydraulic leaks or spills. **Therefore, the proposed action may affect, but is not likely to adversely affect western snowy plovers in the short- and long-term**.

Critical Habitat—Designated critical habitat for western snowy plovers is located about 4 km (2.5 mi) west of the proposed project area on the South Spit (land south of the harbor entrance). **Therefore, the proposed action will have no effect on designated critical habitat for this species.**

6.2.2 Fish

A number of listed fish species have the potential to be in the action area and would potentially experience impacts during proposed project activities. These species include SONCC coho salmon, CC Chinook salmon, NC steelhead, green sturgeon (sDPS), eulachon, and tidewater goby. All salmonid species have a moderate to high likelihood to be present in the action area during the fall, winter, and spring seasons due to its proximity to deeper water habitat in Humboldt Bay. However, there is a low potential for salmonids to be present in the action area during implementation of the proposed action, because the July 1 to October 15 work window was established to allow operations to occur during the time period when salmonids would be more likely to be in the ocean rather than in the bay.

Potential impacts on these species could include injury or mortality of individuals due to installation or removal of pilings. In addition, short-term degradation of water quality could result from construction activities. Degraded water quality may result from increased turbidity from disturbance of sediment or from accidental spills or leakage from machinery during near or in-water construction activities. This may result in localized disturbance of juveniles and adults, potentially resulting in stress, disruption of essential behaviors, or physiological impairment.

6.2.2.1 SONCC Coho Salmon

Steel pipe and timber piles will be driven into the bay substrate as part of the proposed action. The contractor will employ vibratory pile driving to install the pilings, but will use an impact hammer if the pilings meet refusal prior to achieving the tip elevation. Pile driving may adversely affect any coho salmon that may be in the action area. However, there is a low potential for coho salmon smolts or adults to be present within the action area during implementation of the proposed action, because the July 1 to October 15 work window was established to allow operations to occur during the time period when juvenile and adult coho salmon would likely be in the ocean and not the bay.

As stated above in Section 6.1.1, the peak and accumulated SEL are not likely to exceed injury threshold levels if a vibratory hammer is used to place and pull the piles. An impact hammer will be used to set any individual piling that refuses to achieve designed tip elevation. In the case that an impact hammer is used, a bubble curtain will be used to reduce noise levels to below the FHWG (2008) injury threshold levels. Although pile driving noise levels will potentially exceed threshold levels under a worst-case scenario, resulting in injury to fish, SONCC coho salmon are not expected to be present in the action area during the proposed work window. The activity could nonetheless result in individual fish moving out of the area. However, this movement away from the pile driving area would not constitute harassment, which is a form of take. The reason for this is that the movement out of the area, especially in Humboldt Bay where there are wide expanses of suitable habitat, does not rise to the level that there is a likelihood of injury due to disruption of normal behavioral patterns. Therefore, the noise generated during construction is not likely to result in adverse effects on adult coho salmon that may be moving through the work area on their way to staging outside of their spawning streams. Impacts on coho smolts are not expected because these fish would likely already be residing in the ocean at that time. **Noise generated by pile driving and pulling may affect, but is not likely to adversely affect SONCC coho salmon**.

It is expected that any coho salmon within the action area would avoid the area around pile driving activities due to the level of general disturbance caused by the construction activities and pile driving noise. The very short duration of pile driving activities and rapid dispersal of turbid water would further reduce the potential for any suspended sediment-related effects on coho salmon. The in-water operations period (July 1 to October 15) was established to avoid the periods when coho salmon are more likely to be present. **Therefore, suspended sediment generated by driving and pulling piles may affect, but is not likely to adversely affect listed SONCC coho salmon**.

The Chevron Terminal has an oil spill response plan and is fully equipped to handle any accidental discharge of fuel or other hydrocarbons from heavy equipment or dismantled pipelines. Staff from Chevron, U.S. Coast Guard, CDFW, and the Marine Spill Response Team successfully conducted a response test of equipment available on the site on 23 March 2016; this test included marine deployment of oil booms. If a discharge event does occur, Chevron will immediately implement their Facility Response Plan, activate the Incident Command System, refer to the Coast Guard Dock Operation Manual, and enact Spill Prevention, Control, and Countermeasure. **Therefore, accidental hydrocarbon contamination resulting from the proposed action may affect, but is not likely to adversely listed SONCC coho salmon.**

Critical Habitat—The PBF of SONCC coho salmon critical habitat with the action area is limited to the estuarine area with: 1) water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh and saltwater; 2) natural cover such as submerged and overhanging large wood and aquatic vegetation; and 3) juvenile and adult prey, including aquatic invertebrates and fishes, supporting growth and maturation (NMFS 2005b). The essential features that may be affected by the proposed action's pile driving and removal activities include water quality, natural cover in the form of aquatic vegetation, and juvenile prey.

The proposed action includes activities that could degrade the essential feature of water quality. Degraded water quality could result from increased turbidity from disturbance of sediment during pile driving or pulling or hydrocarbon (e.g., gasoline, diesel, lube oil, hydraulic fluid, etc.) spills from equipment. Implementation of the following measures, which are included in the proposed action, will minimize the risk of impacts on individuals, if present nearby. These measures include: 1) institution of an operational work window that limits in-water operations to the late summer and early fall when listed species are unlikely to be present, 2) implementation of a spill response plan and placement of spill kits on site, 3) ensuring that all heavy equipment that works within the action area will be free of fluid leaks, and 4) immediate clean-up of any hydraulic leaks or spills.

The proposed action will result in the temporary reduction of cover/shelter and food resources within the action area due to the placement of five new 16-in and two new 14-in pilings (totaling 9.12 ft^2 [0.86 m^2]). The removal of five 14-in creosote-treated wooden piles and three 14.5-in concrete piles (8.79 ft^2 [0.83 m^2]) currently located within the same area will partially offset the losses associated with installation of new pilings. Additionally, to mitigate permanent losses to eelgrass habitat, Chevron will remove 16.36 ft^2 (1.52 m^2) of piles at another location in Humboldt Bay (within Eureka City limits; H. T. Harvey & Associates 2025), further benefitting salmonid habitat. This temporary loss of food resources will be minimal given the small construction footprint and availability of resources in the surrounding area.

It is uncertain exactly how many spud placements will occur during barge operations and the number of repeated spud replacements that will occupy previous holes. Therefore, an assessment of the affected eelgrass area will occur immediately after pile driving and removal in the trestle area. The affected eelgrass area will be calculated and be used to inform follow-up mitigation efforts, if any. More information on the effects of the proposed action on eelgrass and monitoring and mitigation efforts can be found in a separate analysis (H. T. Harvey & Associates 2025).

Due to the uncertainty of exactly how much eelgrass will be impacted by the project, Chevron will conduct monitoring of eelgrass before, during, and after operations. A similar operation in 2015, at the same site, reported that the effects of pile driving and barge spud placement were temporary and the eelgrass recovered relatively quickly. It is expected that similar recovery will occur with this operation. Similarly, it was reported that propeller wash from the boat used to position the barge in 2015 did not result in any apparent loss of eelgrass turions (H. T. Harvey & Associates 2016). In any event, effects on eelgrass cover are expected to be minor. **Therefore, pile driving and removal activities are not likely to adversely affect or result in the adverse modification of the cover and juvenile and adult prey PBF of critical habitat**.

The Chevron Terminal has an oil spill response plan and is fully equipped to handle any accidental discharge of fuel or other hydrocarbons from heavy equipment or dismantled pipelines. Chevron also has an active Spill Prevention Response Plan on site. If a discharge event does occur Chevron will immediately call the proper regulatory authorities and implement corrective measures as per its response plan. **Therefore, accidental hydrocarbon contamination resulting from the proposed action is not likely to adversely affect or result in the adverse modification of water quality PBF in the long-term**.

Removal of the wooden pilings will result in a beneficial effect on the PBF of sediment and water quality. Many of these pilings were treated with creosote, which has a tendency to leach polycyclic aromatic hydrocarbons into the surrounding substrate and water. The pulling of these treated pilings will remove this source from the bay. **Therefore, the proposed action will have a beneficial effect on sediment and water quality PBF in the long-term**.

6.2.2.2 CC Chinook Salmon

There is a low potential for adult and juvenile CC Chinook salmon to be present in the action area during implementation of the proposed action. This is because the July 1 to October 15 work window was established to allow operations to occur during the time period when juvenile and adult Chinook salmon would be more likely to be in the ocean rather than in the bay.

The effects of the proposed action on Chinook salmon are the same as those described for coho salmon in Section 6.2.2.1. Therefore, the conclusion regarding the level of impacts on Chinook salmon is also the same. **The noise and suspended sediment generated by the proposed action may affect, but is not likely to adversely affect CC Chinook salmon**. **Similarly, accidental hydrocarbon contamination resulting from the proposed action may affect, but is not likely to adversely affect listed CC Chinook salmon**.

Critical Habitat—The PBF of CC Chinook salmon critical habitat within the action area is limited to the estuarine area with: 1) water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh and saltwater; 2) natural cover such as submerged and overhanging large wood and aquatic vegetation; and 3) juvenile and adult prey, including aquatic invertebrates and fishes, supporting growth and maturation (NMFS 2005b). The essential features that may be affected by the proposed action's pile driving and removal activities include water quality, natural cover in the form of aquatic vegetation, and juvenile prey.

The effects of the proposed action on designated habitat for CC Chinook salmon are the same as those described for coho salmon in Section 6.2.2.1. Therefore, the conclusion regarding the level of impacts on designated critical habitat for Chinook salmon is also the same. **Pile driving and removal activities are not likely to adversely affect or result in the adverse modification of the cover and juvenile and adult prey PBF of critical habitat. The noise and suspended sediment generated by the proposed action are not likely to adversely affect or result in the adverse modification of the water quality, cover, and juvenile and adult prey PBF for CC Chinook salmon. Similarly, accidental hydrocarbon contamination**

resulting from the proposed action is not likely to adversely affect or result in the adverse modification of the water quality PBF in the long-term.

Removal of the wooden pilings will result in a beneficial effect on the PBF of sediment and water quality, as described for coho salmon in Section 6.2.2.1. **Therefore, the proposed action will have a beneficial effect on sediment and water quality PBF in the long-term**.

6.2.2.3 Northern California Steelhead

There is a low potential for adult and juvenile NC steelhead to be present in the action area during implementation of the proposed action. This is because the July 1 to October 15 work window was established to allow operations to occur during the time period when juvenile and adult steelhead would be more likely to be in the ocean than in the bay.

The effects of the proposed action on steelhead are the same as those described for coho and Chinook salmon in Sections 6.2.2.1 and 6.2.2.2. Therefore, the conclusion regarding the level of impacts on steelhead is also the same. **The noise and suspended sediment generated by the proposed action may affect, but is not likely to adversely affect NC steelhead**. **Similarly, accidental hydrocarbon contamination resulting from the proposed action may affect, but is not likely to adversely listed NC steelhead**.

Critical Habitat—The PBF of NC steelhead critical habitat within the action area is limited to the estuarine area with: 1) water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh and saltwater; 2) natural cover such as submerged and overhanging large wood and aquatic vegetation; and 3) juvenile and adult prey, including aquatic invertebrates and fishes, supporting growth and maturation (NMFS 2005b). The essential features that may be affected by the proposed action's pile driving and removal activities include water quality, natural cover in the form of aquatic vegetation, and juvenile prey.

The effects of the proposed action on designated habitat for NC steelhead are the same as those described for coho and Chinook salmon in Sections 6.2.2.1 and 6.2.2.2. Therefore, the conclusion regarding the level of impacts on steelhead critical habitat is also the same. **Pile driving and removal activities are not likely to adversely affect or result in the adverse modification of the cover and juvenile and adult prey PBF of critical habitat. The noise and suspended sediment generated by the proposed action are not likely to adversely affect or result in the adverse modification of the water quality, cover, and juvenile and adult prey PBF for NC steelhead. Similarly, accidental hydrocarbon contamination resulting from the proposed action is not likely to adversely affect or result in the adverse modification of the water quality PBF in the long-term**.

Removal of the timber pilings will result in a beneficial effect on the PBF of sediment and water quality, as described for coho and Chinook salmon in Sections 6.2.2.1 and 6.2.2.2. **Therefore, the proposed action will have a beneficial effect on sediment and water quality PBF in the long-term**.

6.2.2.4 sDPS Green Sturgeon

Adult sDPS green sturgeon inhabit estuaries and coastal areas along the West Coast during the summer and fall months (Moser and Lindley 2007). Larval and juvenile sDPS green sturgeon rear in their natal streams within the Central Valley and do not inhabit Humboldt Bay.

The effects of the proposed action on green sturgeon are generally the same as those described for coho and Chinook salmon and NC steelhead in Sections 6.2.2.1, 6.2.2.2, and 6.2.2.3. However, although not well-documented, green sturgeon may be present in the action area during the July 1 – October 15 work window. Applicable BMPs will be implemented to minimize adverse acoustic effects, including the use of a "soft start" to deter any fish away from the piles being driven. Any movement away from the pile driving area would not constitute harassment, as this movement does not rise to the level that there is a likelihood of injury caused by disruption of normal behavioral patterns, due to wide expanses of suitable habitat. **The noise and suspended sediment generated by the proposed action may affect, but is not likely to adversely affect sDPS green sturgeon**. **Similarly, accidental hydrocarbon contamination resulting from the proposed action may affect, but is not likely to adversely listed sDPS green sturgeon**.

Critical Habitat—The action area is located with designated critical habitat for sDPS green sturgeon. The effects of the proposed action's activities on designated green sturgeon critical habitat are limited to pile driving and removal activities' effects on the PBFs of food resources and sediment and water quality.

The proposed action will result in the loss of food resources that would exist within the new 5 pilings' footprint. However, this loss is considered temporary due to the removal of 5 timber piles and the eventual establishment of food resources in those locations. Any temporary loss of benthic prey and redistribution within Humboldt Bay is not likely to impact their population long-term. **Therefore, the proposed action is not likely to adversely affect or result in the adverse modification of the food resources PBF of designated critical habitat for sDPS green sturgeon**.

The effects of the proposed action on the water quality and cover PBF for sDPS green sturgeon are the same as those described for coho and Chinook salmon and NC steelhead in Sections 6.2.2.1, 6.2.2.2, and 6.2.2.3. The impact on the total amount of habitat space for green sturgeon will be very small, if any, and insignificant; a much larger area of the surrounding bay will remain undisturbed. Therefore, the conclusion regarding the level of impacts on green sturgeon critical habitat is also the same. **Pile driving and removal activities are not likely to adversely affect or result in the adverse modification of the cover PBF of critical habitat. The noise and suspended sediment generated by the proposed action are not likely to adversely affect or result in the adverse modification of the water quality and cover PBF for sDPS green sturgeon. Similarly, accidental hydrocarbon contamination resulting from the proposed action is not likely to adversely affect or result in the adverse modification of the water quality PBF in the long-term**.

Removal of the wooden piles will result in a beneficial effect on the PBF of sediment and water quality, as described for coho and Chinook salmon and NC steelhead in Sections 6.2.2.1, 6.2.2.2, and 6.2.2.3. **Therefore, the proposed action will have a beneficial effect on sediment and water quality PBF in the long-term**.

6.2.2.5 Eulachon

Eulachon are anadromous and spend the majority of their lives in the ocean, returning back to coastal freshwater streams to spawn and die. In California, this spawning migration starts as early as December and peaks in March and April, so adults are likely upstream by the time of the project work window (July 1–October 15; California Department of Fish and Game 2008). Humboldt Bay is just south of the known distribution of eulachon, so their presence in the action area is unlikely. **Therefore, noise and suspended sediment generated by pile removal and driving should not affect listed eulachon**.

Critical Habitat—Designated critical habitat for eulachon is located about 16.5 km (10.25 mi) north of the proposed Project area along the Mad River. **Therefore, the proposed action will have no effect on designated critical habitat for this species**.

6.2.2.6 Tidewater Goby

While tidewater goby have been observed adjacent to the action area up Elk River, they are generally restricted to the upper sloughs and high marsh areas of Humboldt Bay. They prefer shallow, low salinity habitats with minimal tidal flow, and thus are unlikely to be present near the Project site nor impacted from Project activities. **Therefore, noise and suspended sediment generate by pile removal and driving is not likely to affect listed tidewater goby.**

Critical Habitat—Designated critical habitat for tidewater goby is located in the Elk River Wildlife Area, approximately 3.4 km (2.1 mi) south (upstream Elk River) of the action area. **Therefore, the proposed action will have no effect on designated critical habitat for this species.**

6.2.3 Invertebrates

6.2.3.1 Sunflower Sea Star

Although sunflower sea star presence is possible within the action area because of their generalist behavior and use of embayments, their preferred habitat type is rocky substrates that primarily occur near the mouth of Humboldt Bay. Sunflower sea stars have not been documented in the intertidal zone in California since before the onset of SSWS and are unlikely to be found along the shore within the action area. Sea stars lack a sensory system that detects changes in sound pressure. Although no equivalent information is available for the response of sea stars, increases in SSCs have previously been linked to decreased oxygen consumption rates in fish (Hess et al. 2017). However, suspended sediment effects resulting from the proposed action are expected to be very short term. **Therefore, noise and suspended sediments generated by pile removal and driving is not likely to have an adverse effect on the sunflower sea star**.

Critical Habitat—The sunflower sea star was proposed for listing as a threatened species under the ESA on March 16, 2023 and may potentially be listed as threatened within the timeline of the proposed project; however, currently no critical habitat for the species has been designated.

6.3 Effects on EFH

This section reviews the potential impacts of the project on EFH. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). For this EFH effects analysis, the ways Terminal repairs and upgrades would impact the waters and substrate necessary for the full lifecycle of a species are considered. The information in this section includes content that can support EFH consultation, where formal impact determinations and assessments will be made. The action area contains EFH as designated under the Pacific Coast Groundfish, Coastal Pelagic, and Pacific Coast Salmon FMPs. The potential impacts of construction, habitat change, and permitted operations on EFH may result from construction itself.

6.3.1 Pacific Coast Salmon

EFH for Pacific salmon in the action area includes nearshore and tidal submerged environments within state territorial waters that are necessary for the feeding or growth to maturity for juvenile coho salmon and Chinook salmon. The potential effects of the proposed action on Pacific Coast Salmon EFH would be similar to those described for designated critical habitat.

The proposed action includes activities that could result in the minor and temporary loss of natural cover (submerged vegetation) and juvenile forage and degrade water quality within the action area due to pile driving and generation of suspended sediment. Any loss of prey from the Terminal improvements is unlikely to represent a significant loss of food resources because juvenile salmon are more dependent on coastal waters for energetic gains that are essential to their survival, and suspended sediment is likely to be very localized and temporary. Their reliance on marine waters for growth is evident by the fact that juvenile steelhead move quickly from coastal marine waters to water further offshore (Daly et al. 2009, MacFarlane 2010). The removal of creosote-treated piles will remove a source of contamination from the action area, resulting in long-term benefits to food resources and water quality in the vicinity of the Project. However, a number of mitigation measures will be implemented to minimize impacts on EFH. These include conducting pile driving in a manner that minimizes impacts on eelgrass, removal of creosote-treated pilings, and implementation of a spill prevention and clean-up plan. Chevon will conduct a post-project eelgrass assessment and implement mitigation measures, as necessary, to mitigate the minor impacts on natural cover (H. T. Harvey & Associates 2025). BMPs implemented to minimize construction-related effects should facilitate no loss of cover or forage, and the removal of creosote-treated piles will remove a source of contamination from the action area, resulting in long-term benefits to food resources and water quality in the vicinity of the Project. Further, work will be performed during the July 1 – October 15 work window, during which time salmon are unlikely to be present and affected by short-term impacts. However, Project activities could temporarily impact water quality and benthic habitat. **Therefore, the proposed action may adversely affect Pacific Coast Salmon EFH in the short term**.

6.3.2 Pacific Coast Groundfish

EFH for groundfish in the action area includes nearshore and tidal submerged environments within state territorial waters that are necessary for their spawning, feeding, or growth to maturity. The potential effects of the proposed action on Pacific Coast Groundfish EFH would be similar to those described for Pacific Coast Salmon EFH.

The proposed action includes activities that could result in the minor and temporary loss of natural cover (submerged vegetation) and juvenile forage habitat and degrade water quality within the action area due to pile driving and generation of suspended sediment. However, a number of mitigation measures will be implemented to minimize impacts on EFH, as described for Pacific coast salmon in Section 6.3.1. BMPs implemented to minimize construction-related effects should facilitate no loss of cover or forage, and the removal of creosote-treated piles will remove a source of contamination from the action area, resulting in long-term benefits to food resources and water quality in the vicinity of the Project. However, Project activities could temporarily impact water quality and benthic habitat. **Therefore, the proposed action may adversely affect Pacific Coast Groundfish EFH in the short term**.

6.3.3 Coastal Pelagic Species

EFH for the species/species groups managed under the coastal pelagic FMP that are potentially present in Humboldt Bay, which include anchovies and Pacific and jack mackerel, could be expected to be affected by the proposed project. That said, any impacts on coastal pelagic species EFH would not necessarily have a measurable effect because these species do not necessarily rely on Humboldt Bay as primary habitat for spawning, breeding, feeding, or growth to maturity. Species/species groups managed under coastal pelagic FMP are more reliant on coastal waters outside of estuaries. Construction activities have potential to result in increased turbidity and result in a loss of habitat. Pile removal in particular may also result in removal of demersal and pelagic prey, although recolonization long-term is likely. BMPs implemented to minimize construction-related effects should facilitate no loss of forage, and the removal of creosote-treated piles will remove a source of contamination from the action area, which could improve habitat conditions and water quality inside Humboldt Bay long-term. However, Project activities could temporarily impact water quality. **Therefore, the proposed action may adversely affect Coastal Pelagic Species EFH in the short term**.

Pacific herring are classified as an ECS in the coastal pelagic FMP. Construction activities are unlikely to affect Pacific herring as they spawn in the bay typically December through February, well after the project work has occurred. Although they deposit their eggs on eelgrass blades, long-term impacts to Pacific herring spawning is not expected, as eelgrass mitigation will address any potential loss of eelgrass from the project (H. T. Harvey & Associates 2025). **The proposed action will therefore result in no net loss of Pacific herring spawning habitat and will not impact Pacific herring spawning**.

6.3.4 HAPC

Eelgrass is an HAPC that provides substrate (specifically bottom structures) necessary for the survival of various organisms. It is ecologically important nursery, foraging, and spawning habitat that is sensitive to disturbance and does not easily recolonize.

There are two spuds on the conventional barge that will be used to stabilize the barge during trestle construction operations. Each spud is 2.3 ft in diameter or 4.3 ft^2 in area. Under the worst-case scenario, the barge will be able to drive one piling from each of the 5 barge placements in the eelgrass bed. It is expected that the barge will need to be moved into position 5 times during pile driving, 2 times for beam installation, 4 times for pile bracing replacement, and 5 times for timber piling removal. Therefore, a total of 16 barge trips over the eelgrass area is anticipated in order to complete the trestle construction operations. The barge will need to set two spuds for stability while working. Given the above information, it is expected that 68.8 ft^2 of eelgrass may be temporarily affected during barge operations. However, given that Humboldt Bay contains 3,614 acres of continuous eelgrass beds and an additional 2,031 acres of patchy eelgrass beds (Schlosser and Eicher 2012), the amount of eelgrass that may be affected by the proposed action is minor.

Estuaries (including Humboldt Bay) are similarly considered an HAPC (PFMC 2020). This designation for estuaries is based on the importance of highly productive shallow waters within estuaries to salmon, groundfish, coastal pelagic species, and their prey. Construction may result in short-term impacts on water quality from increased turbidity, but long-term impacts may not be significant due to tidal flushing. The potentially significant impacts from the proposed project on the estuary will be minimized through BMPs and appropriate minimization measures, which are described in Section 3.1.

Section 7.0 Cumulative Effects

Cumulative effects are defined by FESA regulations as "those effects of future State or private activities, not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation." Future federal actions that are unrelated to the proposed action will require separate consultation pursuant to Section 7 of the FESA. For example, any projects necessitating Clean Water Act permits from the U.S. Army Corps of Engineers will have a federal nexus under Section 7, and thus most projects potentially impacting fish or EFH will undergo Section 7 consultation. If the proposed action has been determined to result in no effect on, or is not likely to adversely affect a species, then future projects would not contribute to any cumulative effects and are thus not discussed in this section.

There are no other projects near the action area that meets the cumulative effects criteria defined above.

The proposed project may affect but is not likely to adversely affect ESA-listed species and designated critical habitat, and may adversely affect EFH as described above. These effects are offset through compensatory eelgrass mitigation and pile removal that will provide a new benefit to these species (see H. T. Harvey & Associates 2025), and BMPs to avoid and minimize impacts. As a result, the project will adequately mitigate its contribution to cumulative adverse effects on the species covered in this BA/EFHA.

Section 8.0 Conclusion

Based on the above analysis, implementation of the proposed project **may affect, and is not likely to adversely affect** listed bird, fish, or invertebrate species in the action area. The project **may affect, and is not likely to adversely affect designated critical habitat.** While potentially adverse effects exist, including increased underwater noise and sediment suspension, such impacts are short-term and **insignificant or discountable**. There are also beneficial effects of the proposed project that are incorporated through mitigation and restoration efforts. These beneficial long-term effects include improving water quality through removal of toxic creosote-treated piles. Any potential long-term effects of the project on critical habitat are also beneficial. Despite these long-term benefits, the proposed Project **may adversely affect EFH in the short term**.

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