6.0 AQUATIC RESOURCES

This chapter describes existing aquatic resources present in the vicinity of the proposed project, including native and nonnative aquatic habitats, special-status communities, managed fishery species, and special-status plant and animal species, and analyzes the effects to these resources that may occur with the implementation of the proposed project.

For the purposes of this chapter, an aquatic resource is defined as a species that is an obligate user of aquatic or marsh habitats, or that uses aquatic or marsh habitat during migration. However, some species that utilize aquatic habitats such as California red-legged frog (*Rana draytonii*) and Western pond turtle (*Emys marmorata*) were considered more likely to be impacted by construction and operation of the storage terminal and the tie in to the existing KLM Pipeline. Impacts to those species are analyzed in Chapter 7.0: Terrestrial Biology.

Based on the expected scale and geographic location of potential impacts, three study areas were defined for this analysis (see Figure 6-1: Aquatic Resource Study Areas):

1. a regional study area with emphasis on Suisun Bay, which includes waters of the San Francisco Bay (Bay) and the Sacramento-San Joaquin River Delta (Delta);

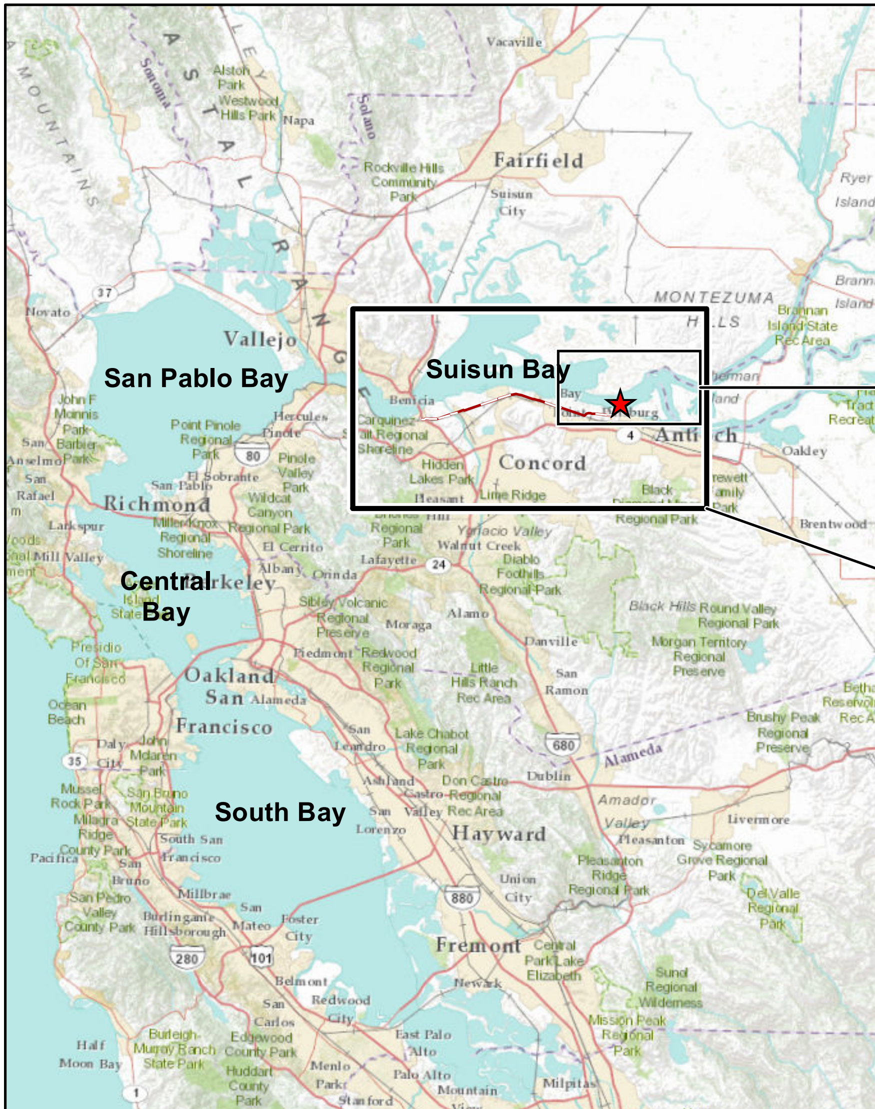
2. the marine terminal study area, which includes both the site of the marine terminal and the area known as the Lower Estuarine River region, which encompasses the waters between Honker Bay in Suisun Bay upstream to Collinsville on the Sacramento River; and

3. a San Pablo Bay Pipeline study corridor, which encompasses at a minimum the area within 1,500 feet of the existing right-of-way and extends to include all wetlands, waterbodies, and the lower reaches of all streams that are contiguous with those located within the 1,500-foot buffer.

More than 500 plant and animal species are found in the San Francisco Bay region. This impact assessment is limited to a subset of species that support commercial or sport fisheries, or that are considered rare or endangered pursuant to California Environmental Quality Act Section 15380. The species specifically addressed in this assessment are listed in Table 6.1. This list includes species associated with the marine habitats of the Lower Estuarine River and the wetland and marsh habitats that form the southern boundary of Suisun Bay. More detailed information concerning the marine habitats and communities in other regions of the San Francisco Bay can be found in Appendix E: Regional Biological Resource Impacts. Additional related discussion is presented in Chapter 7.0: Terrestrial Resources and Chapter 17.0: Water Resources.

Guidelines and key sources of data used in the preparation of this chapter include the following:

- *Report on the Subtidal Habitats and Associated Biological Taxa in San Francisco Bay* (NOAA, 2007)
- *Baylands Ecosystem Species and Community Profiles: Life histories and environmental requirements of key plants, fish and wildlife* (Goals Project, 2000)
- *State of the Bay 2011* (SFEP, 2011)
- *Pelagic Organism Decline Work Plan and Synthesis of Results* (IEP, 2010)
- *Framework for Assessment of Potential Effects of Dredging on Sensitive Fish Species in San Francisco Bay* (Levine-Fricke, 2004)
- *Non-Fishing Impacts to Essential Fish Habitat and Recommended Conservation Measures* (NMFS, 2004)
- *Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish* (ICF Jones & Stokes, 2009)
- *Special-Status Plant Survey Report for the WesPac Pittsburg Energy Infrastructure Project* (TRC Solutions, 2012)

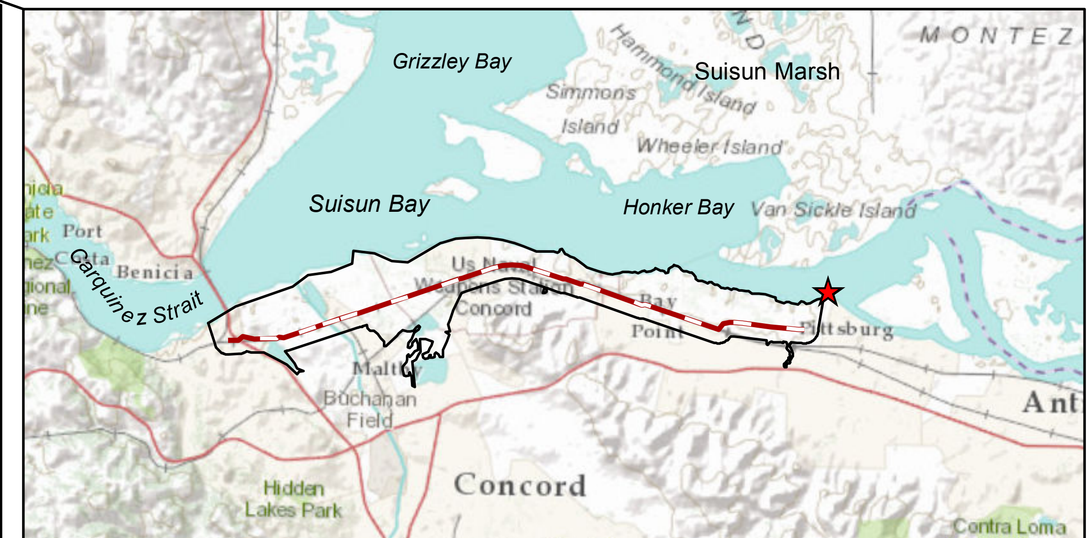


Regional study area

1:750,000 — 0, 5, 10 Miles

Lower Estuarine River Region study area

1:100,000 — 0, 1, 2 Miles



San Pablo Bay Pipeline study corridor

1:250,000 — 0, 1, 2 Miles

E:\Maps\WesPac\6 Aquatic Resources\mxd\Figure 6-1 Aquatic Resource Study Areas.mxd

Figure 6-1
Aquatic Resource Study Areas
City of Pittsburg
WesPac Pittsburg Energy Infrastructure Project

TRC

12/27/2011

- ★ Marine terminal site
- Existing San Pablo Bay Pipeline
- San Pablo Bay Pipeline study corridor
- Lower Estuarine River Region study area

N

Table 6-1: Special-status Species with Potential to Occur

Species	Listing Status*
Wildlife	
Central Valley steelhead (*Oncorhynchus mykiss irideus*)	FT
Central Valley spring-run Chinook salmon (*O. tshawytscha*)	FT, ST
Winter-run Chinook salmon (*Oncorhynchus tshawytscha*)	FE, CH, SE
Central Valley fall/late fall-run Chinook salmon (*Oncorhynchus tshawytscha*)	FSC, SSC
Delta smelt (*Hypomesus transpacificus*)	SE, FT, CH
Green sturgeon (*Acipenser medirostris*)	FT, CH, SSC
Longfin smelt (*Spirinchus thaleichthys*)	ST, SSC
Sacramento splittail (*Pogonichthys macrolepidotus*)	SSC
Starry flounder (*Platichthys stellatu*)	EFH
California black rail (*Laterallus jamaicensis coturniculus*)	BCC, ST, SFP
California clapper rail (*Rallus longirostris obsoletus*)	FE, SE, SFP
California least tern (*Sterna antillarum browni*)	FE, SE, SFP
Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*)	BCC, SSC
Salt marsh harvest mouse (*Reithrodontomys raviventris*)	FE, SE, SFP
Suisun song sparrow (*Melospiza melodia maxillaris*)	SSC-3
California sea lion (*Zalophus californianus*)	MMPA
Harbor seal (*Phoca vitulina richardii*)	MMPA
Plants	
Bolander's water-hemock (*Cicuta maculate* var. *bolanderi*)	2.1
Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*)	1B.2
Mason's lilaeopsis (*Lilaeopsis masonii*)	1B.1
Saline clover (*Trifolium hydrophilum*)	1B.2
Soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*)	FE, SR, 1B.2
Suisun marsh aster (*Symphyotrichum lentum*)	1B.2

***Federal Listing Status** FE: Federally listed endangered; FT: Federally listed threatened; CH: Critical habitat designated; MMPA: Listed under Marine Mammal Protection Act; FSC: NMFS federal species of concern; BCC: Federally listed birds of conservation concern; EFH: NOAA-Fisheries essential fish habitat species. **State Listing Status** SFP: State fully protected; SE: State-listed endangered; SR: state rare; ST: State-listed threatened; SSC: California species of special concern. The SSCs may be ranked by priority—SSC-1: priority one, etc. **CNPS Status** 1B: Rare; 2.1: Rare in California, more common elsewhere

Sources: CDFG, 2011b; CNPS, 2011; USFWS, 2011

6.1 ENVIRONMENTAL SETTING

6.1.1 Regulatory Context

6.1.1.1 Federal Regulations

National Environmental Policy Act

The National Environmental Policy Act of 1969 (NEPA) established the nation's national environmental policy. NEPA provides an interdisciplinary framework for environmental planning by federal agencies and contains action-forcing procedures to ensure that federal decision makers take environmental factors into account. NEPA establishes a process by which federal agencies must study the environmental effects of their actions and allows federal agencies broad discretion concerning the degree of substantive environmental protection they may require when approving proposed actions.

Federal Endangered Species Act

Federal Endangered Species Act (ESA) (16 United States Code [USC] Sections 1531-1544) provisions protect federally listed threatened or endangered species and their habitats from unlawful take. *Take* is defined under the ESA as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any of the specifically enumerated conduct." U.S. Fish and Wildlife Service (USFWS) regulations define *harm* as "an act which actually kills or injures wildlife." Activities that may result in take of individuals are regulated by the USFWS or National Marine Fisheries Service (NMFS).

Pursuant to the ESA, the USFWS or NMFS may also designate areas that are essential to the conservation of threatened and endangered species as "critical habitat." Areas of critical habitat are specified "to the maximum extent prudent and determinable," and may, therefore, be quite large in order to encompass and protect the primary constituent elements (PCEs) required to aid recovery and delisting of the species (50 Code of Federal Regulations [CFR] 424.12). PCEs include habitat for movement, foraging, shelter, and reproduction within the historical geographical or ecological range of the species. Projects require consultation if they affect areas containing PCEs. Developed areas such as roads and buildings that fall within designated critical habitat are normally excluded from critical habitat.

Estuary Protection Act

The Estuary Protection Act (16 USC Sections 1221-1226) provide a means for federal agencies to consider the need to protect, conserve, and restore estuaries during the permit-approval process.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 USC Sections 1801-1882) established jurisdiction over marine fisheries in the United States exclusive economic zone (EEZ) through fishery management plans (FMPs). The Pacific Fishery Management Council drafted three FMPs, the Pacific Groundfish Fishery Management Plan, Coastal Pelagic Fishery Management Plan, and Pacific Salmon Fishery Management Plan, to describe the habitat essential to the fish being managed and to describe threats to that habitat from both fishing and non-fishing activities.

Sustainable Fisheries Act

The Sustainable Fisheries Act of 1996 (Public Law No. 104-267) reauthorized the Magnuson-Stevens Act and amended the habitat provisions of the Magnuson-Stevens Act to direct the NMFS, Fishery Management Councils, and federal agencies to protect, conserve, and enhance essential fish habitat (EFH). EFH is defined as waters and substrate necessary for spawning, breeding, feeding, and rearing of federally managed fish species. Under the Magnuson-Stevens Act, all federal agencies must consult with the NMFS prior to authorizing projects that may adversely affect EFH.

Habitat Areas of Particular Concern (HAPCs) are a subset of EFH that are rare or threatened environmentally. HAPCs do not receive additional regulatory protection under the Magnuson-Stevens Act, but projects with potential adverse impacts to HAPCs receive additional scrutiny during the consultation process.

Marine Mammal Protection Act

The Marine Mammal Protection Act of 1972 (MMPA) (16 USC Sections 1361-1421) prohibits take and importation of marine mammals in U.S. waters and by U.S. citizens on the high seas. The MMPA has been amended numerous times to authorize and regulate take related to prescribed activities, mainly related to weapons testing by the U.S. military.

Migratory Bird Treaty Act

This Migratory Bird Treaty Act (MBTA) (16 USC Sections 703-712) prohibits killing, possessing, or trading in migratory birds except in accordance with regulations prescribed by the Secretary of the Interior. This act encompasses whole birds, parts of birds, bird nests, and eggs. Nest destruction that results in the unpermitted take of migratory birds or their eggs is illegal under the MBTA. Disturbances that result in the incidental loss of fertile eggs or nestlings due to nest abandonment are considered a violation of the MBTA. The MBTA does not contain any prohibition that applies to the destruction of a bird nest alone (without birds or eggs), provided that no possession occurs during the destruction.

Rivers and Harbors Act

The Rivers and Harbors Act of 1899 (33 USC Sections 401, 403, 407) address projects and activities in navigable waters, and harbor and river improvements.

Under Section 10 of this act, any construction or alteration of a navigable water is required to first obtain the approval of the chief of the U.S. Army Corps of Engineers (USACE). Both the construction at the marine terminal and the dredging would require permits from the USACE. Permits normally contain conditions requiring the permittee to comply with best management practices or requirements with respect to such matters as turbidity, water quality, containment of material, nature and location of approved spoil disposal areas, extent and period of dredging, and other factors relating to protection of environmental and ecological values.

Lacey Act

Under the injurious wildlife provisions of the Lacey Act (18 USC Section 42; 50 CFR 16), the USFWS is authorized to regulate the importation and interstate transport of animal species determined to be injurious. Injurious wildlife are those vertebrates and invertebrate species, including their gametes and viable eggs, that are injurious to the interests of human beings, agriculture, horticulture, forestry, wildlife, or wildlife resources of the United States. Under Section §16.13 of this act, no live fish, mollusks, crustacean, or any progeny or eggs may be released into the wild without a permit from the relevant state authority.

Nonindigenous Aquatic Nuisance Prevention and Control Act

The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA) established the first major federal program to prevent the introduction and control the spread of introduced aquatic nuisance species. NANPCA was amended in 1996 by the National Invasive Species Act to implement voluntary ballast water exchange guidelines for vessels entering U.S. waters from outside the U.S. EEZ. Since 2004, ballast water exchange has been mandatory; the program is overseen by the U.S. Coast Guard.

Clean Water Act

Areas meeting the regulatory definition of waters of the United States (jurisdictional waters) are subject to the jurisdiction of the USACE. The USACE, under provisions of Section 404 of the Clean Water Act of 1972 (CWA) (33 USC Sections 1251-1376) and Section 10 of the Rivers and Harbors Act of 1899, has jurisdiction over waters of the United States. These waters may include all waters "used, or potentially used, for interstate commerce, including all waters subject to the ebb and flow of the tide, all interstate waters, all other waters (intrastate lakes, rivers, streams, mudflats, sandflats, playa lakes, natural ponds, etc.), all impoundments of waters otherwise defined as waters of the United States, tributaries of waters otherwise defined as waters of the United States, the territorial seas, and wetlands adjacent to waters of the United States" (33 CFR, Part 328, Section 328.3).

Section 311 of the CWA prohibits the discharge of oil in quantities that may be harmful, as described in 40 CFR Part 110, into or upon the navigable waters of the United States or adjoining shorelines (33 USC Section 1321(b)(3)). The U.S. Environmental Protection Agency (EPA) is authorized to regulate non-transportation-related onshore facilities. Facilities that transfer oil over water to or from vessels and have a total oil storage capacity greater than or equal to 42,000 gallons are classified as a "substantial harm facility" and must prepare and submit a Facility Response Plan (FRP) to the EPA Regional Administrator. The CWA, with amendments by the Oil Pollution Act of 1990, requires response plans for immediate and effective protection of sensitive resources.

Section 303(d) of the CWA requires states to "identify those waters within its boundaries for which the effluent limitations are not stringent enough to implement any water quality objective applicable to such waters" and to establish total maximum daily loads (TMDLs) for such waters. In California, the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards are responsible for preparing lists of 303(d) impaired waterbodies and preparing TMDLs. The State of California has identified *invasive species* from ballast water as a high priority pollutant/stressor for all of the Bay and the Delta since 2006. To date, no TMDLs have been completed for invasive species. TMDLs for invasive species in Region 2 are projected to be completed by 2019 (CDWR, 2011).

The California Toxics Rule

In 2000, the EPA promulgated numeric water quality criteria for priority toxic pollutants and other provisions for water quality standards for California's waters (65 FR 31681-31719). These federal criteria are legally applicable to estuaries under the Clean Water Act. This rule establishes Aquatic Life Criteria, which are numeric water quality criteria for protection of fresh and marine water aquatic organisms. The criteria are expressed as short-term and long-term numbers. The criteria maximum coverage is a one-hour average acute limit; the criteria continuous concentration is a four-day average concentration chronic limit. Together, these criteria are meant to provide protection of aquatic life and prevent bioconcentration of pollutants in aquatic organisms.

National Pollution Discharges Vessel General Permit

In 2008, the EPA issued the NPDES Vessel General Permit for discharges incidental to the normal operation of vessels. EPA released a new draft Vessel General Permit in 2011, and expects a final 2013 Vessel General Permit to be issued in 2013. This permit applies/will apply to the tankers that will frequent the marine terminal. The permit limits discharges of aquatic nuisance species (also called invasive species in this chapter) from ballast water and discharges from antifouling hull coatings; antifouling hull coatings and chemicals must be registered according to the Federal Insecticide, Fungicide, and Rodenticide Act or must not contain biocides or toxic materials that have been banned for use in the US.

The Oil Pollution Act

The Oil Pollution Act of 1990 (OPA) (33 USC Sections 2701-2761) provides new requirements for contingency planning by industry such that owners or operators of vessels and certain facilities that pose a serious threat to the environment must prepare FRPs and authorizes trustee agencies to seek monetary compensation for injured natural resources.

Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 USC Sections 9601-9675) authorized the Department of the Interior to seek monetary compensation for injured natural resources in the aftermath of an oil spill or other pollution event.

Pipeline Safety Act

The Pipeline Safety Act of 1979 (49 USC Section 601 *et seq.*) authorized the U.S. Department of Transportation (DOT) to regulate pipelines carrying hazardous liquid materials across state lines. Congress passed subsequent bills in 1988, 1992, 1996, 2002, and 2006 to improve oversight of the nation’s pipeline infrastructure. Regulations promulgated by the Pipeline and Hazardous Materials Safety Administration at the DOT require operators of pipelines located within 1 mile of environmentally sensitive areas to prepare a response plan that includes procedures and a list of resources for responding to worse-case discharge scenarios in case of pipeline failure (49 CFR 194). Section 195 of Title 49 of the CFR requires additional safety precautions and reporting for certain pipelines located within 0.5 mile of an Unusually Sensitive Area. An Unusually Sensitive Area is defined as an area unusually sensitive to damage from a hazardous pipeline release; the natural areas adjacent to the existing San Pablo Bay Pipeline meet the criteria for characterization as an Unusually Sensitive Area because they contain critically imperiled species, multi-species assemblages, and migratory waterbird concentrations such that the area is designated as a Western Hemisphere Shorebird Reserve Network site.

Through an agreement with the DOT, the California Office of the State Fire Marshall has jurisdiction over pipelines that convey hazardous materials within state boundaries.

6.1.1.2 State Regulations

California Environmental Quality Act

The California Environmental Quality Act (CEQA) requires that California's state and local agencies prepare multidisciplinary environmental impact analyses and make decisions based on those studies' findings regarding the environmental effects of proposed activities. The main objectives of CEQA are to disclose, to decision makers and the public, the significant environmental effects of proposed activities and to require agencies to avoid or reduce environmental effects by implementing feasible alternatives or mitigation measures.

Under CEQA, a proposed project's potential impacts on plant or animal species must be analyzed in an environmental impact report (EIR) if the species is considered endangered or rare within the meaning of Guidelines Section 15380 (Title 14, California Code of Regulations, Section 15380). A species is endangered when its survival and reproduction in the wild are in immediate jeopardy. A species is *rare* when, though not immediately endangered, it exists in such small numbers that it may become endangered should its environment worsen, or it is likely to become endangered within the foreseeable future throughout all or a significant portion of its habitat range and may be considered "threatened" as that term is used in the Federal ESA. In general, an EIR for a proposed project must include analysis of potential effects to species listed as:

- federally threatened, rare, or endangered pursuant to the federal ESA;
- threatened or endangered pursuant to the California Endangered Species Act (CESA);
- fully protected pursuant to California Fish and Game Code 3511 and 4700;
- species of special concern as designated by the California Department of Fish and Wildlife (CDFW; formerly the California Department of Fish and Game [CDFG]); or
- rare or endangered in the *Inventory of Rare and Endangered Vascular Plants of California* published and maintained by the California Native Plant Society.

Rare or endangered species that are known to or have the potential to occur in the project vicinity are listed in Appendix F: Special-status Species with Potential to Occur.

In assigning "impact significance" to populations of non-listed species, analysts usually consider factors such as population-level effects, proportion of the taxon's range affected by a project, regional effects, and impacts to habitat features.[1]

[1] Refer to CEQA Guidelines, Section 15065, determination of the significance of an environmental effect caused by a project (Title 14, California Code of Regulations, Section 15065).

California Endangered Species Act

Provisions of the CESA protect state-listed threatened and endangered species. The CDFW regulates activities that may result in take of individuals (i.e., "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill"). Habitat degradation or modification is not included in the definition of take under the California Fish and Game Code. Any project that has the potential to take listed species must apply for an incidental take permit pursuant to Sections 2081 (B) and (C) of the California Fish and Game Code.

Other Provisions of the California Fish and Game Code

The California Fish and Game Code Sections 3511, 4700, 5050, and 5515 prohibit take of fully protected bird, mammal, reptile and amphibian, and fish species, respectively. Species that are classified as fully protected species, or parts thereof, may not be taken or possessed at any time, nor may licenses be issued for their take.

Sections 3503 and 3503.5 of the California Fish and Game Code outlaw take, possession, or destruction of birds and raptors, respectively, and their nests. Disturbance during the breeding season that results in the incidental loss of fertile eggs or nestlings, or otherwise leads to nest abandonment, is also considered take by the CDFW.

The CDFW promulgates various lists of sensitive species for which analysis of project impacts is required under CEQA. These lists include species of special concern lists for invertebrates, fish, amphibians and reptiles, mammals, and birds.

California Fish and Game Code Section 2014 specifies that "the state may recover damages in a civil action against any person or local agency which unlawfully or negligently takes or destroys any bird, mammal, fish, reptile, or amphibian..." and that "the measure of damages is the amount which will compensate for all the detriment..."

The CDFW also regulates activities that may substantially modify a river, stream, or lake; substantially change or use any material from the bed, channel, or bank of these waters; or dispose of debris, waste, or other material into these waters through California Fish and Game Code Sections 1600-1607. The project applicant would be required to provide the regional CDFW office with notification of the project under Section 1602 and enter into a Lake or Streambed Alteration Agreement with the CDFW.

Porter-Cologne Water Quality Control Act

Areas meeting the regulatory definition of waters of the State are subject to the jurisdiction of the California State Water Resources Control Board. Waters of the State means any surface water or groundwater, including saline waters, within the boundaries of the State (California Water Code, Section 13050(e)). Any person discharging waste, or proposing to discharge waste, within any region that could affect the quality of the waters of the State, other than into a community sewer system, must file a report of the discharge with the appropriate regional board (California Water Code, Section 13260(a)(I)). Section 13050 specifically includes the regulation of "biological" pollutants, and ballast water and hull fouling constitute "waste" as defined by this section. Aquatic invasive species would be considered biological pollutants if they are discharged to receiving waters from, for example, ballast water or hull fouling.

Lempert-Keene-Seastrand Oil Spill Prevention and Response Act

The Lempert-Keene-Seastrand Oil Spill Prevention and Response Act of 1990 covers all aspects of marine oil spill prevention and response in California. Administration of the act is under the authority of a chief deputy director of the CDFW, who is also then responsible for carrying out the CDFW's water pollution enforcement duties. Through the act, California State Lands Commission (CSLC) responsibilities were expanded through the creation of the Marine Facilities Division to oversee the safety of marine terminals and the transfer of crude oil from ships to shore-based facilities. The act also authorizes trustee agencies to seek monetary compensation for injured natural resources.

Public Resources Code

Public Resources Code §6301 and §6306 grants the CSLC jurisdiction over all ungranted tidelands and submerged lands within the State, and grants certain residual and review authority over certain granted tidal and submerged lands.

Marine Invasive Species Act

The Marine Invasive Species Act of 2003, made permanent by the Coastal Ecosystems Protection Act of 2006, requires ballast water management for all vessels that intend to discharge ballast water in California waters. Regulations depend on the vessel's origin of voyage. All vessels covered under the law are required to complete and submit a ballast water report form to the CSLC upon departure from each port of call in California and must comply with good housekeeping practices.

Chapter 308, Statutes of 1978 (AB 3765)

Pesticides that are used in the State of California must be registered by the California Department of Pesticide Regulation (CDPR; (Title 3, California Code of Regulations [CCR], Section 6100-6122). The CDPR evaluates each proposed pesticide to determine if the pesticide has the potential to cause significant, unavoidable, unmitigable adverse impacts to health and human safety or the environment. The CDPR may only register pesticides with significant adverse impacts if the benefits of registration clearly outweigh the risks. Following registration, the CDPR is required to continually evaluate registered pesticides, which it does via its Reevaluation Program (CCR Section 6220). On June 1, 2010, the CDPR placed into reevaluation antifouling paints containing copper oxide, copper hydroxide, and cuprous thiocyanate after a study (conducted by the CDPR) indicated that dissolved copper concentrations in over half the water samples taken from salt and brackish water marinas exceeded state water quality standards for copper (CDPR, 2009). Copper-based antifouling paints remain in reevaluation as of the publication of the Reevaluation Program's most recent Semiannual Report (CDPR, 2012).

6.1.1.3 Local Regulations

Contra Costa County General Plan

Specific policies with application to the project in the *Contra Costa County General Plan* (Contra Costa County, 2005) include:

8-10 Any development located or proposed within significant ecological resource areas shall ensure that the resource is protected.

8-11 The County shall utilize performance criteria and standards which seek to regulate uses in and adjacent to significant ecological resource areas.

8-16 Native and/or sport fisheries shall be preserved and re-established in the streams within the County wherever possible.

8-17 The ecological value of wetland areas, especially the salt marshes and tidelands of the bay and delta, shall be recognized. Existing wetlands in the County shall be identified and regulated. Restoration of degraded wetland areas shall be encouraged and supported wherever possible.

8-18 The filling and dredging of lagoons, estuaries, and bays which eliminate marshes and mud flats shall be allowed only for water-oriented projects which will provide substantial public benefits and for which there are not reasonable alternatives, consistent with state and federal laws.

8-25 The County shall protect marshes, wetlands, and riparian corridors from the effects of potential industrial spills.

8-27 Seasonal wetlands in grassland areas of the County shall be identified and protected.

City of Pittsburg General Plan

Specific policies with application to the project in the *City of Pittsburg General Plan* (City of Pittsburg, 2001) include:

9-P-1 Ensure that development does not substantially affect special-status species, as required by state and federal agencies and listed in Table 9-1 (of the general plan). Conduct assessments of biological resources as required by CEQA prior to approval of development within habitat areas of identified special-status species, as depicted on Figure 9-1 (of the general plan).

9-P-2 Establish an ongoing program to remove and prevent the re-establishment of invasive species and restore native species as part of development approvals on sites that include ecologically sensitive habitat.

9-P-12 Protect and restore threatened natural resources such as estuaries, tidal zones, marine life, wetlands, and waterfowl habitat.

City of Martinez General Plan

The San Pablo Bay Pipeline is located within the North Contra Costa Waterfront Zone. Under Section 22.23 of the *City of Martinez General Plan* (City of Martinez, 2010), limited industrial development compatible with wetland habitat and other natural conditions are appropriate uses of this area.

San Francisco Bay Basin Water Quality Control Plan

The Porter-Cologne Act requires the development and periodic review of Water Quality Control Plans (Basin Plans) that designate beneficial uses of California’s rivers and groundwater basins and establish numerical water quality objectives for those waters. Resolution R2-2007-0042 amended the Basin Plan to adopt site-specific objective for copper for the San Francisco Bay Basin (San Francisco Bay Regional Water Quality Control Board, 2008). This amendment contained non-regulatory provisions for control of copper-based marine antifouling coatings. The San Francisco Bay Regional Water Quality Control Board relies on the authority of the CDPR to regulate the pesticidal use of copper in antifouling paints to attain water quality objectives (Looker, 2008).

6.1.1.4 Management Plans

In addition to the federal, state, and local regulations described above, the project lies within the boundaries of many management plans and conservation strategy plans. Some of these plans are regulatory, while others are meant to provide general technical assistance and discretionary guidance for managing habitats in the San Francisco Bay Estuary.

Table 6-2 lists regulatory and non-regulatory plans that have bearing on the Lower Estuarine River and that were reviewed during the development of the existing conditions and impacts analysis section of this chapter.

Table 6-2: Management Plans

Management Plans
Regulatory Plans
Comprehensive Conservation and Management Plan (1993, revised 2007) **Administrator:** San Francisco Estuary Project Implementation Committee **Project location:** Suisun Bay **Description:** San Francisco Estuary Project is a federal-state-local partnership established in 1987 under the Clean Water Act's Section 320: National Estuary Program. The plan was mandated under a reauthorization of the Clean Water Act in 1987, and Congress has directed that it be implemented.
California Aquatic Invasive Species Management Plan (2008) **Administrator:** California State Lands Commission (CSLC), California Department of Fish and Wildlife (CDFW), Department of Water Resources (DWR) **Project location:** State of California **Description**: The plan proposes management actions for addressing aquatic invasive species threats, with emphasis on nonnative algae, crabs, clams, fish, and plants. Commercial shipping is identified as a vector of aquatic invasive species via ballast water discharge and hull fouling. The CSLC implements regulations governing ballast water management and hull fouling for vessels arriving or operating on the West Coast of North America, while the CDFW is responsible for biological surveys, environmental planning, and enforcement. The DWR addresses invasive species issues that impact water supply and delivery, and flood control.
California Noxious and Invasive Weed Action Plan (2005) **Administrator:** California Department of Food and Agriculture **Project location:** State of California **Description:** A strategic plan to protect and enhance the economy, natural environment, and safety of the citizens of California through greater awareness, cooperation, and action in the prevention and control of noxious and invasive weeds.
Delta Protection Act of 1992 (1992) **Administrator:** Delta Protection Commission (DPC) **Project location:** Secondary Zone **Description:** The project is located in the Secondary Zone of the jurisdiction of the DPC within the legal Delta boundary, but outside of the Primary Zone, which comprises the principal jurisdiction of the DPC. The Secondary Zone is not within the planning area of the DPC.

Management Plans
Delta Plan (expected 2012) **Administrator:** Delta Stewardship Council (formerly known as CALFED) **Project location:** Secondary Zone **Description:** The Delta Plan, authorized under the Sacramento-San Joaquin Delta Reform Act of 2009, will be a comprehensive management plan for the Sacramento-San Joaquin River Delta and Suisun Marsh. Although the project lies within the area regulated by the plan, it would be statutorily excluded from the definition of covered action because it (1) is within the boundary of the Secondary Zone of the Delta and (2) would be consistent with the sustainable communities strategy, the Plan Bay Area.
Plan Bay Area (expected 2014) **Administrator:** Association of Bay Area Governments, Bay Area Air Quality Management District, San Francisco Bay Conservation and Development Commission, and Metropolitan Transportation Commission **Project location:** Cities of Pittsburg and Martinez in Contra Costa County **Description:** When complete, the plan will be the region's long-range plan for sustainable land use, transportation, and housing.
Draft Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (2010) **Administrator:** U.S. Fish and Wildlife Service **Project location:** Suisun Bay Area Recover Unit, Segments A and B, Zones 1 and 2 **Description:** Identifies threats to seven endangered species associated with San Francisco Bay tidal marshes, and elaborates implementation measures to complete species recovery.
Long-term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region Management Plan (2001) **Administrator:** U.S. Army Corps of Engineers Dredged Material Management Office **Project location:** Within the Long-term Management Strategy (LTMS) Planning Area **Description:** The goals of the LTMS includes managing dredging and disposal in an economically and environmentally sound manner, maximizing the beneficial use of dredged material, and developing a coordinated permit application review process for dredging and disposal projects. The initial dredging at the marine terminal would not be eligible for coverage under the plan, but subsequent maintenance dredging would.

Management Plans
Non-regulatory Plans
Baylands Ecosystem Habitat Goals Project (1999) **Developed by:** San Francisco Bay Area Wetlands Ecosystem Goals Project **Project location:** Segment C, Contra Costa North, Suisun Subregion **Description:** A guide for restoring and improving the baylands and adjacent habitats of the San Francisco Estuary.
San Francisco Bay Subtidal Habitat Goals Project 50-Year Conservation Plan (2010) **Developed by:** California State Coastal Conservancy and Ocean Protection Council, National Marine Fisheries Service and Restoration Center, San Francisco Bay Conservation and Development Commission, and San Francisco Estuary Partnership **Project location**: Suisun Bay subbasin, Segment C: Contra Costa North **Description:** A guide for restoring and improving subtidal habitat, including all submerged areas of Suisun Bay upstream to Sherman Island.
The Conservation Lands Network: San Francisco Bay Area Upland Habitat Goals Project (2011) **Developed by:** Bay Area Open Space Council **Project location:** Mount Diablo Range/North Contra Costa Valley **Description:** A guide for improving the areas upland of the Baylands. The existing tank storage facility lies in an area classified as low potential for conservation.
Strategic Plan for the Restoration of Wetlands and Wildlife in the San Francisco Bay Area (1996) **Developed by:** San Francisco Bay Joint Venture **Project location:** Suisun Bay subregion **Description:** Outlines habitat protection goals for estuary species, with focus on waterfowl.
North American Waterfowl Management Plan (1986) **Developed by:** U.S. Fish and Wildlife Service **Project location:** Pacific Flyway **Description:** Establishes habitat protection and restoration goals to increase waterfowl populations, and calls for the creation of 18 joint ventures—public/private partnerships—around the country to achieve the goals.
The U.S. Shorebird Conservation Plan (2003) **Developed by:** U.S. Fish and Wildlife Service **Project location:** Pacific Flyway **Description:** The U.S. Shorebird Conservation Plan addresses declining shorebird populations throughout the country. The Southern Pacific Shorebird Conservation Plan, completed in 2003, is a regional implementation plan covering shorebirds along the coast, including San Francisco Bay, and in the Central Valley.

Management Plans
North American Waterbird Conservation Plan (2002) **Developed by:** Waterbird Conservation for the Americas **Project location:** Pacific Coast **Description:** The Waterbird Initiative was launched to coordinate a broad range of projects benefitting waterbirds over a huge geographical area, multiple scales of planning and implementation, and the involvement numerous partners from government and nongovernmental organizations, from the scientific community, and from local citizenry.
California Current System Marine Bird Conservation Plan (2005) **Developed by:** PRBO Conservation Science **Project location:** Pacific Coast **Description:** Addresses seabirds, coastal water birds, wading birds, and marsh birds dependent on aquatic habitats from British Columbia to Baja California
U.S. Fish and Wildlife Service Pacific Region Seabird Conservation Plan for Region One (2005) **Developed by:** U.S. Fish and Wildlife Service **Project location:** Region One **Description:** Addresses seabirds, coastal waterbirds, wading birds, and marshbirds dependent on aquatic habitats in California, Oregon, Washington, Hawaii, and the U.S. Pacific Island commonwealths

6.1.2 Existing Conditions

The proposed project is located in the San Francisco Bay Estuary at New York Point, where the San Francisco Bay watershed overlaps with the legal definition of the Sacramento-San Joaquin River Delta in the area between Chipps and Sherman islands.

The San Francisco Bay-Delta region is among the best studied estuaries in the world, and an extensive scientific literature exists on its ecology. Owing to its ecological and economic importance to the region, it is also subject to numerous management programs. Because of the abundance of available reports, plans, and papers that describe the region, only the existing conditions in the vicinity of the project are discussed in detail. A general discussion of the ecology of San Francisco Bay is presented to provide regional context for the detailed discussion that follows. Additional information on regional aquatic resources is provided in Appendix E.

6.1.2.1 San Francisco Bay Estuary

The San Francisco Bay Estuary is typically divided into five segments: the Sacramento-San Joaquin River Delta, Suisun Bay, San Pablo Bay, Central Bay, and South Bay. The Delta is the easternmost, or most upstream, segment. The Delta is a 1,150-square-mile triangle-shaped region roughly bounded on the north by the City of Sacramento, on the south by the City of Tracy, and on the west by Chipps Island. The Sacramento and San Joaquin rivers and their tributaries flowing into the Delta drain about half of the surface area of California. The Delta provides drinking water for 22 million people, supports the state's $27 billion agricultural industry, and provides 12 million recreation user days annually (DWR, 2008). Most importantly for aquatic species, the Delta carries freshwater and sediment into the estuary and establishes the extent of brackish water habitat in Suisun Bay.

Suisun Bay is a shallow estuarine bay bounded by Chipps Island on the east and the Benicia-Martinez Bridge on the west. Suisun Marsh, the largest brackish water marsh in the United States and the largest wetland in California, forms its northern boundary. The southern shore of Suisun Bay is home to the Concord Naval Weapons Station and the cities of Pittsburg, West Pittsburg, Avon, and Martinez. Suisun Bay is connected to San Pablo Bay via the Carquinez Strait, a narrow, 12-mile-long band of water that extends from between the Benicia-Martinez Bridge to Mare Island. San Pablo Bay is the second largest bay in the estuary; it extends from the Carquinez Strait to the San Pablo Strait near the Richmond-San Rafael Bridge, where it forms the upstream boundary of the Central Bay. The Central Bay is defined as an area bounded by three bridges: the Richmond-San Rafael Bridge; the Golden Gate Bridge; and the San Francisco-Oakland Bridge. The waters south of the San Francisco-Oakland Bridge form the largest embayment, known as the South Bay.

The bay's tidal cycle is mixed semidiurnal, resulting in two cycles each day. The average height of the higher tide is called local mean higher high water (MHHW), while the average of the high tides is called local mean high water (MHW). Mean lower low water (MLLW) and mean low water (MLW) refer to the average height of the lowest tide and the average of all low tides, respectively. Mean tide level (MTL) lies midway between MHW and MLW. The relative height covered by these tidal datums has important implications for shoreline habitat. Tidal highs and lows in the bay vary with time of day, the position of the moon, season, and distance from the Pacific Ocean. Fluctuations in tidal currents, freshwater inflow, sediment loading, and seasonal temperatures all combine to create a complex and dynamic system.

Barges carrying crude oil to the marine terminal would pass through three bays enroute to the marine terminal: Central, San Pablo, and Suisun (refer to Figure 2-17 in Chapter 2.0: Proposed Project and Alternatives). Central Bay is the coldest, deepest, and most saline of the three bays, as well as the most strongly influenced by tidal currents. Because of its proximity to the Pacific Ocean, its water quality parameters are more stable than its neighboring bays. Ecological conditions in the Central Bay are also more stable than in neighboring bays. Its populations of native aquatic species appear to be stable or increasing, and its overall fish index is rated "Good" by the San Francisco Estuary Partnership (SFEP, 2011).

San Pablo and Suisun bays are partially to well-mixed estuaries that are dominated by seasonally varying river inflow. These bays receive the majority of freshwater flows from the Delta; as a result, their waters tend to be well oxygenated, only moderately saline, and high in suspended solids. High tides in both bays almost double the water surface area (NOAA, 2007). Suisun Bay surface area increases from 39 to 66 square miles (mi^2), while San Pablo Bay's surface area increases from 100 to 170 mi^2. By contrast, the surface area of the Central Bay increases from 85 mi^2 at low tide to 97 mi^2 at high tide. Because the bays are generally shallow (less than 10 feet), they are susceptible to wind-generated currents and sediment resuspension. San Pablo Bay's ecosystem health is in decline compared to the Central Bay's but is less threatened than Suisun Bay's (SFEP, 2011). Much of the north shore of San Pablo Bay is protected as part of the San Pablo Bay National Wildlife Refuge; the southern shoreline contains the most extensive areas of eelgrass beds in the San Francisco Bay.

Suisun Bay has the lowest salinity levels in the San Francisco Bay system, with values ranging from oligohaline (0.5 to 5.0 parts per thousand [ppt]) to mesohaline (5.0 to 18.0 ppt) depending on seasonal variations in tides, evaporation, and freshwater inflows from the Delta. Though not as tidally influenced as other embayments, Suisun Bay experiences the greatest evaporative losses (Josselyn, 1983) as well as the greatest magnitude and variation in freshwater flows. The marsh vegetation of Suisun Bay also contributes to evaporative loss through transpiration. Water temperature in Suisun Bay ranges from 10 degrees Celsius (°C) in winter to 21°C in summer.

The bays are bordered by tidal marshes. Tidal marshes, also called salt-marshes or estuarine wetlands, comprise the portion of the estuary that is both exposed at low tide and covered with rooted, primarily herbaceous, vegetation. Tidal marshes form along shallow margins of estuaries where wave erosion is low and sediment can accumulate.

The 45,000 acres of tidal marshes found in the estuary represents 75 percent of the total acreage of California's saline wetlands (SWRQCB, 2008). Reclamation and land use has reduced the historical amount of tidal marshes across the State by over 90 percent; in San Francisco Bay, this figure is closer to 85 percent. Dikes and levees have been identified as among the most frequent and severe stressors of tidal marshes because they reduce water exchange with the ocean, causing infilling and attendant loss of habitat complexity. Other stressors of tidal marshes include rising sea levels, invasive plants, pollutants, excessive runoff, flow obstructions, and trash or refuse from land and sea.

Notwithstanding the challenges that face it, the estuary is one of the most productive areas of the State. It is home to more than 200 bird species, and as a major stop on the Pacific Flyway, supports over 15 species of wintering and migrating shorebirds and 20 species of waterfowl. The estuary has been designated a Western Hemispheric Shorebird Reserve Network.

6.1.2.2 Marine Terminal

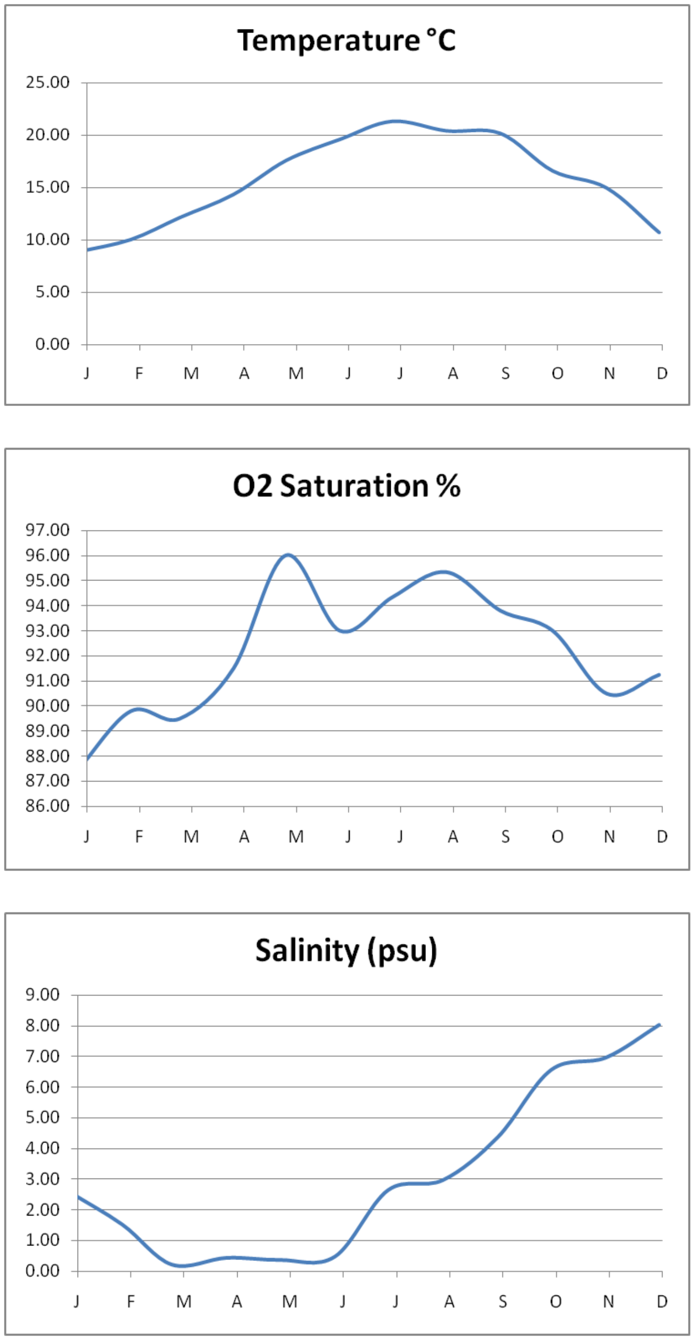
The marine terminal is located at New York Point, approximately 700 feet south of the toeline of the Suisun Bay Ship Channel (USACE, 2011a). It is located within the Lower Estuarine River region of the Delta, an area that includes the estuarine river upstream of Honker Bay to Collinsville on the Sacramento River (NOAA, 2007). A portion of this area is also considered to be part of the West Delta, which stretches from Chipps Island to Rio Vista.

Water sampling conducted by the U.S. Geological Survey approximately 0.75-mile upstream of the project site at the Pittsburg Monitoring Station (Station #3) shows annual temperature ranging from 10°C in winter to highs of 23°C in summer. Oxygen saturation ranges between 80 and 100 percent. Salinity rises gradually from spring lows of 0.05 psu (practical salinity units, equivalent to parts per thousand) at the peak of freshwater inflows from the Delta to highs of 10 psu in the autumn, at which point it decreases sharply over a matter of weeks in the winter, when snowpack accumulation leads to a sudden increase in freshwater discharges from the Delta (USGS, 2011). Figure 6-2: Average Temperature, Oxygen Saturation, and Salinity 8 Meters below MLLW at New York Point 2006-2011 depicts average temperature, oxygen saturation, and salinity 8 meters below MLLW in the vicinity of the marine terminal.

The typical tidal cycle in the vicinity of the marine terminal consists of two highs and lows each day. The estimated highest annual tide of 4.8 feet above MLLW occurs in December, January, and June and corresponds with maximum tidal range; lowest tide of 0.8 feet below MLLW occurs in May (NOAA, 2011). This combination of reduced tidal range and relatively elevated low tides contributes to a narrower and higher wetland configuration (Josselyn, 1983).

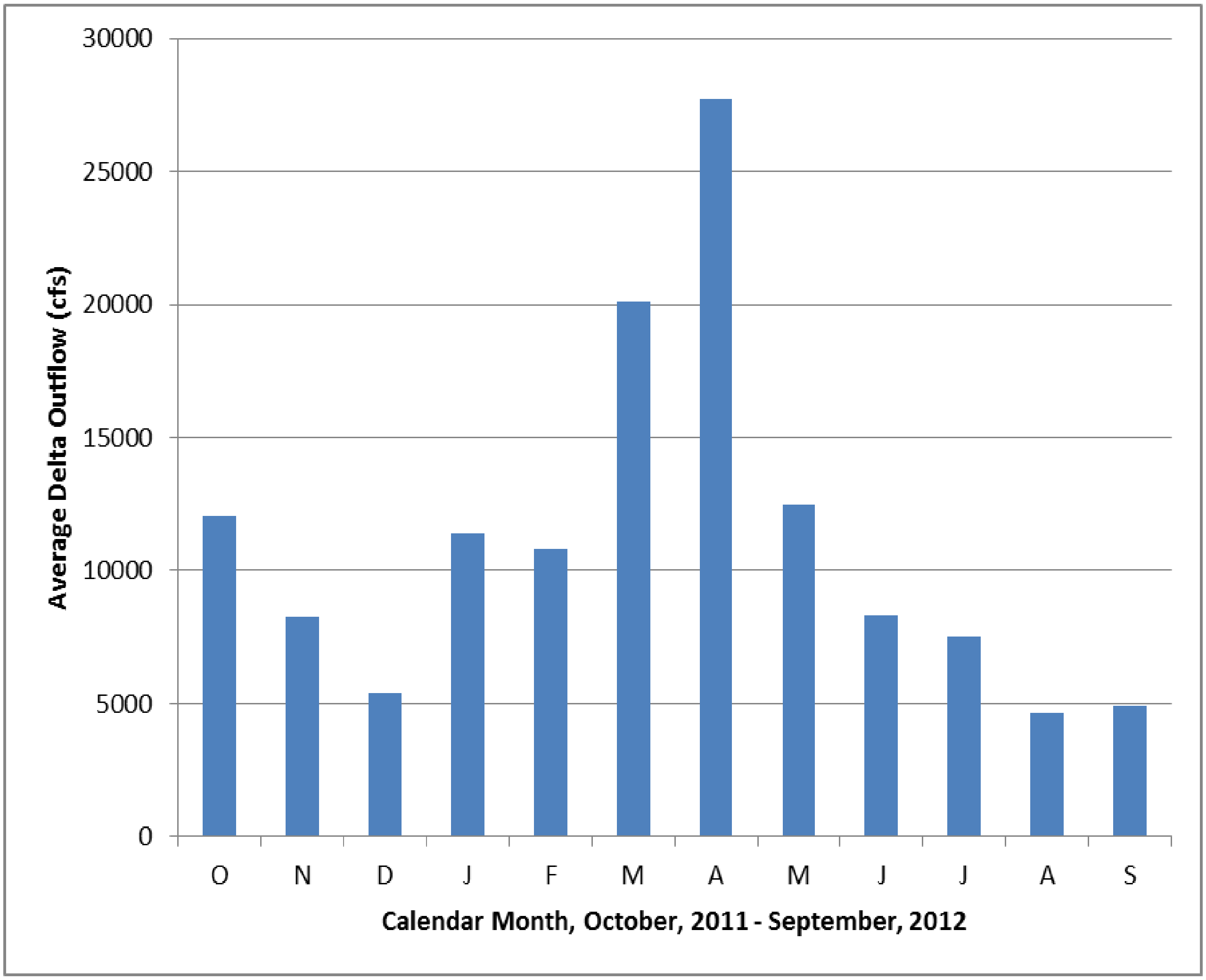
The water depths associated with the south side of the existing marine terminal range from -5 feet MLLW to -24 feet MLLW between the catwalks and the shore. On the north side of the marine terminal, the area proposed to be dredged, the water depth is -37 feet MLLW to -15 feet MLLW. The proposed dredge depth in this area is -38 feet MLLW plus 2 feet of overdredge (Olberding, 2011).

Water flows in the Lower Estuarine River are tidally influenced, and receive net inflow from both the Delta and ocean tides. An estimate of net Delta outflow at Chipps Island is provided by the California Department of Water Resources DAYFLOW model. The average daily outflow for the Water Year 2012 is shown on Figure 6-3. The data shows that the lowest Delta outflows occur in the summer, when average daily outflows drop below 5,000 cubic feet per second (cfs).



Source: USGS, 2011

Figure 6-2
Average Temperature, Oxygen Saturation, and Salinity 8 Meters below MLLW at New York Point 2006-2011
City of Pittsburg
WesPac Pittsburg Energy Infrastructure Project



Source: DAYFLOW, 2012

Figure 6-3: Average Daily Delta Outflow, Water Year 2012
City of Pittsburg
WesPac Pittsburg Energy Infrastructure Project

Turbidity in the water column at the marine terminal is relatively high due to the high suspended-sediment load entering from the Sacramento and San Joaquin River watersheds and transported upstream and into the water column via tidal waves. Sediment load throughout the bay is subject to natural cycles of deposition and resuspension. Overall, however, turbidity has declined throughout the bay in the past 40 years (IEP, 2010).

Many variables influence suspended-sediment load into the water column at the marine terminal site, including freshwater flows from upstream and the sediment available for transport (McKee *et al*., 2006). Sediment transport into the bay from the Delta is greatest during the wet season (December through May) of each year; the amount of sediment available for transport depends on sediment accumulation in the Sacramento and San Joaquin River watersheds, which is in turn influenced by the previous year's transport. McKee *et al.* (2006) suggest that the best estimate of annual suspended-sediment load transported from the Delta into the bay is 1.0+/-0.3 million tons, which is roughly 800,000 cubic yards of sediment.

Suspended sediment is measured in units of milligrams per liter (mg/L). Approximately 1.25 miles downstream of the project site, daily average suspended-sediment load at McKee *et al.*'s study site, Mallard Island, varied between 14 to 223 mg/L. The source of the sediment varied seasonally: during the wet season, the majority of sediment was transported downstream; during the dry season, the contribution of sediment transport upstream approached half of the available sediment supply. Suspended-sediment concentrations vary within the water column (see, for example, Buchanan and Ganju, 2002 and Buchanan and Morgan, 2010). Daily suspended-sediment concentrations can vary by over 100 mg/L over the course of a day. Peak sediment loads occur between March and July, with a second, smaller pulse of sediment loading in the fall. The average daily suspended-sediment load is variable from year to year: In 2002, it measured 37 mg/L near the surface of the water and 48 mg/L near the bottom; in 2007, it measured 24 mg/L near the surface and 27 mg/L near the bottom (Buchanan and Ganju, 2002; Buchanan and Morgan, 2010).

The marine habitat types at the marine terminal can be divided into three classes: Habitat formed by the structure itself, the substrate at the bottom of the water channel, and the water column. The following sections provide brief descriptions of these habitats and their associated biological communities. Figure 6-4: Marine Habitat shows a schematic representation of these habitats and their biotic assemblages. Figure 6-5: Lower Estuarine River Region Marine Habitat maps the habitats at the marine terminal.

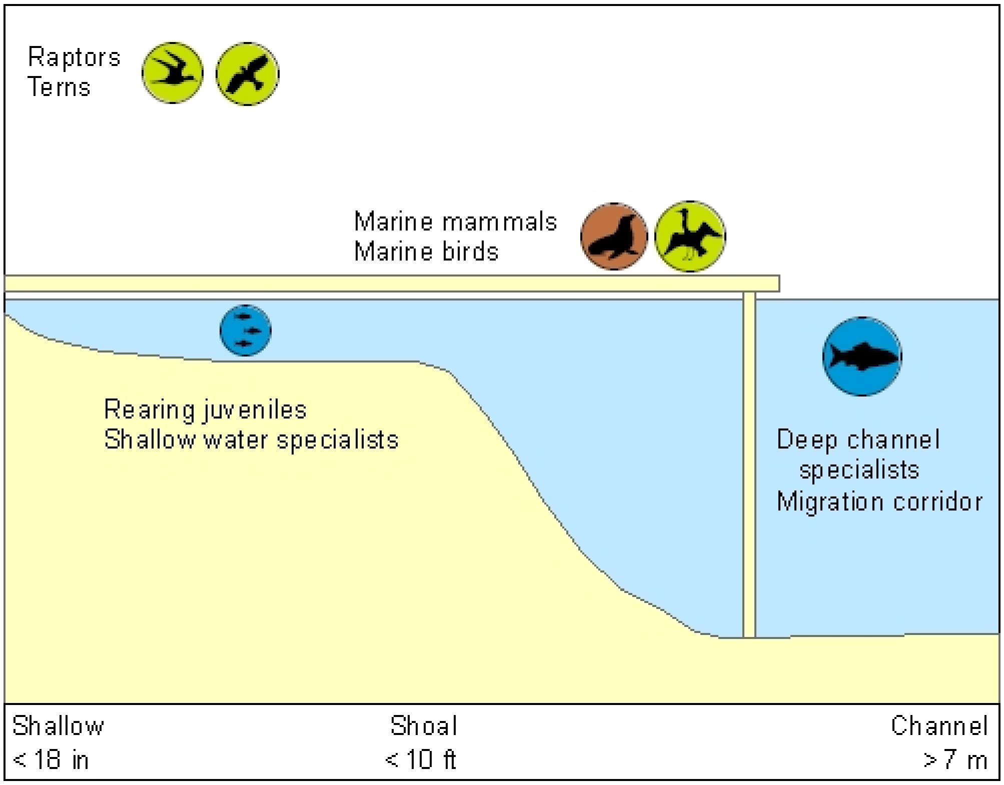
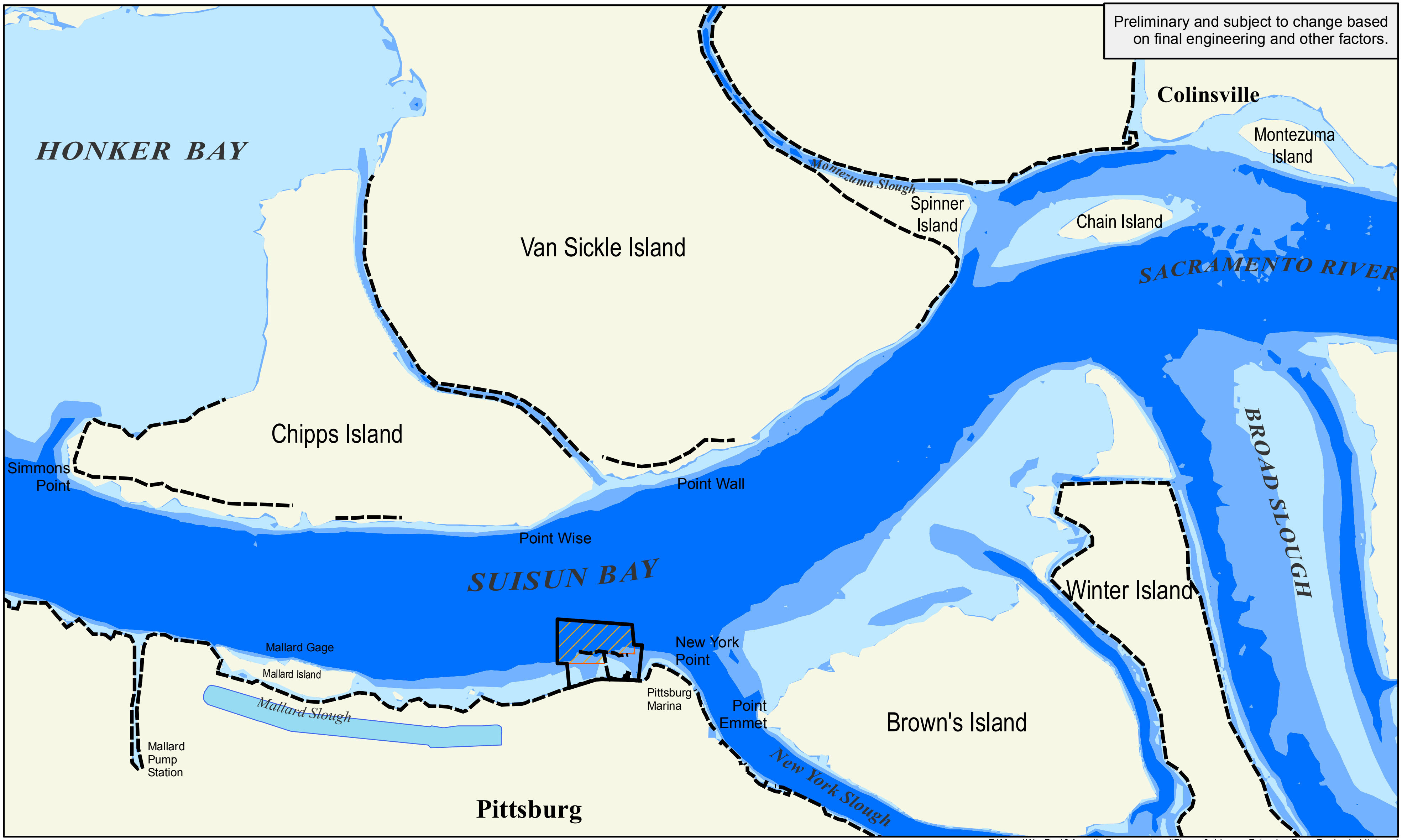


Figure 6-4
Marine Habitat
City of Pittsburg
WesPac Pittsburg Energy Infrastructure Project



E:\Maps\WesPac\6 Aquatic Resources\mxd\Figure 6-4 Lower Estuarine River Region habitat.mxd

Figure 6-5
Lower Estuarine River Region Marine Habitat
City of Pittsburg

TRC

3/22/2013

Dredging area

Terminal boundary

Riprap or solid man-made structure

Water depth

0 - 10 ft

10 ft - 7 m

> 7 m

DATA: WesPac 2011; USGS 2004; NOAA 2005

N

1:36,000

1 cm = 360 m

Miles

0 0.25 0.5

The following discussion contains two terms that may not be familiar to readers. To aid comprehension, these terms are defined below.

X2: X2 measures the distance in kilometers from the Golden Gate Bridge to the location in the estuary where fresh and salt water first mix so that salinity near the bottom of the water column is 2 ppt (about 6 percent as salty as seawater). X2 corresponds to the central axis of open water estuary habitat, or brackish water. When X2 is located within Suisun Bay, the brackish water habitat is widely distributed throughout the slow, shallow waters and marshes of the bay; as X2 moves upstream in the channels of the Sacramento and San Joaquin Rivers, the total surface area of brackish water is reduced, the water channel is deeper, and the currents faster. X2 fluctuates over space and time depending on inflow levels of freshwater from the Delta rivers. In winter, X2 is closer to the Golden Gate Bridge; in summer, it is closer to the mouth of the Delta. The location of X2 is an important proxy for the health and productivity of the estuary, because for a number of bay fish and invertebrate species, each 10-kilometer upstream shift in X2 during the spring corresponds to a two- to five-fold decrease in abundance or survival (SFEP, 2011). The Lower Estuarine River region incorporates the summer extent of X2 during most non-drought years (see Figure 6-6: X2).

Entrapment zone: The marine terminal site is located within the furthest upstream range of the main estuarine entrapment zone. The entrapment zone is an area where suspended materials concentrate as a result of mixing by the outgoing freshwater flow from the Delta above the heavier saltwater flow from the bay. The entrapment zone contains concentrations of suspended materials such as nutrients, plankton, and fine sediments that are often many times higher than in areas upstream or downstream of the entrapment zone (Levine-Fricke, 2004). This trophically rich habitat is thought to be important for the rearing of many fish species. Its precise location between the lower Delta and Suisun Bay varies according to the strength and phase of the tides, and the level of freshwater inflow from the Sacramento and San Joaquin rivers. High freshwater flows from the Delta push the entrapment zone west toward Carquinez Strait; low flows put it closer to the mouth of the Delta. The entrapment zone is most likely to be found in the vicinity of the marine terminal when freshwater flows from the Delta are at their annual autumn low. When the entrapment zone is found near the marine terminal at other times of the year, it is an indication that the estuary bioassemblage is under stress. It is worth noting that similar but smaller mixing zones occur in conjunction with every freshwater stream or channel that flows into the bay.

Marine Terminal Structures

The existing marine terminal structures and rock revetment (rip-rap) used to armor the shoreline provide physical habitat for a number of species. The existing marine terminal consists of approximately 0.8 acre of artificial structure. The marine terminal extends 700 feet perpendicular from the shoreline into the 4,100-foot-wide channel, or across approximately 20 percent of the channel's width. The rip-rap shoreline along the marine terminal is roughly 400 feet long and 15 feet deep. It is composed of large, uniformly sized pieces of concrete rubble.

The existing marine terminal alters local wave and current velocities, which affects the deposition of sediments and consequent distribution of soft-bottom habitat, and increases water circulation around pilings. A thorough discussion of this process is provided in Chapter 17.0: Water Resources.

The marine terminal creates shade, which reduces the light levels below it. Because the marine terminal is long and thin, it produces a narrow, diffuse shadow. The parts of the marine terminal that are oriented north-south produce a shadow that moves across the bottom of the channel throughout the day, while the portions that are oriented east-west produce a permanently shaded area that is inhospitable to plant growth.

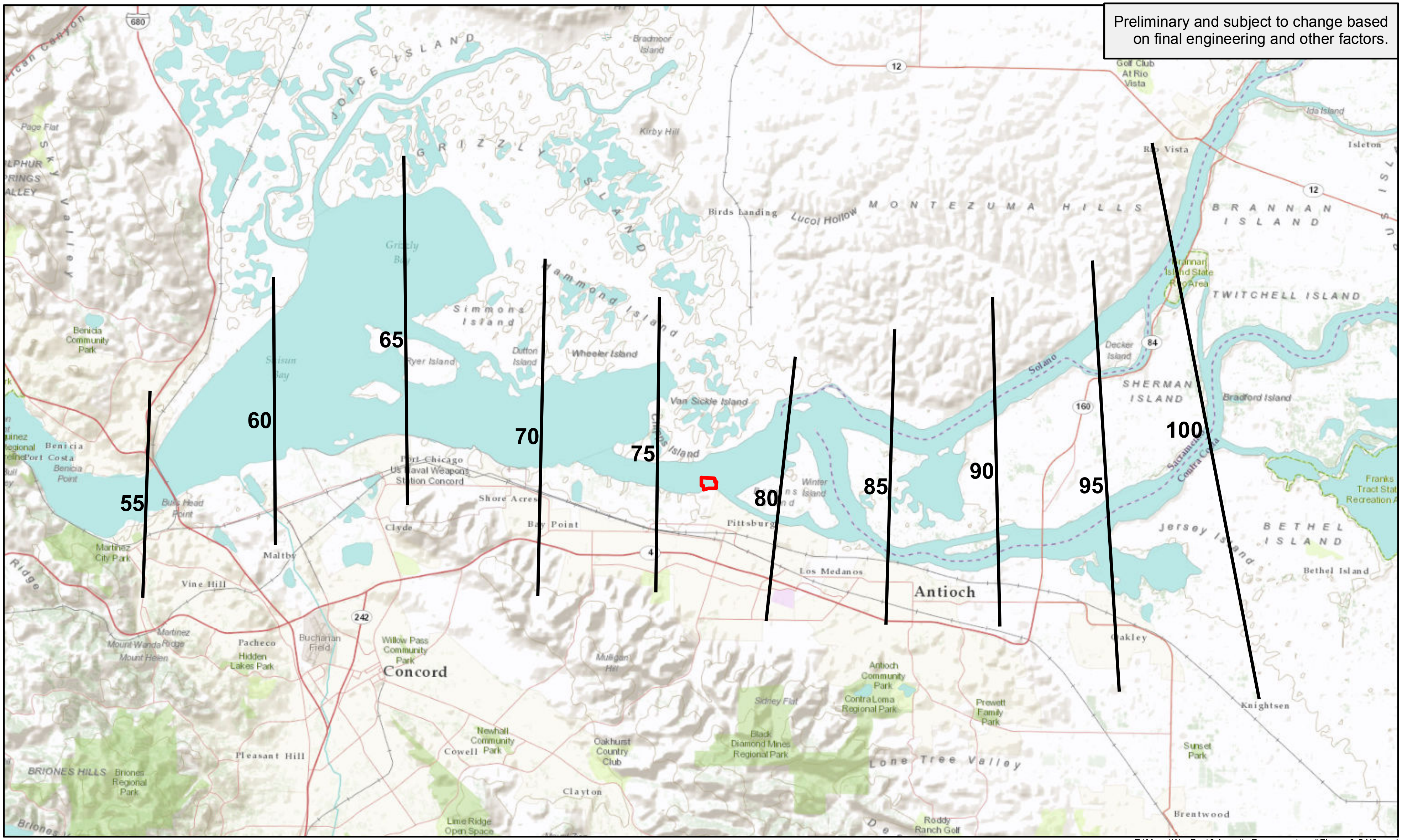
The marine terminal is supported by creosote pilings, which release contaminants such as poly-aromatic hydrocarbons into the water that cause adverse effects to fish health (NMFS, 2004). The increased water circulation around pilings is thought to lessen this impact by diluting the contaminants as they leach (State Coastal Conservancy, 2010).

Sessile invertebrates may cling to the pilings, which also provide a substrate for fish to spawn. The marine terminal also provides shade and refuge for plants and fish, and foraging opportunities for fish, birds, and marine mammals. The marine terminal shadow may increase predation on some fish species by providing a semi-concealed area for predatory fish to lie in wait, perching places for predatory birds, and haulouts for seals and sea lions.

The rip-rapped shoreline provides physical habitat for species as well. Rip-rap is considered to provide similar functions as natural rock substrate; however, because the rock is located in an area that would not have naturally had much rock, it is assumed that most of the aquatic organisms found here are not native to the estuary (State Coastal Conservancy, 2010).

Tidal Marsh

A narrow band of marshland supporting a *Typha* species and/or *Scirpus* species association is found along the shoreline near the existing marine terminal. Special-status plant species are found in this area and are discussed further in Section 6.1.2.5, Special-status Plant Species.



E:\Maps\WesPac\6 Aquatic Resources\mxd\Figure 6-5 X2.mxd

Figure 6-6
X2
City of Pittsburg
WesPac Pittsburg Energy Infrastructure Project

3/22/2013

Terminal boundary
X2 distance from Golden Gate Bridge (km)

DATA: WesPac 2011; ESRI 2011; Jassby 1995

1:200,000

1 cm = 2,000 m

Miles
0 1 2

Soft-bottom Substrate

The marine terminal contains approximately 50 acres of bottom substrate habitat sloping gently from the shoreline to a depth of 70 feet below mean sea level at the north boundary of the site (Foxgrover *et al*., 2005).

The bottom of the water channel at the marine terminal is most likely covered with a fine mud/silt/clay substrate known as soft bottom substrate habitat. This widely distributed habitat is the most common bottom habitat in the bay. Most of the soft sediment in the estuary is composed of particles less than 0.0625 millimeters, which are readily mobilized by tidal currents. The primary source of sediment into the estuary is the watersheds of the Sacramento and San Joaquin rivers. River currents carry sediment into the estuary and deposit it onto the channel bottom. Tidal currents resuspend the fine sediment into the water column. The cyclical deposition and resuspension of fine sediments leads to sorting by grain size, where larger grain sediments are found in the channels and mud/silt/clay accrete into consolidated mudflats near shore. Sediment quality is discussed further in Chapter 17.0: Water Resources, Section 17.1.2.9.

Soft-bottom substrates are characterized by a lack of large, stable surfaces for plant and animal attachment (NOAA, 2007). Because of the lack of hard surfaces for rooting, few plants are associated with soft-bottom habitats. However, though mobile, the fine-grained sediment is both stable and compact enough to support a diverse benthic assemblage. The biotic assemblage associated with this habitat is known as the benthos. Typical benthos at the marine terminal would consist of bacteria and animals that live in (infauna), on (epifauna), or near (demersal) the bottom of the water channel.

Infauna bacteria are stratified by depth, with aerobic respirating microbes at the surface and anaerobic microbes below the depth that oxygen can penetrate. Anaerobic respiration results in denitrification, metal reduction, and methane production, which produces a black, sulfurous layer below the sediment surface. Typical infauna animals would include deposit feeders such as polychaete worms and oligochaetes, and filter feeders such as subsurface bivalves. Typical epifauna on soft-bottom substrates include amphipods and decapods. The benthic invertebrate community in the marine terminal study area annually shifts between an oligohaline association and a mesohaline association with the seasonal shifts in salinity. Common invertebrate taxa on soft-bottom substrates in oligohaline and mesohaline waters are listed in Table 6-3.

The species composition at the benthos is determined largely by salinity levels, thus the oligohaline benthic community is different from the mesohaline community. After die off of the benthic community due to the annual change of salinity levels, it can take months for a new group of organisms to settle and grow. Benthic species that thrive in this radical environment tend to be short-lived, rapidly maturing opportunists that breed multiple times throughout the year and are capable of achieving high adult densities (Nichols, 1985).

The benthic assemblage at and near the marine terminal can be roughly divided into two groups: the channel assemblage and the channel-edge assemblage. Both assemblages are dominated by two invasive clams, *Corbicula fluminea* and *Corbula amurensis*. Channel-edge oligochates, polychaetes, and amphipods are abundant compared to densities in channel assemblages (NOAA, 2007).

This habitat type typically provides benthic foraging for demersal fish such as green sturgeon (*Acipenser medirostris*) and starry flounder (*Platichthys stellatus*). The channel edge may provide rearing habitat for the larvae and juveniles of Sacramento splittail (*Pogonicthys macrolepidotus*), while the channel may provide rearing habitat for longfin smelt (*Spirinchus thaleichthys*). This habitat type may provide foraging opportunities for diving birds such as canvasback (*Aythya valisineria*) and Greater scaup (*Aythya marila*) and may be used for feeding by several marine mammal species such as harbor seal.

<u>Water Column</u>

The water column consists of the area between the benthos and the water surface. It contains both channels, which are areas with strong currents and a deep rounded bottom, and shoals, or shallow weak-current areas. Channels provide a connection between marine and freshwater ecosystems, while shoals function as collection areas for sediment and detritus. The water column provides foraging areas for invertebrates, fish, diving birds, and marine mammals, and nursery and spawning habitat for invertebrates and fish.

Water quality in the vicinity of the marine terminal is discussed further in Chapter 17.0: Water Resources, Section 17.1.2.5, Surface Water Quality. Table 17-2 compares concentrations of nine pollutants with the San Francisco Basin Plan's Marine Water Quality Objectives.

Table 6-3: Common Benthic Invertebrate Taxa

Species	Taxa	Feeding Mode	Growth Form	Salinity					Relative Frequency
				Oligohaline		Mesohaline			
				CE*	C*	CE	SC*	C	
Americorophium spinicorne	Amphipod	Filter and deposit feeder	Tube, free living	x	x				Interannually / seasonally ephemeral
Americorophium stimpsoni	Amphipod	Filter and deposit feeder	Tube, free living	x	x		x		Present into fall only in wet years
Ampelisca abdita	Amphipod	Filter feeder	Tube to surface			x			Dry years-common
Gammarus daiberi	Amphipod	Deposit and scraper	Free living/surface	x	x		x		Present into fall only in wet years
Grandidierella japonica	Amphipod	Filter and deposit feeder	Tube, free living			x			Low number/persistent
Monocorophium alienense	Amphipod	Filter and deposit feeder	Tube, free living				x		Common/persistent
Corbula amurensis	Bivalve	Filter feeder	Surface-subsurface	x	x	x	x	x	Dry years or dry months only
Corbicula fluminea	Bivalve	Filter and deposit feeder	Surface-subsurface	x	x			x	Present into fall only in wet years
Nippoleucon hinumensis	Cumacean	Surface deposit	Free living/surface-subsurface			x	x	x	Low number/persistent
Palaemon macrodactylus	Decapod	Detritus and omnivore	Surface	x					Common/persistent
Rhithropanopeus harissii	Decapod	Detritus and omnivore	Surface	x					Low number/persistent
Synidotea laevidorsalis	Isopod	Carnivore	Free living subsurface			x			Dry years-common
Limnodrilus hoffmeisteri	Oligochaete	Subsurface deposit	Free living subsurface	x	x		x		Common/persistent
Varichaetadrilus angustipenis	Oligochaete	Subsurface deposit	Free living subsurface	x	x				Common/persistent

Species	Taxa	Feeding Mode	Growth Form	Salinity					Relative Frequency
				Oligohaline		Mesohaline			
				CE*	C*	CE	SC*	C	
Heteromastus filiformis	Polychaete	Subsurface deposit	Free living subsurface			x		x	Low number/persistent
Laonome sp.	Polychaete	Surface deposit	Tube to surface	x					Low number/persistent
Marenzellaria viridis	Polychaete	Surface deposit	Tube to surface	x	x	x	x	x	Peak abundance in fall

*CE = channel edge; C = channel; SC = shallow channel

Source: NOAA, 2007

Plankton

Plankton forms the base of the water column food web. Plankton is made up of plants (phytoplankton), animals (zooplankton), and fish eggs and larvae (ichtyoplankton).

Phytoplankton are small floating plants that provide forage for many invertebrates. Representative species found in the water column at the marine terminal include diatoms, dinoflagellates, and cryptonomads (NOAA, 2007). Productivity of the water column habitat depends in part on the growth of phytoplankton. However, because light cannot penetrate through the sediment-heavy water, phytoplankton productivity in the water column here is low and further compromised by the presence of the invasive, nonnative clam *Corbula amurensis*.

Zooplankton are a diverse group that can range in size from microscopic (microplankton) to those that can be seen by the naked eye (macroplankton). This heterogeneous group includes mysid shrimp, clams, jellyfish, copepods, and crustaceans. They feed upon phytoplankton, bacteria, organic detritus, and each other.

The zooplankton community structure in the Suisun Bay region has undergone both long-term and abrupt changes in biomass and species composition (Winder and Jassby, 2011). Following the invasion of *Corbula amurensis*, zooplankton biomass dropped to one third its 1970s levels and the community structure shifted away from a dominance of phytoplankton consumers such as calanoids, rotifers, and mysid shrimp to one that is dominated by detritus consumers such as cyclopoids.

Nonnative jellyfish are found throughout the estuary, including three hydrozoan species thought to be native to the Black Sea and one scyphozoan species thought to be introduced from Tokyo Bay. The hydrozoan species are present among the plankton from May through November, with peak abundances coinciding with warmer summer and fall temperatures. It has been theorized that jellyfish have the ability to passively spread through all low-salinity areas of San Francisco Bay via attachment to boat bottoms (NOAA, 2007).

Icthyoplankton consists of fish eggs and larvae found in near-surface waters, where they float passively on water currents. Ichtyoplankton feed on microplankton and are in turn fed on by larger animals.

Fish

Common fish in the Lower Estuarine River include the recreationally fished striped bass (*Morone saxitilis*) and white sturgeon (*Acipenser transmontanus*). Striped bass are found in the area in fall months and migrate inland to fresh water to spawn in spring. Other species that may be in the project vicinity include yellowfin goby (*Acanthogobius flavimanus*), logjaw mudsucker (*Gillichthys mirabilis*) in the smaller marsh channels, juvenile starry flounder, American shad (*Alosa sapidissima*), and rainwater killifish. Pacific herring (*Clupea pallasii*) are found at low population levels. Special-status species include delta smelt (*Hypomesus transpacificus*), longfin smelt, Sacramento splittail, steelhead (*Oncorhynchus mykiss*), and Chinook salmon (*O. tshawytscha*).

Historically, Suisun Bay supported a population of northern anchovy (*Engraulis mordax*), though population levels were never high compared with the San Pablo and Central bays with their cooler and more saline water columns, and in recent years northern anchovy have virtually disappeared from Suisun Bay. This decline has coincided with the establishment of the clam *Corbula amurensis*, the disappearance of phytoplankton blooms, and declines in zooplankton species (SFEP, 2011).

Overall, populations of fish in Suisun Bay declined in the decades between 1980 and 2010, leading the SFEP to label the condition of the fish community “poor” (SFEP, 2011). Abundance of pelagic fishes was 88 percent lower in Suisun Bay in 2010 than in 1980, with nonnative species predominant, accounting for more than 60 percent of fish caught during sampling across Suisun Bay in the 2000s. At a third of sampling stations, nonnative species accounted for all samples caught. The precipitous drop in abundance of several pelagic fishes in the Delta has become known as the Pelagic Organism Decline (POD); the causes of the decline are under investigation by the POD Management Team, a consortium of state and federal agencies that monitor aquatic organisms and water quality in the San Francisco Bay. Their most recent work plan and synthesis of results explores the hypothesis that the Sacramento-San Joaquin Delta is in the midst of an ecological regime shift that is changing community composition in all niches of the estuary (IEP, 2010).

Birds and Mammals

Both birds and mammals utilize the water column to forage and rest. Common birds that may forage for fish in the vicinity of the marine terminal include gulls such as California gull (*Larus californicus*) and western gull (*Larus occidentalis*), and diving birds such as double-crested cormorant. Marine mammals that may forage for fish in the vicinity include harbor seal (*Phoca vitulina richardii*) and California sea lion (*Zalophus californianus*). These species are addressed in detail in Section 6.1.2.6.

6.1.2.3 San Pablo Bay Pipeline Study Corridor

The San Pablo Bay Pipeline study corridor consists of approximately 10,000 acres of industrial, commercial, residential, and natural uses in Contra Costa County and the cities of Pittsburg and Martinez. Land uses along the existing pipeline are discussed in detail in Chapter 12.0: Land Use and Recreation. This section discusses the subset of land uses that have high habitat and wildlife value, namely the tidal marshes, freshwater wetlands, waterbodies, and streams that, combined, cover over 60 percent of the study corridor (see Figure 6-7: San Pablo Bay Pipeline Study Corridor Habitat).

No delineations of USACE-jurisdictional wetlands were conducted in the San Pablo Bay Pipeline corridor study area. The measurements in the discussion below are derived from desktop analysis of National Wetlands Inventory (NWI), National Hydrography Dataset (NHD), and California Natural Diversity Data Base (CNDDB) layers within a Geographic Information System.

The study corridor contains approximately 90 wetlands mapped in the NWI, encompassing a total of 6,800 acres of wetland habitat (USFWS, 1985). Wetland types include tidal marshes, diked marshes, and freshwater emergent wetland. Four ponds, one lake, and two water-retention basins lie within the study corridor.

<u>Wetlands</u>

Wetlands are defined in Section 404 of the Clean Water Act as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas” (33 CFR 328.3(b)). Wetlands must have all three of the following parameters: (1) hydrophytic vegetation consistent with wetland community composition in at least some part of the year, (2) hydric soils, and (3) periodic inundation by water.

<u>Marshes</u>

Approximately 6,000 acres of tidal marsh are found in the study corridor (USFWS, 1985). Tidal marshes are defined as the vegetated habitat between mean low water and extreme high water (Josselyn, 1983). They are also called salt marshes or saline wetlands. These wetlands intergrade on their bay side with tidal flats and on their inland side with freshwater marshes. Tidal marshes are highly productive biological systems. Though only a small number of vascular plant species are capable of living in these areas, they support unique and diverse communities of plants and animals. Vegetation in tidal wetlands provides forage and cover for nurseries of commercial and endangered fisheries; the grounds are major feeding and nesting areas for birds.

Birds that feed or roost in tidal marshes include herons, egrets, ducks, coots, rails, swallows, wrens, and hawks. The majority of birds that utilize the marshes are migratory and breed elsewhere. Shorebirds that breed in the marshes include American avocet, black-necked stilt, and snowy plover. Mammals found in these areas include mice, shrews, bats, and raccoons. Lizards and snakes are commonly found here, as are frogs and toads. Tidal marshes provide nursery habitat for fish, offering protection, food, and reduced osmoregulatory stress (Josselyn, 1983).

Tidal marshes also provide habitat for serious pests and disease vectors such as salt marsh mosquitoes *Aedes dorsalis* and *Aedes squamiger*, which have been a chronic problem in the bay for over a hundred years. Mosquito abatement activities over the past century have included the installation of miles of ditches through the wetlands with the intent of draining the marshland to eliminate mosquito breeding. This practice contributed to an extensive ditch network throughout the south-shore wetlands, which, owing to the ineffective conveyance of water through the aging network, has led to the promulgation of isolated potholes of water that form the ideal habitat for mosquito propagation (Kramer *et al*., 1992).

The marshes in the study corridor may be grouped into three categories based on whether or not they are exposed to full tidal action and whether they are defined in the CNDDB as a special-status habitat. Tidal marshes are undiked marshes that are subject to tidal action; historically, the shoreline between the cities of Martinez and Pittsburg was composed almost entirely of tidal brackish marsh (Goals Project, 1999). Diked marshes are tidal marshes that are irregularly exposed to tidal flooding. Undiked marshes comprise approximately 2,500 acres of the tidal marshes in the study corridor; the remaining 3,500 acres of tidal marsh is comprised of diked marsh. Approximately 3,000 acres overlapping with the previous two categories is delineated by the CDFW as Coastal Brackish Marsh.

Tidal Marsh

Tidal marshes can be qualitatively divided into low, middle, and high marsh based on tidal inundation (see Figure 6-8: Marsh Zonation). Low marsh consists of the area between MTL and MHW (Goals Project, 1999). These areas are characterized by saline-tolerant plants, usually grasses, which are adapted to regular inundation. In brackish marshes, cattails (*Typha* sp.), California bulrush (*Scirpus* sp.), and alkali bulrush dominate the low marsh. Waterfowl and rails make extensive use of low marshes. Middle marsh consists of the area between MHW and MHHW. Plant species typically found in the middle marsh include bulrushes, spike rush, silverweed, and salt grass. High marsh consists of the area between MHHW and the highest margin of the marsh. Plants typically found in the high marsh include pickleweed, saltgrass, gumplant, and alkali heath.

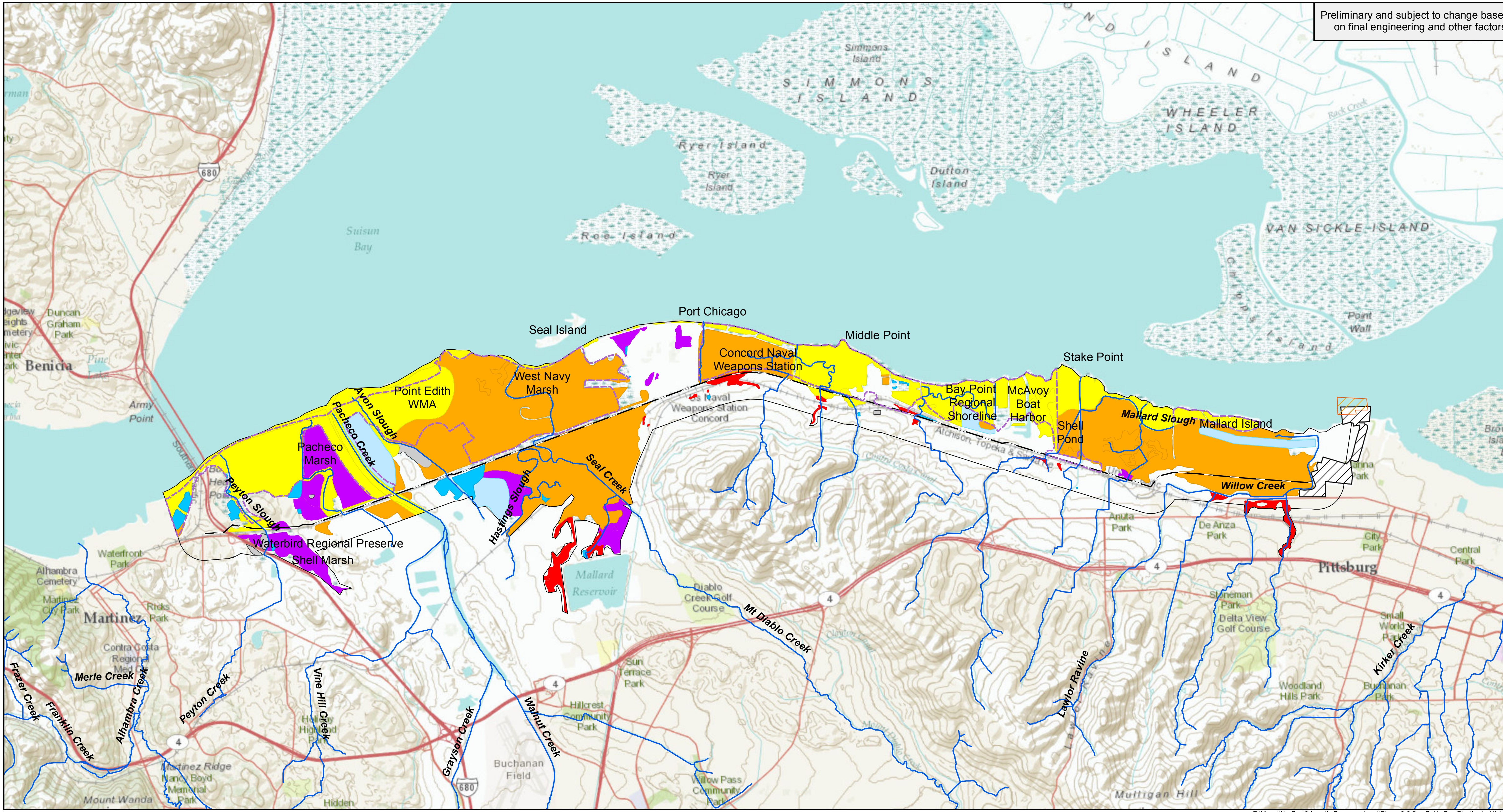


Figure 6-7
Existing San Pablo Bay Pipeline Study Corridor Habitat
City of Pittsburg

TRC

3/22/2013

- Existing San Pablo Bay Pipeline
- Dredging area
- Terminal boundary
- San Pablo Bay Pipeline study corridor
- Streams and canals
- CDFG Coastal Brackish Marsh
- Tidal marsh
- Diked marsh
- Freshwater emergent wetland
- Freshwater emergent wetland - diked/impounded
- Lake
- Pond
- Water basin (manmade)

DATA: WesPac 2011; USGS 2004; NOAA 2005; CNDDB 2011; ESRI 2011

1:63,360

1 in = 1 mi

Miles
0 0.25 0.5

N

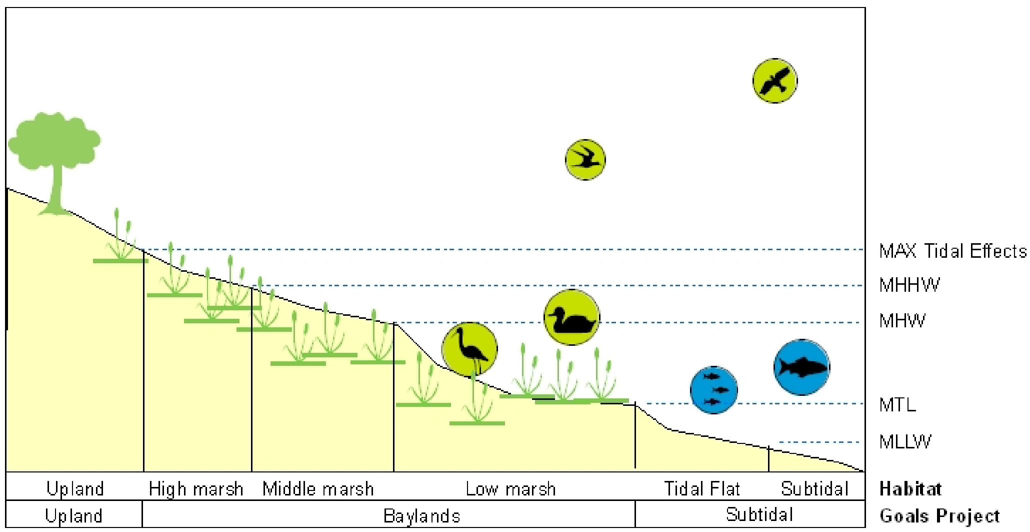


Figure 6-8
Marsh Zonation
City of Pittsburg
WesPac Pittsburg Energy Infrastructure Project

Historically, tidal marshes in the study corridor extended into the lower reaches of local streams and were bordered by well-developed riparian forest stands. Today, the remaining tidal marshes exist in a degraded state with only remnant riparian forest stands, none of which are found in the study corridor. Still, these marshes are considered highly productive, and some support significant populations of special-status species, including soft bird's-beak, Delta tule pea, and salt marsh harvest mouse.

Diked Marsh

Diked marshes were formed during reclamation projects of the last century and prior. Because they are not subject to frequent tidal flushing, these marshes may exhibit hypersaline conditions during summer, when freshwater inflows are low and evapotranspiration levels high (Josselyn, 1983). Restriction of tidal affects into diked wetlands decreases sediment supply to the wetland but, due to the lower flow velocities, allows greater deposition of any sediment that is present in the water column. Wetland topography in diked tidal marshes is more uniform than in undiked tidal wetlands. Channel sedimentation may form shallow isolated ponds, which are breeding grounds for mosquitoes and other disease vectors. Common native plants of diked marshes include pickleweed, saltgrass, bulrush, and cattail. These marshes provide forage, resting, and refugial habitat for waterfowl, shorebirds, and small mammals.

Coastal Brackish Marsh

Approximately 3,000 acres of the tidal marshes in the study corridor are classified as Coastal Brackish Marsh by the CDFG (CDFG, 2011b). The Coastal Brackish Marsh community corresponds to Holland's element code 52200 (Holland, 1986). It is typically dominated by perennial, emergent, herbaceous plants up to 6 feet tall; dominant species include cattails and bulrush. Depending on the salinity, sedges (*Carex* sp.), rushes (*Juncus* sp.), pickleweed, and others may be present.

Within the study corridor, several protected open-space areas contain significant extents of Coastal Brackish Marsh, including Bay Point Shoreline, Point Edith Wildlife Area, and Pacheco Marsh. Additional areas are listed in Table 6-4.

Table 6-4: Coastal Brackish Marsh in the San Pablo Bay Pipeline Study Corridor

Marsh Name	Acres	Owner
Tidal Marsh		
Port Chicago	111	United States Navy
Avon and Hastings Slough	398	United States Navy
Point Edith Wildlife Area	166	California Department of Fish and Wildlife
West Navy Marsh	64.4	United States Navy
Pacheco Marsh	122	Muir Heritage Land Trust, East Bay Regional Park District
Diked Marsh		
Waterbird Regional Preserve	198	East Bay Regional Park District
Bay Point Wetlands Regional Park	150	East Bay Regional Park District

Sources: East Bay Regional Park District, 2011; Goals Project, 1999; Josslyn, 1983

Freshwater Emergent Wetland

The estuarine marshes in the study corridor intergrade with approximately 750 acres of freshwater emergent wetland. The NWI classifies the freshwater wetlands in the study corridor as palustrine wetlands with emergent vegetation (USFWS, 1985). Water regimes for these wetlands vary from temporarily flooded to seasonally flooded, to semipermanently flooded, to permanently flooded. Approximately 550 acres of freshwater emergent wetlands are diked or impounded, mainly in the area south of the Concord Naval Weapons Station.

Freshwater emergent wetlands are among the most productive wildlife habitats in California. They provide food, cover, nesting, and roosting habitat for over 160 species of birds, and numerous mammals, reptiles, and amphibians (CDFG, 1988). Waterfowl breed and overwinter in these marshes, as do shorebirds and terns. Commonly observed bird species in these areas include gadwall (*Anas strepera*), American wigeon (*Anas americana*), northern shoveler (*Anas clypeata*), great blue heron (*Ardea herodias*), killdeer (*Charadrius vociferus*), tree swallow (*Tachycineta bicolor*), marsh wren (*Cistothorus palustris*), and western meadowlark (*Sturnella neglecta*) (Glover, 2007).

Waterbodies

The NWI identifies 21 freshwater ponds and 4 freshwater lakes in the San Pablo Bay Pipeline study corridor (USFWS, 1985). Ponds vary in size from less than 0.10 acre to over 35 acres. Lakes vary in size from approximately 30 acres to 130 acres. All of the ponds and lakes have unconsolidated bottoms. Their water regime varies from semipermanently flooded to permanently flooded; two of the lakes and eight of the ponds are artificially flooded. All of the lakes are located upstream of diked wetlands, as are eight ponds. Half of the ponds are classified as excavated, indicating that they lie within a manmade basin.

Lakes and ponds in the study corridor that contain large bodies of open waters that provide important wildlife services include Shell Pond, McAvoy Boat Harbor, Bay Point Regional Shoreline, Hastings Slough, and the Waterbird Regional Preserve. Freshwater lakes in the study corridor provide foraging habitat for thousands of migratory waterfowl (eBird, 2011).

Streams and Canals

The study corridor contains an extensive and complex system of streams and canals composed of over 30 miles of waterways that collect and drain surface runoff from three watersheds. The NHD records 27 miles of perennial streams, 3 miles of intermittent streams, and 1.5 miles of surface or near-surface aqueducts and canals in the study corridor. In addition, the area contains a network of minor drainage channels designed to reduce stagnant ponding habitat under approximately 75 years of mosquito abatement programs.

Streams in the study corridor can be divided into two classes based on their fish assemblages: Estuarine/tidal riverine and lower mainstem. Estuarine/tidal riverine stream habitats are subject to fluctuating salinity levels and their use is thus restricted to species that are tolerant of a wide range of salinities. Lower mainstem streams are freshwater, nontidal streams that, because the land use surrounding the streams tends to be developed, support predominantly nonnative freshwater species.

All tributaries to the estuary have tidal estuarine conditions near their mouths, and the larger streams in the study area support freshwater to brackish water tidal riverine environments. Native fishes characteristic of the tidal riverine assemblage include white sturgeon, green sturgeon, Sacramento splittail, Delta smelt, longfin smelt, threespine stickleback (*Gasterosteus aculeatus*), prickly sculpin (*Cottus asper*), Pacific staghorn sculpin (*Leptocottus armatus*), tule perch (*Hysterocarpus traskii*), shiner perch (*Cymatogaster aggregate*), longjaw mudsucker (*Gillichthys mirabilis*), and starry flounder (Leidy, 2007). Nonnative fishes include black bullhead (*Ameiurus melas*), brown bullhead (*Ameiurus nebulosus*), white catfish (*Ameiurus catus*), channel catfish (*Ictalurus punctatus*), wakasagi (*Hypomesus nipponensis*), rainwater killifish (*Lucania parva*), western mosquitofish (*Gambusia affinis*), inland silverside (*Menidia beryllina*), striped bass, yellowfin goby (*Acanthogobius flavimanus*), shimofuri goby (*Tridentiger bifasciatus*), and chameleon goby (*Tridentiger trigonocephalus*).

Streams in the study corridor are low gradient, and may have either intermittent or continually running water. Flows are typically low velocity and water volumes high, producing the higher temperatures and turbidity, lower dissolved oxygen, and muddy bottoms typical of estuarine streams. The streams traverse wetlands dominated by emergent vegetation, which sloughs into the stream. The decaying vegetation supports plankton populations, which in turn support a diverse array of species within the stream channel, including mollusks and crustaceans adapted to slow-moving water.

The lowermost mainstem reaches of many streams consists of the area from the tidal zone upstream to about 20 meters elevation. Many of these stream reaches flow through highly urbanized environments, and are channelized or undergrounded for flood control. Summer water temperature and conductivity are high and water clarity and cover are low. Nonnative fishes outnumber native fishes in these reaches.

Dominant nonnative fishes in these streams include common carp (*Cyprinus carpio*), goldfish (*Carassius auratus auratus*), golden shiner (*Notemigonus crysoleucas*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*), redear sunfish (*Lepomis microlophus*), largemouth bass (*Micropterus salmoides*), inland silverside, and western mosquitofish (Leidy, 2007). Rainwater killifish, striped bass, and yellowfin goby may occur within this assemblage nearest the tidal zone. Native fishes occurring as common members of the assemblage include Sacramento sucker, Sacramento blackfish, threespine stickleback, and prickly sculpin, and, near the tidal zone, staghorn sculpin.

6.1.2.4 Special-status Habitats

Essential Fish Habitat

The marine terminal is located within the extent of EFHs for three fisheries plans (NMFS, 2011b):

1. **Pacific Groundfish Fishery**. Over 90 groundfish species (e.g., flatfish, rockfish, sharks) are included in the Pacific Groundfish FMP. The groundfish EFH includes seamounts, water depths less than 3,500 meters, and the upriver extent of saltwater intrusion. In the San Francisco Bay Delta, this definition encompasses all of the Bay and the Delta, and upriver toward the cities of Sacramento and Stockton.

2. **Pacific Salmon Fishery**. In California, Chinook and coho salmon are included in this FMP. This EFH includes all streams and other waterbodies occupied or historically accessible to salmon in specified hydrologic units in the San Francisco Bay Delta Region.

3. **Coastal Pelagic Species Fishery**. This fishery includes four finfish and one invertebrate; however, only the northern anchovy is found regularly in the San Francisco Bay. The geographic extent of this EFH includes all marine and estuarine waters from the shoreline to the limits of the U.S. EEZ; within the water column, it is limited to the water column between the thermoclines where temperatures range from 10°C to 26°C.

The marine terminal is further located within the extent of a groundfish HAPC incorporating San Francisco Estuary from the Pacific Ocean to the west bank of Broad Slough.

Critical Habitat

The project is located within critical habitat for delta smelt (Federal Register, 1994) and the southern Distinct Population Segment (DPS) of green sturgeon (Federal Register, 2009a). PCEs for the delta smelt that are located within the vicinity of the project include the physical habitat, water, river flow, and salinity concentrations required to maintain delta smelt habitat for (1) larval and juvenile transport, (2) rearing habitat, and (3) adult migration. Because of the fluid nature of the San Francisco Bay Delta's hydrology, the quality of the PCEs for the delta smelt fluctuate within the designated area. The final ruling on the critical habitat identifies marina construction as activities that, depending on the season of construction and scale of the project, might result in destruction or adverse modification of critical habitat that could jeopardize the continuing existence of the delta smelt and that would require consultation with the USFWS.

PCEs for the southern DPS of the green sturgeon in the estuary include food resources for all life stages, water flows, water quality, migratory corridors, channel depths, and sediment quality. Dredging, in-water construction, National Pollutant Discharge Elimination System activities, commercial shipping, and habitat restoration are identified in the final critical habitat rule as activities that may affect one or more PCEs through alteration of the physical parameters of the estuary.

The marine terminal is located near, but not in, critical habitat for winter-run Chinook salmon (58 CFR Part 114). Critical habitat for the winter-run Chinook salmon includes the Sacramento River from Keswick Dam in Shasta County to Chipps Island, and all waters downstream of Chipps Island and north of the San Francisco-Oakland Bridge. In its critical habitat designation, the NMFS excluded rivers and sloughs of the Delta as nonessential for the conservation of winter-run Chinook.

6.1.2.5 Special-status Plant Species

This section describes seven special-status plant species that are documented to occur in or that have the potential to occur in the marine terminal study area and the San Pablo Bay Pipeline study corridor (CNPS, 2011):

- Soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*)
- Bolander's water-hemlock (*Cicuta maculata* var. *bolanderi*)
- Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*)
- Mason's lilaeopsis (*Lilaeopsis masonii*)
- Delta mudwort (*Limosella subulata*)
- Suisun Marsh aster (*Symphyotrichum lentum*)
- Saline clover (*Trifolium hydrophilum*)

A special-status plant survey of the shoreline within 250-feet of the marine terminal was conducted by TRC Biologist Michael Farmer on August 29, 2012. The survey was conducted according to the plant survey guidelines and protocols developed by the USFWS, CDFW, and CNPS. The survey results are shown on Figure 6-9.

<u>Soft Bird's-beak</u>

Soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*) is listed as endangered by the USFWS (Federal Register, 1997) and as rare by the CDFG (CDFG, 2011a). It is an erect annual herb in the snapdragon family, *Scrophulariaceae*. Mature plants grow between 4 and 16 inches in height. They are hemiparasitic plants, meaning that although they possess chlorophyll and are thus capable of limited photosynthesis within a laboratory setting, they must attach their root system to that of a host plant to extract water and nutrients and reproduce. Because soft-bird's beak is active during the summer, suitable host plants are those that are also active in summer such as pickleweed, saltgrass, and fleshy jaumea. Soft bird's-beak reproduces from a long-lived seed bank, so colonies may emerge intermittently depending on unknown environmental triggers.

Though never abundant, this plant was historically distributed throughout the marshlands of San Pablo and Suisun bays. Marsh alteration has restricted its current distribution to 11 sites (USFWS, 2010). Of the nine general areas where this species is found, two occur in the San Pablo Bay Pipeline study corridor: Concord Naval Weapons Station and McAvoy Boat Harbor. This species is restricted to the high marsh or upper middle marsh zone of brackish tidal marshes; it is virtually unknown from diked brackish marsh. Loss or degradation of habitat poses the greatest threat to this species, but habitat invasion by nonnative species that reduces the availability of host species also presents a threat to soft bird's-beak. Soft bird's beak blooms April to November. It is threatened by habitat destruction and competition from nonnative species.

Bolander's Water-hemlock

Bolander's water-hemlock (*Cicuta maculata* var. *bolanderi*) is ranked 2.1 by the California Native Plant Society (CNPS) (CNPS, 2011). It is a perennial herb in the carrot family (*Apiaceae*) that inhabits both freshwater and brackish marshes. It is highly toxic, and may cause serious illness or death if ingested. It is widely distributed in the western United States, with documented occurrences in the states of California, Washington, Arizona, and Utah. In California, it is known from 17 occurrences, all of which are in the general region of the San Francisco Bay. It has not been documented within the San Pablo Bay Pipeline study corridor, but has been found both east and west of the corridor.

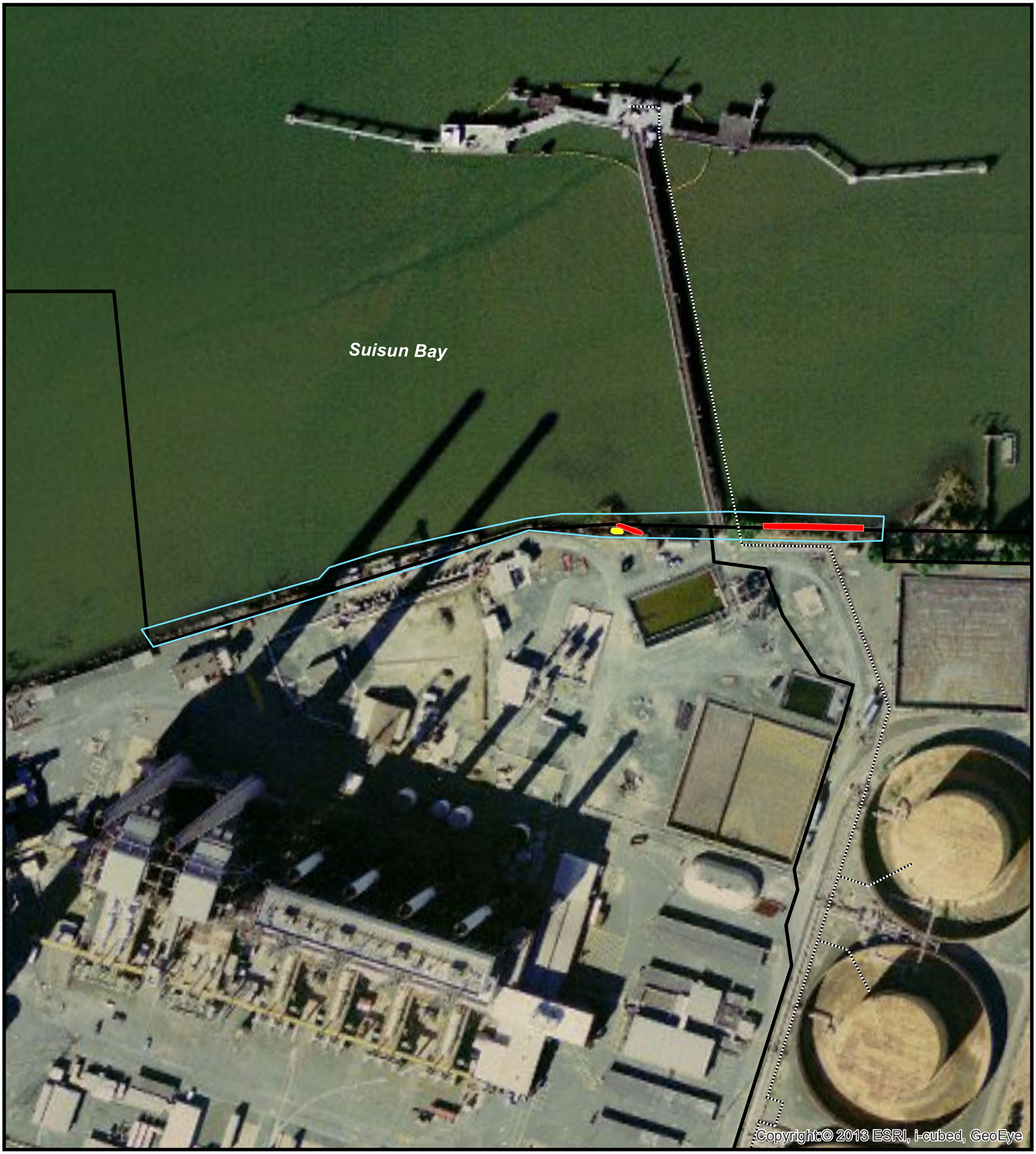
Bolander's water-hemlock blooms from July to September. It is threatened by development, nonnative plants, and hydrological alterations that reduce the amount of available marshland.

Delta Tule Pea

Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*) is ranked 1B.2 by the CNPS (CNPS, 2011). It is a perennial herb in the pea family (*Fabaceae*) that is found in freshwater and brackish marshes. This species is endemic to California, where its distribution is confined to the marshes of the Bay-Delta region. Approximately 130 small populations have been documented. In the San Pablo Bay Pipeline study corridor, this species has been observed on Mallard Island and Seal Island, along Pacheco Slough, at Point Edith Wildlife Area, at Stake Point, at Shell Pond, and at the Concord Naval Weapons Station near Middle Point. Where reported, the population is small (<13 plants), though the Seal Island record states that the plants were common along most of the slough edges (CDFG, 2011b).

A population of Delta tule pea was found intertwined in a blackwood acacia tree (*Acacia melanoxylon*) about 130 feet west of the existing dock was identified during the August 29, 2012 special-status plant survey.

Delta tule pea blooms from May to September. It is a climbing species, most frequently seen climbing tules. It is found most often with Typha/Scirpus association at marsh and slough edges. This species is threatened by agriculture, water diversions, and erosion.



F:\Maps\WesPac\6 Aquatic Resources\mxd\Figure 6-9 Shoreline Rare Plant Survey.mxd

Figure 6-9
Special-Status Plant Survey Area for the Shoreline and Special-Status Species Locations
City of Pittsburg

TRC

4/10/2013

Special-Status Plant Survey Area
Delta Tule Pea
Suisun Marsh Aster
Onshore Pipeline
Terminal Boundary

DATA: WesPac 2011; TRC 2012

N

1:2,400

1 inch = 200 feet

0 75 150 ft

Mason’s Lilaeopsis

Mason’s lilaeopsis (*Lilaeopsis masonii*) is listed as rare by the CDFG and is ranked 1B.1 by the CNPS (CDFG, 2011a; CNPS, 2011). It is a perennial rhizomatous herb in the carrot family (*Apiaceae*). It inhabits brackish or freshwater marshes and swamps and sea-level riparian scrub habitat, where it is a shade-sensitive, early successional colonizer of newly deposited or exposed sediments. Though locally common in Suisun Bay, many populations are ephemeral. Mason’s lilaeopsis is known from nine occurrences in the San Pablo Bay Pipeline study corridor. Colonies tend to be small, less than 5 square miles (m^2), but in good condition. One local population was impacted by the 1988 oil refinery spill (see Impact AR-16 for discussion of this spill). Approximately 50 colonies are scattered along the Suisun Bay shoreline between Middle Point and Mallard Island. Colonies may also be found at the shoreline around Peyton Slough, Pacheco Creek, Seal Island, and McAvoy Boat Harbor.

Delta Mudwort

Delta mudwort (*Limosella subulata*) is ranked 2.1 by the CNPS (CNPS, 2011). It is a perennial stoloniferous herb in the figwort family (*Scrphulariaceae*) that inhabits marshes and swamps. It is possibly found on both coasts of the United States, and is perhaps not native to California. In California, it is known from approximately 50 recent occurrences in the Delta. It is not known to occur within the San Pablo Bay Pipeline study corridor, but several occurrences are documented approximately 2 miles upstream from the facility site. Delta mudwort blooms from May to August. Not enough is known about this species to say with certainty what factors affect its abundance.

Suisun Marsh Aster

Suisun marsh aster (*Symphyotrichum lentum*) is ranked 1B.2 by the CNPS (CNPS, 2011). It is a perennial rhizomatous herb in the *Asteraceae* family, which inhabits brackish and freshwater marshes. This species is endemic to California, where it is known only from the Bay-Delta region. One hundred sixty-nine populations have been documented, four of which are located along within the San Pablo Bay Pipeline study corridor. Colonies are found at McAvoy Boat Harbor, around Middle Point, and along Pacheco Creek. Colonies in the study corridor may contain up to 4,000 plants.

During the August 29, 2012 special-status plant survey, roughly 30 to 40 Suisun marsh aster plants (small and large clusters) were identified between approximately 40 feet and 215 feet east of the existing dock. Another 15 to 20 plants, ranging from a single plant to large clusters, were found between about 100 feet and 140 feet west of the existing dock. The majority of the plants were in full bloom during the survey.

Suisun marsh aster blooms from May to November. It is found in tidally influenced brackish sloughs and riverbanks, associated with Scirpus, Typha, and Juncus sp., and may be found with other rare species such as soft bird's-beak or delta tule pea. It is seriously threatened by loss or alteration of marsh habitat and may also be impacted by herbicide application.

Saline Clover

Saline clover (*Trifolium hydrophilum*) is ranked 1B.2 by the CNPS (CNPS, 2011). It is an annual herb in the pea family, known to occur in marshes and swamps but also hydric annual alkaline grassland and vernal pools. It is endemic to California, where it known from 44 documented occurrences in Central and Coastal California. It is thought that many sites are likely extirpated. This species has not been documented in the San Pablo Bay Pipeline study corridor. The closest occurrence is along the western marshes of Suisun Marsh east of the City of Benicia. Saline clover blooms from April to June. It is threatened by development, trampling, road construction, and vehicles.

6.1.2.6 Special-status Wildlife Species

Fish

Green Sturgeon (Southern Distinct Population Segment)

The Southern DPS of North American green sturgeon (*Acipenser medirostris*) is listed as threatened by the NMFS (Federal Register, 2006) and a species of special concern by the CDFG (CDFG, 2011a).

The green sturgeon Southern DPS is a long-lived anadromous species found in marine and estuarine waters of the North Pacific. The Southern DPS consists of the population segment of green sturgeon that utilizes the Sacramento River and tributaries for spawning. Green sturgeon spend most of their life in marine and estuarine environments. In winter, they aggregate in estuaries and migrate north along the North Pacific coastal shelf. They overwinter in waters north of Vancouver Island and return south in spring. Not all green sturgeon are migratory, however. They may be found in San Francisco Bay throughout the year, though numbers increase in summer with the return of migrants moving into the estuary for feeding, holding, and spawning (Lindley *et al*., 2011).

Green sturgeon reach maturity between 10 and 15 years. Mature green sturgeon are thought to spawn every two to four years. Mature fish enter and migrate rapidly up the Sacramento River in March and April, where they spawn and then either return to the estuary or over-summer and migrate out of the river with the first fall flow event (Heublein *et al*., 2009). Juveniles move from their natal river into the estuary at two years and may remain in the estuary from one to four years before migrating to the Pacific Ocean. In the estuary, green sturgeon are associated with turbid water, where they prey on benthic organisms such as clams and crabs. Green sturgeon live from 40 to 60 years and exhibit cohesive social behavior in overlapping age cohorts.

Sacramento Splittail

The Sacramento splittail (*Pogonichthys macrolepidotus*) was federally listed as threatened from 1999 to 2003, and was most recently found by the USFWS to not warrant protection under the ESA (Federal Register, 2010). It remains a CDFW species of special concern, and is a targeted species of the Delta Stewardship Council (CDFG, 2011a).

The Sacramento splittail is an endemic inhabitant of brackish waters of the San Francisco Bay. Its distribution is limited to the estuary and estuarine environments of large streams, including lower Walnut-San Ramon Creek, where it inhabits small, shallow, turbid sloughs lined with emergent vegetation (Leidy, 2007). Splittail reach maturity around two years of age and may live up to seven years. Mature splittail migrate into freshwater floodplains for the winter to forage and hold until spring spawning. Spawning occurs from late February to July, with peak spawning in March and April. Adults return to the estuary after spawning. Young-of-year splittail move into the estuary between April and August where they inhabit broad shoals or channels of intertidal habitat at the mouths of estuarine streams (Feyrer *et al*., 2005). Juvenile splittail are tolerant of a wide range of temperature and salinity and can adapt to low dissolved oxygen levels and strong water currents (Young and Cech, 1996). Splittail are benthic feeders of macroinvertebrates and detritus. Feeding activity is greatest in the morning and early afternoon and peak growth is between May and September (Daniels and Moyle, 1983).

Longfin Smelt

The longfin smelt (*Spirinchus thaleichthys*) is listed as threatened by the CDFW (CDFG, 2011a). The USFWS has found that this species is in need of protection but will not be immediately considered for listing as an endangered species (77 CFR 19756, 2012). The longfin smelt is a small, pelagic fish distributed along the Pacific Coast of North America. San Francisco Bay supports the most southerly distributed and largest population in California. Longfin smelt mature at two to three years of age. They are partially anadromous, with at least some portion of the population of first-year smelt migrating in spring into coastal waters beyond the Golden Gate Bridge. Little is known about their movements in coastal waters, but they return to the bay in their second winter just before spawning season (Rosenfield and Baxter, 2007). Mature fish gradually migrate upstream December through February to spawn in fresh water. Longfin spawning occurs in fresh water over sandy-gravel substrates, rocks, and aquatic plants; the downstream extent of spawning is near the City of Pittsburg (LTMS, 2009). Larvae develop a swim bladder and move downstream into the estuary January through March.

Longfin smelt juveniles and adults feed on small copepods, though adults will also consume mysid shrimp when available. Longfin smelt can be found in the bay throughout the year. Juveniles and adults aggregate in cooler waters in deep-water habitats and are thought to be intolerant of higher temperatures (>22°C), thus, between approximately June and September, they are most abundant in the Central Bay (Rosenfield and Baxter, 2007). Longfin smelt prefer deep channel areas (> 7 meters) over shallower shoals (< 7 meters). Data from the CDFW's Fall Midwinter Trawl Surveys, which surveys September through December, show longfin smelt are found in the ship channel near the marine terminal throughout the fall, with numbers rising through November and average forklength generally rising through December as mature longfin smelt migrate upstream (see Table 6-5). Like the delta smelt, longfin smelt distribution is correlated with the inland intrusion of saline waters, and they are relatively abundant in the Lower Estuarine River in all seasons of drought years (CDFG, 2008d; Wang, 1991).

Table 6-5: Average Longfin Smelt Catch off New York Point 1996-2006

Month	Average Number of Longfin Caught	Average Forklength (millimeters)
September	17	57.6
October	120	59.8
November	261	60.1
December	14	66.9

Source: CDFG, 2008d

Delta Smelt

Delta smelt (*Hypomesus transpacificus*) is listed as threatened by the USFWS (Federal Register, 1993) and endangered by the CDFW (CDFG, 2008a). Delta smelt is a small, annual species endemic to the estuary. Delta smelt spend much of their lives in the brackish waters of the estuary. They are weakly anadromous; after the first high-winter flow, mature smelt migrate upstream in pulses between December and April to spawn in fresh water. Delta smelt most likely use selective tidal swimming behavior to reduce energy expenditure by migrating during periods of slack water (Sommer *et al*., 2011). Most delta smelt die after spawning. By the beginning of June, most larvae have entered a post-larvae state (15 to 25 millimeters) in which have they developed a swim bladder and drifted passively downstream to rear in the brackish waters of the estuary. By the end of June, most smelt that will survive the winter are in the estuary and have entered the juvenile stage (20 to 40 millimeters). June through August represents the delta smelt's primary growing season. Delta smelt attain maturity between November and January when they are 50 to 80 millimeters in length (Bennet, 2005).

In the estuary, delta smelt are distributed within turbid waters over large shoals (depth < 7 meters) at the freshwater edge of the entrapment zone, where they feed on small crustaceans such as copepods and amphipods in the trophically rich waters (Bennet, 2005).

Delta smelt distribution is highly correlated with the location of X2, which in turn depends on the volume of freshwater flow from the Central Valley Project and State Water Project, two of the world's largest water-diversion projects. Water flows into the Delta are partially dependent on the previous water year's water index. Water years are measured from the October of the previous year through September of the current year. The water index for the water year is estimated by the Department of Water Resources starting in December; the final water index is available May 1.

During the summer, X2 and the entrapment zone are typically located in Suisun Bay. Under the provisions of the USFWS Biological Opinion, issued to the Central Valley Project and State Water Project in the fall following wet years in the Sacramento Basin, freshwater flows are expected to be sufficient to create an average X2 of 74 kilometers in September and October. This maintains the central axis of delta smelt distribution in Suisun Bay (DWR, 2011; USFWS, 2008). Following the fall of above-normal water years, fall X2 will be maintained at 81 kilometers, at the confluence of the Sacramento and San Joaquin rivers. No additional releases are triggered following water years with a below normal or dry water index.

Table 6-6 shows the average catch off New York Point from 1996 to 2006.

Table 6-6: Average Delta Smelt Catch off New York Point 1996-2006

Month	Average Number of Delta Smelt Caught	Average Forklength (millimeters)
September	72	50.9
October	1	59.8
November	2	63.1
December	9	56.7

Source: CDFG, 2008d

Chinook Salmon

Chinook salmon are born in fresh water and migrate into the Pacific Ocean to mature, reaching maturity between one and three years of age. They migrate into swift-running natal streams to spawn over gravel beds in places where cold, fast, shallow water oxygenates the water around their eggs. Salmon die after spawning. Their eggs incubate for several months. After hatching, fry undergo physiological changes in preparation for migration and enter the smolt stage. Most Chinook smolt migrate to the ocean within a few months of hatching, though some may remain in fresh water for a year.

There are four runs of Chinook salmon that pass by the project site to access Central Valley streams or, as juveniles, outmigrate to the ocean. These four runs are generally differentiated by their time-of-spawning migrations. The four runs of Chinook salmon are: fall-run, late fall-run, winter-run, and spring-run.

Fall-run Chinook Salmon

Central Valley fall-run Chinook salmon are presently the most numerous of the four runs of salmon, and they are also the variety used for most hatchery production. As they can be spawned as they arrive at the hatchery and their fry have to be reared for a relatively short time before being released, the fall-run fish are ideal for hatchery propagation (Moyle *et al*., 2008). The mature fish leave the ocean and migrate upstream past the project area mostly in September through November. These fish spawn in Central Valley rivers October through December, shortly after arriving. Juveniles emerge from the gravels in December through March, moving downstream into the main rivers within a few weeks of emergence. The young fish enter the San Francisco Estuary as both fry and smolts (smolts are young salmonids that have changed color and gill and kidney functions to process salt water). This outmigration starts in December (Brandes and McLain, 2001) and peaks from March through April, but it may extend into May and June by the time the smolt enter the estuary. Juvenile fall-run Chinook salmon may rear in the estuary for some time prior to completing their journey to the Pacific Ocean. After two to five years at sea, the adult fish begin their spawning migration.

Late Fall-run Chinook Salmon

The NMFS considers the fall-run and the late-fall run Chinook salmon to be one distinct evolutionary significant unit (ESU). This is why they are often grouped together when discussing these two runs of Chinook salmon. Late fall-run Chinooks migrate into fresh water to spawn mostly during December and January, although they have been recorded from November through April (Moyle *et al*., 2008). As these are mature fish, spawning occurs shortly after arrival at riverine spawning areas. Fry emerge from April through early June, but they may hold in the river for 7 to 13 months before outmigrating to the ocean. Peak outmigration occurs in October, but may occur most months of the year (Moyle *et al*., 2008).

Winter-run Chinook Salmon

The winter-run Chinook begin their spawning migration as immature adults, migrating upstream from January to May with a migration peak in March. Reaching the Sacramento River below Keswick Dam (forming Lake Shasta), they hold for several months until spawning from April through early August (Moyle *et al*., 2008). Emerging from the gravels between July and mid October, the young fish rear for 5 to 10 months before outmigrating. Juvenile entry to the Sacramento-San Joaquin Delta is typically from January to April.

Spring-run Chinook Salmon

The spring-run Chinook salmon migrate as immature adults in the spring, spend the summer in deep pools of their natal river, and spawn in early fall. Their young may outmigrate after a few months or spend a year in fresh water (Moyle *et al*., 2008). The spawning migration is generally from February to early July with the peak of the run entering their natal stream in April or May. Throughout the summer, the adult salmon may move gradually upstream from pool to pool. The age of spawning for spring-run Chinook varies from two to four years old. The emerged fry may spend a few months in their natal stream, then outmigrate from December through March (USFWS, 1987). Peak downstream migration of juvenile spring-run Chinook salmon through the Lower Estuarine River is November to December (CDFG, 2004).

Steelhead

Central Valley steelhead mature between two and three years of age. They are mainly “winter” run, though a small summer-run population exists. The small summer-run population migrates into the Sacramento River starting in July. The majority of steelhead begin migration in the fall. Spawning migration peaks in September and October and may continue through February or March. Unlike the Chinook salmon, not all steelhead die after spawning. Some may return to the ocean and return to spawn several times. Most juvenile steelhead spend one to two years in fresh water before migrating toward the ocean in the winter and spring, with an outmigration peak in mid-March (Moyle *et al*., 2008). USFWS trawl data from Chipps Island, indicate that juvenile steelhead are present in Suisun Bay from at least October through July, with hatchery fish (clipped adipose fin) emigration peaking between January and March, and wild juvenile outmigration more evenly spread out over six months or more (USFWS, 2008). The difference in emigration peak is a reflection of the timing of hatchery releases of juvenile steelhead. Fish salvage data from the Delta pumps indicate that most steelhead move through the Delta from November to June, with the peak numbers occurring in February through April (USFWS, 2008).

Birds

Pacific Flyway

Suisun Bay is a major stopover for birds migrating along the Pacific Flyway. Nearly half of Pacific Coast waterfowl and shorebirds depend upon the bay and its mudflats for foraging during migration (SFEP, 2011). In recognition of its critical conservation importance for shorebirds, San Francisco Bay is listed as an important shorebird migratory stopover in the Western Hemisphere Shorebird Reserve Network (USFWS, 2002). Migratory stopovers are wetlands and associated habitats that have high densities of food available at critical times during waterfowl and shorebird migration. These migrations are energy intensive and may include long-distance, non-stop flights of over 1,000 miles between stopover areas. Migrating flocks are large and migrations may occur in a very tight window, resulting in a large proportion of a species' entire population visiting a single sight over a few weeks and requiring a vast quantity of available forage.

Coastal Seabirds

Coastal seabirds are a subset of seabirds that seldom range far from land. They utilize estuarine, freshwater, near-coastal marine waters, and occasionally terrestrial areas for foraging, and then return to terrestrial roosts at night. Their primary method of hunting is to dive for food, propelling themselves underwater using either wings or feet. Some species included in this assemblage such as double-crested cormorant have broad distributions ranging far inland, and segments of the population are permanent inland inhabitants. The 13 seabird species that may utilize the areas around the marine terminal and within the San Pablo Bay Pipeline study corridor for rest or foraging do not breed in either study area, though colonies of all 13 species are found within the regional study area (see Table 6-7).

Waterfowl

Dabbling ducks such as northern pintail (*Anas acuta*), northern shoveler (*A. clypeata*), and mallard (*A. platyrhynchos*) that feed on small invertebrates and plant material populations have increased in Suisun Bay since the late 1980s. Populations of diving ducks, which feed on large invertebrates such as clams, have been stable. The marshes along the pipeline provide vital winter habitat for approximately 30 species of waterfowl (eBird, 2011). Large populations of northern shovelers are reported within the San Pablo Bay Pipeline study corridor, with sightings in excess of 12,000.

Table 6-7: Seabirds, Waterfowl, and Shorebird Species in Suisun Bay

Seabirds	Waterfowl	Shorebirds
American white pelican	American green-winged teal	American avocet
Bonaparte's gull	American wigeon	Black-bellied plover
Brown pelican	Barrow's goldeneye	Black-necked stilt
California gull	Blue-winged teal	Dunlin
Caspian tern	Canada goose	Greater yellowlegs
Double-crested cormorant	Canvasback	Killdeer
Forster's tern	Cinnamon teal	Least sandpiper
Glaucous gull	Common goldeneye	Lesser yellowlegs
Herring gull	Eared grebe	Long-billed curlew
Mew gull	Gadwall	Long-billed dowitcher
Ring-billed full	Greater scaup	Marbled godwit
Thayer's gull	Greater white-fronted goose	Short-billed dowitcher
Western gull	Green-winged teal	Spotted sandpiper
	Horned grebe	Western sandpiper
	Lesser scaup	Willet
	Mallard	
	Northern pintail	
	Northern shoveler	
	Pied-billed grebe	
	Ring-necked duck	
	Surf scoter	

Sources: CADC, 2011; eBird, 2011

Shorebirds

Shorebirds can be found in both the tidal marshes and diked wetlands in the San Pablo Bay Pipeline study corridor and in the open waters of the Lower Estuarine River. Of the 53 shorebird species addressed in the 2001 U.S. Shorebird Conservation Plan, 14 are represented in birding checklists from surveys within the San Pablo Bay study corridor. Of these, American avocet and killdeer are local breeders. The bay is also the site of important populations of long-billed curlew (*Numenius americanus*) and marbeled godwit (*Limosa fedoa*), while the short-billed dowitcher (*Limnodromus griseus*) is listed as a USFWS bird species of conservation concern.

Pelagic Species

Least Tern

The least tern (*Sterna antillarum*) is listed as endangered by the USFWS (Federal Register, 1970) and the CDFW (CDFG, 2011a). California least terns are migratory breeders in California, where they establish large nesting colonies on sparsely vegetated sandy beaches along the ocean, lagoons, and bays. The species breeds along shorelines in the San Francisco Bay, and on ocean beaches in southern California. A total of 6,744 breeding pairs were observed in 2007, compared with fewer than 500 in 1970 (Marschalek, 2008). Four hundred thirty-six breeding pairs were observed in the San Francisco region, including seven pairs along Mallard Slough at the NRG Energy, Inc. Pittsburg Generating Station approximately 0.75-mile southwest of the marine terminal, accounting for 6.5 percent of the total number of breeding pairs statewide. 202 fledglings were observed in the San Francisco region, though none were seen at Pittsburg Generating Station.

Least terns generally arrive at nesting areas mid-April and depart by late September. There are two “waves” of nesting during this time, one in mid-May and the second in June. Both parents incubate the eggs, which hatch in approximately three weeks. Young fledge at four weeks. The primary threat to least tern is loss of habitat for both nesting and forage species, and nest predation by gulls, owls, herons, feral cats, and rats.

Marsh Birds

Suisun Salt Marsh Song Sparrow

This subspecies is listed as a bird species of special concern by the CDFW (CDFG, 2011a). The Suisun salt marsh song sparrow (*Melospiza melodia maxillaris*) is an endemic resident species of Suisun Bay salt marshes where its prime habitat consists of tall brackish marsh with full tidal flows. Populations of Suisun salt marsh song sparrow are dependent upon the availability of suitable tidal marsh habitat within the range of the species. It is thought that its populations decreased proportionately to the decrease in tidal marsh. Current population estimates, which are based on the acreage of available habitat rather than pair counts, estimate that enough habitat exists to support approximately 10,000 pairs (Goals Project, 2000).

This species establishes small territories (roughly 30 feet wide) within marsh vegetation, which they use for food (insects and seeds), roosting, and nesting. Their prime habitat is located in marsh with full tidal flow; however, they have also been found in diked marshes, though it has not been determined if they can successfully nest there. Nesting occurs between March and June, though nesting attempts later in the season may fail due to increased flooding caused by late spring/early summer high tides. Young sparrows are able to disperse only a limited distance (< 200 meters on average) and adults tend to stay within the confines of their territories; thus fragmentation of habitat via localized degradation can have a disproportionately great effect on this species (Goals Project, 2000).

Salt Marsh Common Yellowthroat

Salt marsh common yellowthroat (*Geothlypis trichas sinuosa*) is listed as a bird species of special concern by the CDFW (CDFG, 2011a). It is a year-round resident in San Francisco Bay, where it migrates annually between its winter grounds in salt marshes and breeding grounds in fresh water to brackish marshes. In 1997, the population size was estimated to be between 6,000 to 11,000 breeding birds (Goals Project, 2000). Recent recorded observations have established that some small populations of yellowthroats breed east of the Carquinez Strait in marshlands at and near Point Edith Wildlife Area (CDFGb, 2011; PRBO Conservation Science, 2005).

Salt marsh common yellowthroat males begin to establish territories in mid-March in preparation for the March to July breeding season. Nests, which are constructed by females, are typically found low to the ground in marsh scrub. Incubation and fledging lasts about three weeks. Yellowthroats preferentially inhabit marsh edges (Goals Project, 2000).

California Black Rail

California black rail (*Laterallus jamaicensis*) is listed as threatened by the CDFW and is a fully protected species (CDFG, 2011a). It is included on the USFWS birds of conservation concern list. This species is found in tidal marshes, where it preferentially occupies pickleweed marsh. Breeding populations are found in both the San Francisco Bay and Morro Bay. It is relatively abundant in Suisun Bay marshes, where its populations are considered stable.

Rails are found in densely vegetated wetlands with easily penetrated understories that facilitate movement. They require dense marsh vegetation contiguous from the low- to high-tide zones for protection from predators. Primary rail forage consists of insects and crustaceans. Nesting season begins in February and extends at least through April. Predators of California black rail include northern harrier, great egret, and great blue heron, which hunt rails along the marsh periphery during extreme high tide when the rails are forced to seek cover at the top of emergent vegetation. This species is vulnerable to habitat loss and degradation.

California Clapper Rail

The California clapper rail (*Rallus longirostris*) is listed as endangered by the USFWS (Federal Register, 1970) and the CDFW, and is a CDFW fully protected species (CDFG, 2011a). The California clapper rail is restricted to tidal salt marshes, where it feeds on crustaceans, insects, and small mammals. Historically, clapper rails were abundant in all tidal marshes in the estuary and bay, with the largest populations found in the South Bay. Clapper rails were never abundant in Suisun Bay marshes, though they have been found in low numbers in the shoreline marshes from Martinez east to the Concord Naval Weapons Station. Recent surveys indicate that clapper rails are sporadically present in marshes around Pacheco Creek and Point Edith Wildlife Area (USFWS, 2010).

Clapper rails are secretive diurnal birds and difficult to observe in the dense upper-middle or high tidal marsh zone vegetation that they preferentially inhabit. Clapper rails build their nests within 1.5 meters of narrow wetland channels. They are sensitive to disturbance during the breeding season. Nesting occurs anytime from February through June. Breeding pairs may build several platform nests, but use only one for incubation. Other platform nest may be used as high-tide refuges by the pairs' young-of-year. Adults remain and forage with their chicks for up to six weeks. Adults have a limited dispersal and an average home range of less than 10 acres. California clapper rails are impacted by predation, contaminants, and habitat loss and degradation.

<u>Mammals</u>

Northern Salt-marsh Harvest Mouse

The northern salt-marsh harvest mouse (*Reithrodontomys raviventris halicoetes*) is listed as endangered by the USFWS (Federal Register, 1970) and the CDFW, and as a fully protected species by the CDFW (CDFG, 2011a). It is an endemic species found only in the salt marshes of the San Francisco Bay, where it preferentially inhabits pickleweed vegetation in the middle zone of the marsh. Its distribution and abundance is not well understood, but it is assumed to be found wherever there is suitable habitat (CDFG, 2005). In the Suisun Bay area, it is found in mixed saline/brackish marsh. It is found in the marshlands immediately west of the existing project site and throughout the San Pablo Bay Pipeline study corridor. The most current abundance estimates are derived from biological surveys conducted for land-use changes and are not considered to present a complete picture of northern salt-marsh harvest mouse population levels

(USFWS, 2010). In the San Pablo Bay Pipeline study corridor, the populations found in tidal marshes are considered stable, while the populations found in diked marshes are considered unstable depending on the quality of water management. In diked marshes, abundant mice populations may develop in areas of extensive tall (>6 inches), dense pickleweed vegetation; marshes that are unmanaged or poorly managed are vulnerable to flooding, which causes extirpation of the local mouse population.

The salt-marsh harvest mouse is a fecund species. Males are sexually active April through September, while females are sexually active March through November. Average foraging range is 0.5 acre. They feed on the green vegetation and seeds of pickleweed and other plants of the middle zone of the marsh. It was previously thought that individuals of this species would not leave thick cover or traverse bare ground, thus limiting dispersal (Josselyn, 1983); more recent studies have shown that movement through open areas such as roads and levees are not restricted to rare or extraordinary events, and mice may seasonally exploit grasslands that are adjacent to tidal marshes (Bias and Morrison, 1999). Habitat loss and degradation through filling of marshes and invasion by nonnative species are the primary threats to salt-marsh harvest mice.

Marine Mammals

Distribution of marine mammals is related to availability of prey species (NOAA, 2007). Seven species of marine mammals occur in the San Francisco Bay. However, only two have been reported to venture into Suisun Bay.

Harbor Seal

Harbor seals are protected under the MMPA (50 CFR 216). Harbor seals are permanent residents in San Francisco Bay. They are widely distributed in the North Pacific. Most recent population estimates for the California stock of harbor seals is 30,196 individuals (NMFS, 2011a). Although overall populations of harbor seals have increased since passage of the MMPA, the population of harbor seals in San Francisco Bay has held steady at approximately 600 individuals. Seals from the San Francisco Bay have been shown to migrate out of the bay and become resident in coastal areas (Lidicker and Ainley, 2000). In Suisun Bay, they are known from Garner Point (NOAA, 1998).

Harbor seals show site fidelity in choice of resting sites. They feed on fish in the deeper waters of the bay. Feeding frequency is greater at night. Pups are born in spring. There are no pupping sites in Suisun Bay. This species is not considered to be at risk from human-related activities that might cause mortality (NMFS, 2011a); however, they are susceptible to human-caused disturbance and will flush from haul-out sites from disturbances occurring as far away as 300 meters (Lidicker and Ainley, 2000).

California Sea Lion

California sea lions are protected under the MMPA (50 CFR 216). In 2009, the California sea lion was recognized as a full species. The most recent population estimate is 296,750 individuals (NMFS, 2011a). Since censuses began in the mid-1970s with the passage of the MMPA, populations have trended upwards and are now considered stable. Within the San Francisco Bay, a large haul-out is found at San Francisco's Pier 39. This species breeds on islands off the coasts of southern and Baja California. Populations are impacted by El Nino, accidental mortality associated with commercial fishing, and poisoning from toxic algal blooms.

6.1.2.7 Fisheries

Sport Fishery

The project is located in the CDFW Valley Fishing District. Species that are fished recreationally in the Lower Estuarine River include salmon, splittail, shad, catfish, white sturgeon, steelhead salmon, and striped bass (CDFG, 2012a). Annual fishing restrictions are decided by the CDFW in April and published to the website in May. Typically, restrictions are placed on the time and number caught. Striped bass, white sturgeon, and Sacramento splittail may be fished year round with restrictions on size and number taken (generally fewer than two). Other sport fishes may be fished year-round without size limit, though with a five fish limit.

One charter/private boat sport service is located near the marine terminal. The closest charter service is Fish Hookers, a sportfishing charter service that operates out of the City of Pittsburg Marina, located approximately half mile upstream of the marine terminal. Fish Hooker's Delta season runs from October 1 to May 31 of each year (Fish Hookers, 2011).

Shoreline access for fishing is found immediately adjacent to the marine terminal at the Pittsburg Jetty at Riverview Park. At its closest, this jetty is 300 feet north of the project boundary and 600 feet north of the marine terminal's physical structure. Fishing is allowed from the jetty day and night.

Commercial Fishery

Suisun Bay does not support a significant commercial fishery, though shrimp are trawled for sale as bait to sports anglers (CSLC, 2012). The amount harvested fluctuates with availability of shrimp and demand by sport anglers, with peak harvest June through November. Shrimp abundance in Suisun Bay fluctuates seasonally in response to temperature, with densities lowest in the winter and highest in spring. In Suisun Bay, shrimp are found in areas with water velocity <0.12 m/s (NOAA, 2007). Biomass and numbers of shrimp have declined throughout the Estuary, though not as swiftly in Suisun Bay as in other bays (Hennessy, 2011).

6.1.2.8 Non-native Species

The San Francisco Estuary has been described as one of the most invaded ecosystems in North America (Cohen and Carlton, 1995). Introduced species dominate many parts of the Bay, to the extent that in some locations only introduced species can be found. In 2010, the CDFG collected 497 species from ports, harbors, estuaries and the outer coast, of which 98 species were classified as introduced, including three newly arrived non-native species that had likely been spread from other locations in California (CDFG & OSPR, 2011). Non-native species have been introduced to the Bay via a number of vectors, including the deliberate introduction of species for recreational or commercial purposes. Transoceanic vessel traffic has been identified as one of the major vectors of non-native species, and hull fouling and ballast water are the single largest contributor of non-native species to the Bay.

Though some non-native species are benign or beneficial, others have the potential to become invasive. Invasive species may compete directly with native species for food or space or prey upon native species. Invasive species can also change the food chain or physical environment to the detriment of native species. The most important invasive species in the project vicinity is the overbite clam, *Corbula amurensis,* which is discussed in the impact analysis Aquatic Resources-18 (AR-18). Thought to have been introduced in the bay by ballast water exchange from a cargo ship, this phytoplankton eater species is now so abundant that the current population is capable of filtering the estuary's water column several times a day and has caused a crash in the abundance of phytoplankton in the Bay (SFEP, 2004).

Both invertebrate and vertebrate non-native aquatic species are found in the vicinity of the marine terminal or within the streams along the San Pablo Bay Pipeline (see Table 6-8). Of the 67 invertebrate species known to occur at New York Point, only 15 species can be reliably identified as native to California. The remaining species are introduced (n = 19; see Table 6-8), cryptogenic (n = 3), or are of unresolved origin (n = 30). Non-native fish are found in the water column in the Lower Estuarine River. Of the 32 species of fish collected by CDFW's Fall Midwater Trawl in the Lower Estuarine River between 1967 and 2006, 10 were non-native. Along the San Pablo Bay Pipeline study corridor, Leidy estimated that half of species of the tidal riverine assemblage and two-thirds of the species in the lower mainstem assemblage were non-native.

Table 6-8: Introduced Species in the Project Vicinity

Invertebrates	
Phylum	***Species***
Annelida	*Alitta succinea* *Branchiura sowerbyi* *Laonome sp. SF1 Norris*
Arthropoda	*Ampelisca abdita* *Amphibalanus improvisus* *Amphibalanus improvises* *Exopalaemon modestus* *Gammarus daiberi* *Gammarus daiberi* *Nippoleucon hinumensis* *Sinelobus* sp. (of Cohen 2007) *Sinocorophium alienense* *Sinocorophium heteroceratum* *Synidotea laticauda*
Chordata	*Diplosoma listerianum*
Ectoprocta	*Conopeum tenuissimum* *Membranipora chesapeakensis*
Mollusca	*Corbicula fluminea* *Corbula amurensis* *Littoridinops monroensis*
Vertebrates	
Tidal riverine assemblage	
Black bullhead (*Ameiurus melas*) Brown bullhead (*Ameiurus nebulosus*) White catfish (*Ameiurus catus*) Channel catfish (*Ictalurus punctatus*) Wakasagi (*Hypomesus nipponensis*) Rainwater killifish (*Lucania parva*) Western mosquitofish (*Gambusia affinis*) Inland Silverside (*Menidia beryllina*) Striped bass (*Morone saxatilis*) Yellowfin goby (*Acanthogobius flavimanus*) Shimofuri goby (*Tridentiger bifasciatus*) Chameleon goby (*Tridentiger trigonocephalus*)	

Lower mainstem assemblage
Common carp (*Cyprinus carpio*) Goldfish (*Carassius auratus auratus*) Golden shiner (*Notemigonus crysoleucas*) Green sunfish (*Lepomis cyanellus*) Bluegill (Lepomis macrochirus) Pumpkinseed (*Lepomis gibbosus*) Redear sunfish (*Lepomis microlophus*) Largemouth bass (*Micropterus salmoides*) Inland silverside (*Menidia beryllina*) Western mosquitofish (*Gambusia affinis*) Rainwater killifish (*Lucania parva*) Striped bass (*Morone saxatilis*) Yellowfin goby (*Acanthogobius flavimanus*)
Lower Estuarine River
American shad (*Alosa sapidissima*) Channel catfish (*Ictalurus punctatus*) Common carp (*Cyprinus carpio*) Mississippi silverside (*Menidia audens*) *Palaemon* spp. Shimofuri goby (*Tridentiger bifasciatus*) Striped bass (*Morone saxatilis*) Threadfin shad (*Dorosoma petenense*) White catfish (*Ameiurus catus*) Yellowfin goby (*Acanthogobius flavimanus*)

Sources: CDFG 2008d ; CDFG and OSPR, 2009; Leidy 2007

6.2 IMPACT ANALYSIS

6.2.1 Methodology for Impact Analysis

The existing conditions section of this report was developed by reviewing state and federal data sets, websites, management plans, reports, and peer-reviewed journal articles. Habitats at the marine terminal and in the San Pablo Bay Pipeline study corridor were identified by consulting maps from the San Francisco Goals projects, NOAA's Environmental Sensitivity Index Maps, NWI, and CNDDB. A list of species to address was obtained from queries of the CNDDB, the USFWS online species lists, Calfish database, and CNPS inventory of sensitive plant species. Results of the CNDDB, USFWS, and CNPS queries are provided in Appendix E. A list of species with potential to occur in and/or be affected by the project was derived from these queries, and is provided in Appendix F. Species that either have no suitable habitat in the project site or whose known or modeled range does not include the project site are not addressed further in this document.

6.2.2 Significance Criteria

For the purposes of this analysis, an impact was considered to be significant and to require mitigation if it would result in any of the following:

- Substantially affect threatened or endangered species, or protected species (including candidate, sensitive, or special-status species)
- Substantially affect sport fish populations in the Pittsburg area
- Alter or diminish critical habitat or a special aquatic site, including wetlands
- Isolate wildlife populations and/or disrupt wildlife migratory or movement corridors, or impede the use of native wildlife nursery site
- Violate any environmental law or regulation designed to protect wildlife, plants, or habitat areas
- Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan
- Conflict with any local policies or ordinances protecting biological resources
- Create underwater sound pressure levels during construction or operation that exceed guidelines for protection of aquatic species
- Cause the introduction or substantial spread of invasive nonnative plants or wildlife

- Substantially reduce any fishery in the bay, straits, or along the outer coast
- Cause impacts on living marine resources and habitat, and equipment or vessel loss, damage, or subsequent replacement
- Cause a degradation in water quality such that criteria for the protection of aquatic life and the prevention of bioconcentration of pollutants in aquatic organisms are exceeded.

6.2.3 Impacts and Mitigation Measures

6.2.3.1 Proposed Project

Construction-related Impacts

Impact Aquatic Resources (AR)-1: Cause adverse impacts to special-status species. (Significant and unavoidable.) Several elements of construction, including dredging and pile driving, have the potential to cause adverse impacts to special-status fish species (as individually described below). Which species would be impacted by the project depends on the timing and sequence of construction activities. Construction on the marine terminal is expected to be completed in the ten months between July 2014 and April 2015. With the exception of dredging, in-water work shall be allowable only between 30 minutes after sunrise to 30 minutes before sunset. Generally, the closer to winter, the greater the chance that special-status species would be within the project impact area. Expected presence and life stages of special-status species are summarized in Table 6-9 and discussed in detail below. There is no point between July and April in which all special-status species are expected to be absent from the Lower Estuarine River. Therefore, construction activities have the potential to cause significant impacts to special-status species. Mitigation measures AR-1 through AR-5 are provided to minimize impacts; however, impacts to special-status species may still be significant with the implementation of the mitigation measures.

Delta smelt

Delta smelt have the potential to occur in the vicinity of the project throughout the proposed construction term. As discussed in Section 6.1.2.6, the fall abundance of delta smelt in the vicinity of the marine terminal depends in large part on the water index of the previous year. If the water year index of the previous year is wet, then water will be released from the two water projects, X2 will be maintained at 74 kilometers (in Suisun Bay), and delta smelt should not be abundant in the vicinity of the marine terminal and take is unlikely. If the water index of the previous year is above normal, below normal, or dry, then the potential for delta smelt to be relatively abundant near the marine terminal increases and take becomes likely. However, under any scenario, the marine

Table 6-9: Special-status Species and Timing in the Lower Estuarine River

Species	Status		Month											
	Federal	State	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Delta Smelt (water < 10 feet)	FT	SE	P	P	P	P	P	R	R	R	R	R	R	M_s
Delta Smelt (water > 10 feet)*	FT	SE	P	P	P	P	P	R	R					M_s
Longfin Smelt*	None	ST, SSC	S	S	S	S	R	R	R	R	M_s	M_s	M_s	S
Sacramento Splittail	None	SSC					M_o	M_o	M_o	M_o			M_s	M_s
Green Sturgeon (adult)	FT	SSC	M_s	M_s	M_s	M_s	M_s	M_s	M_s					M_O
Green Sturgeon (juv. and subadult)	FT	SSC	R	R	R	R	R	R	R	R	R	R	R	R
Central Valley Chinook Salmon (adult)														
Fall/Late Fall-run	FSC	SSC	M_s								M_s	M_s	M_s	M_s
Winter-run	FE	SE	M_s	M_s	M_s	M_s	M_s							
Spring-run	FT	ST		M_s	M_s	M_s	M_s	M_s						
Central Valley Chinook Salmon (juvenile)														
Fall/Late Fall-run	FSC	SSC	M_o	M_o	M_o	M_o	M_o	M_o	M_o	M_o	M_o	M_o	M_o	M_o
Winter-run	FE	SE	M_o	M_o	M_o	M_o	M_o							
Spring-run	FT	ST	M_o	M_o								M_o	M_o	M_o
Central Valley Steelhead (adult)	FT	None	M_s	M_s					M_s	M_s	M_s	M_s	M_s	M_s
Central Valley Steelhead (juvenile)	FT	None	M_o	M_o	M_o	M_o	M_o	M_o				M_o	M_o	M_o

M_S = spawning migration; M_O = outmigration; R = rearing; S = spawning; P = Present

*Levine-Fricke (2004) shows a permissible work window from the Carquinez Strait to Collinsville from August 1 through November 30.

Sources: Bennett, 2005; CDFW, 2011a; Israel and Klimley, 2008; Levine-Fricke, 2004; LTMS, 2009; Moyle, 2002; Moyle *et al*, 2008; USFWS, 2008 terminal is located within the low-salinity zone, so there is potential for delta smelt to use areas near the marine terminal for rearing and foraging while construction is underway. Beginning in December, delta smelt are expected to begin to migrate upstream in the waters off the marine terminal.

Longfin smelt

Longfin smelt are located in the project dredging area year-round. Longfin smelt are most likely to be abundant in the ship channel 100 meters north of the dredging area in October and November, as adults migrate upstream to spawn. The furthest downstream extent of spawning occurs near the City of Pittsburg. Take is unlikely for project activities that occur in waters that are shallow (<6 meters) and warm (>=22°C), conditions that exist August 1 to September 31. Take is likely as the dredging connects with the ship channel, or with the construction of the marine terminal in colder months.

Chinook salmon

Adult Chinook salmon could potentially migrate past the project area during most months of the year, but minimal numbers of migrants are expected July 1 to August 31. Depending on environmental conditions and the timing of spawning runs, this lull in migration may extend through September 31. In-water work that occurs July 1 to November 31 is unlikely to impact adults of the threatened or endangered winter-run and spring-run Chinook salmon.

Juvenile Chinook salmon from the fall-run and late fall-run pass through Suisun Bay during all months of the year. Smolt of the threatened or endangered winter-run and spring-run pass through the area October 1 to April 30. Winter-run smolts enter the Delta January through April and are unlikely to be impacted by construction. However, spring-run smolts enter the Lower Estuarine River near the project area starting October 1, with peak numbers in November and December. In-water work that occurs June 1 to September 31 is unlikely to impact juveniles of the threatened or endangered winter-run and spring-run Chinook salmon.

Adult and juvenile Chinook salmon and steelhead tend to travel under low light conditions such as early morning, dusk, and at night. Construction activities that occur during the daylight hours of 30 minutes after sunrise to 30 minutes before sunset, when there is less movement of salmonids, are less likely to impact salmonids. Construction activities, such as dredging, that occur at dusk, dawn, and nighttime, when salmonids are active, are more likely to cause negative impacts to these fish.

Steelhead

While some adult steelhead move upstream through the Delta beginning in July, the spawning migration through this area peaks in September and October and continues into the winter. Most juvenile steelhead emigrate through the Delta from November through June, with the peak numbers occurring in February through April. Although relatively small numbers of adult or juvenile steelhead are present in the project area during the summer months, construction occurring June 1 to September 31 would minimize impacts to this species.

Green sturgeon
Adult green sturgeon could potentially be present in the Lower Estuarine River from December through May, and juvenile and subadults of this species rear in Suisun Bay all months of the year. However, green sturgeon are wide ranging throughout the bay and it can be assumed that if individuals find the area obnoxious, they can move elsewhere in the bay without adverse effect to their health or survival. With this assumption, construction during the summer months would minimize impacts to this species.

Splittail
Sacramento splittail are unlikely to utilize the marine terminal as habitat but can be expected to pass through the area in several waves of migration during May through August and in December. Adults returning to the lower estuary following spawning may pass downstream in June and July. Young-of-year splittail migrate downstream into the estuary during the summer months through August. In late November and December, following the start of winter floods, splittail will migrate upstream past the marine terminal as they move into the floodplains to hold prior to spawning. Construction occurring September 1 to October 31 is unlikely to impact migrations of this species.

Marine Mammals
Marine mammals that have potential to occur in the vicinity of the marine terminal include harbor seal and California sea lion. These species are expected to avoid the area while construction is active, but may approach the work site after work stops for the day. No take of seal or sea lions is likely.

Least tern
Least tern is known to nest at the nearby Pittsburg Generating Station. However, construction activities associated with the marine terminal would take place over 3,000 feet from potential nesting sites and are not expected to disturb this species. Therefore, the impacts to least tern from construction of the marine terminal would be less than significant.

Marsh Species
Suisun salt marsh song sparrow, salt marsh common yellowthroat, California black rail, California clapper rail, and northern salt-marsh harvest mouse are all present in the marshlands west of the project site. However, construction activities associated with the marine terminal would be conducted at over 3,000 feet from the closest marshland—a diked marshland associated with Willow Creek and Mallard Slough—and are not expected to disturb these species. Of the marsh species, California black rail and California clapper rail are obligate inhabitants of tidal marshes and would not be found in the marshland immediately west of the

project site. Suisun salt marsh song sparrow, salt marsh common yellowthroat, and northern salt-marsh harvest mouse have the potential to be present at the marsh immediately west of the project site. However, they are unlikely to stray out of the marsh and into the marine terminal area. Therefore, the impacts to these species from construction of the marine terminal would be less than significant.

Construction activities associated with the storage terminal are not expected to impact these species. The storage terminal site is an active industrial site which lacks habitat for marsh obligate species, thus these species are not expected to be present at the site. All construction activity will be conducted within the boundary of the secondary containment and in developed portions of the existing site, and no direct impacts to special-status marsh species are anticipated. Indirect impacts from construction at the storage terminal, such as construction noise or activity, could be significant if it causes the loss of an active nest. Suisun salt marsh song sparrow is not known to nest in diked marsh and would not be affected by construction noise. Salt marsh common yellowthroat can nest successfully in diked marsh and prefers marsh edge habitat but have not been recorded nesting east of Point Edith, which is approximately ten miles west of the project site. With the implementation of Mitigation Measure Terrestrial Resources-9, Nesting Bird Surveys, no indirect impacts are anticipated to nests.

Several special-status plant species are present in the marshlands in the San Pablo Bay Pipeline study corridor, including soft bird's-beak, Bolander's water-hemlock, delta tule pea, Mason's lilaeopsis, delta mudwort, Suisun marsh aster, and saline clover. Because no construction activities along the San Pablo Bay Pipeline are proposed as part of this EIR, no impacts to these species are anticipated from construction-related activities associated with the San Pablo Bay Pipeline.

At the marine terminal, Delta tule pea and Suisun marsh aster are present along the shoreline. Suisun marsh aster plants are found 40 to 215 feet east of the existing dock and 100 to 140 feet west of the dock. Delta tule pea are found 130 feet west of the dock. Plants to the west are over 100 feet from the dock and unlikely to be impacted by construction activities. To the east, construction of the new pipeway would occur within approximately 10 feet of the mapped Suisun marsh aster plants. If construction were to extend into the area where the plants are found, individuals could be trampled or destroyed and their habitat degraded. Establishment of protective measures along the shoreline for special-status plants (Mitigation Measure AR-2) would ensure that special-status plants and their habitats are protected and reduce potential impacts to less than significant.

Mitigation Measure AR-1: Conduct environmental training prior to construction. A qualified biologist shall prepare a Worker Environmental Awareness Program (WEAP) to provide environmental training for construction personnel, including contractors, prior to the commencement of construction activities. The training shall include specific measures to prevent injury to special-status species and information about what to do if one is found in the construction area. The program shall also provide workers with information on their responsibilities with regard to special-status species, an overview of the life history of the species, information on take prohibitions, protections afforded the species under the ESA, and an explanation of the relevant terms and conditions of the incidental take permit. Training material shall be submitted to the City of Pittsburg for review two weeks prior to construction. Proof of training in the form of sign-in sheets shall be submitted to the City of Pittsburg within 48 hours of each training conducted under the WEAP.

Mitigation Measure AR-2: Special-status plant protection. A qualified biologist or botanist will conduct pre-construction surveys for special-status plants along the shoreline within 250 feet of the existing dock to determine the aerial extent of special-status plant populations. Timing of pre-construction surveys and flagging shall correspond with the blooming period when the species is most conspicuous and easily recognizable. These periods are:

- Soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*): April to November
- Bolander's water-hemlock (*Cicuta maculata* var. *bolanderi*) July to September
- Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*): May to September
- Mason's lilaeopsis (*Lilaeopsis masonii*): April to November
- Delta mudwort (*Limosella subulata*): May to August
- Suisun Marsh aster (*Symphyotrichum lentum*): May to November
- Saline clover (*Trifolium hydrophilum*): April to June

Areas identified as supporting special-status plants will be mapped and clearly marked in the field. These areas will be avoided during construction to the extent practicable. In the event that impacts to individual special-status plants cannot be avoided, the following conditions will apply:

(1) A qualified biologist or botanist with experience in plant transplanting and propagation shall:

  a) Harvest plants and relocate them, either to a suitable permanent off-site location or to a nursery for storage to be replanted following construction; and/or
  b) Harvest seeds from mature plants and properly store them for post-construction propagation and re-establishment.

(2) A Restoration and Monitoring Plan shall be prepared that details the monitoring requirements and performance standards to restore the site and monitor transplants or seeded areas, in accordance with

CNPS field sampling protocols (Sawyer and Keeler-Wolf, 1995). Following CNPS guidelines, the site will be monitored for success or failure for a minimum of five years (CNPS, 1998).The Restoration and Monitoring Plan will be submitted to the City of Pittsburg for final approval.

Mitigation Measure AR-3: Conduct biological monitoring during construction. A qualified biologist shall inspect construction-related activities at the proposed project site to ensure that no unauthorized take of federally listed species or destruction of their habitat occurs. The biologist shall be available for monitoring throughout all phases of construction that may result in adverse effects to special-status species. Furthermore, the biologist shall have the authority, through communication with the resident engineer, to stop construction activities in the immediate area if a special-status species is encountered during construction until appropriate corrective measures are completed, or until the animal is determined to be unharmed. Special-status species encountered during construction should be allowed to move away from the area on their own volition. The biologist shall notify the appropriate agency(ies) immediately if any listed species are found on-site and submit a report, including date(s), location(s), habitat description, and any corrective measures taken to protect the species found. Specific reporting requirements to document biological monitoring shall be developed during consultation with the relevant agencies and included in the project's Mitigation Monitoring and Reporting Program (MMRP), per applicable agency requirements.

Mitigation Measure AR-4: Schedule work to avoid impacts to species. Project components that have the potential to cause significant impacts such as pile driving shall be scheduled to the extent practicable to occur in summer when the fewest numbers of special-status species are expected to occur. With the exception of dredging, in-water construction activities shall occur from 30 minutes after sunrise to 30 minutes before sunset, when fewer fish species are active. Additional scheduling recommendations are provided in Mitigation Measures AR-6 and AR-7.

Mitigation Measure AR-5: Keep the work site clean and free of hazards. To protect seals or sea lions that may attempt to use the marine docks for haul-out in the evening and overnight, the work site shall be kept clean and free of sharp tools or other hazards that could cause harm.

Impact AR-2: Disrupt wildlife migratory corridors. (Significant and unavoidable.) The marine terminal extends 700 feet across a 4,000-foot channel. Because sound waves transmit well through water, certain in-water construction activities such as pile driving have the potential to cause enough noise to create something akin to a wall of sound that could interrupt fish migration through the Lower Estuarine River. Implementation of Mitigation Measures AR-4, AR-8, and

AR-9 would reduce the impacts to migratory corridors. As most of the migration movements of adult and juvenile salmonids occur under low light conditions (dawn, dusk, and night), restricting the pile driving to daylight hours would reduce the disturbance to fish. However, because there is no point when special-status species are not expected to be migrating through the Lower Estuarine River, work scheduling can only reduce the impacts to most species, not all. Therefore, the impacts to migratory corridors are expected to be significant and unavoidable.

Mitigation Measure: No additional mitigation measures available.

Impact AR-3: Create adverse impacts to special-status habitats. (Significant and unavoidable.) This section specifically considers impacts to primary constituent elements of EFH and critical habitat at the marine terminal that could be affected by construction activities.

Essential Fish Habitat

The dredging would cause permanent alteration of the bathymetry at the marine terminal. Though the effect would be site specific, dredging is expected to remove benthic organisms and other ecosystem components with at least short-term impact to primary and potentially secondary productivity. The NMFS considers marina construction, pile removal, pile driving, and dredging operations that remove more than 100,000 cubic yards (cy) of material to potentially cause adverse impacts to EFH requiring consultation under the Magnuson-Stevens Act. The project may also cause adverse impacts to the San Francisco Bay Estuary, which is a designated HAPC. Consultation with the NMFS is initiated by the federal agency permitting the action, which in this case would be the USACE. The project would require an Essential Fish Assessment that includes a description of the proposed project, an analysis of the potential adverse effects on EFH, and proposed mitigation measures.

Critical Habitat

Delta smelt

PCEs at the marine terminal site include physical habitat for rearing and migration. Both PCEs may be temporarily adversely affected by construction activities that increase turbidity, resuspend solids, or increase noise levels to the point where they injure fish or deter them from using the area. No long-term adverse effects to PCEs of the delta smelt critical habitat are anticipated.

Green sturgeon

PCEs at the marine terminal site include physical habitat for foraging and migration. Dredging and in-water construction may temporarily adversely affect water quality, migratory corridors, and sediment quality through alteration of the physical parameters of the estuary. Dredging would also permanently alter channel depth near the marine terminal; however, the final amount of habitat altered by the dredging is minor compared to the total available habitat in the Lower Estuarine River and would thus be considered less than significant. Mitigation measure AR-4 would lessen the impacts to PCEs of the delta smelt critical habitat, but as discussed in Impact AR-1 above, may not be able to reduce them to less than significant.

Mitigation Measure: No additional mitigation measures available.

Impact AR-4: Introduce or spread aquatic invasive species into or within the Lower Estuarine River. (Less than significant.) The *California Aquatic Invasive Species Management Plan* (CDFG, 2008b) identifies the use of contaminated equipment for construction or post-project restoration or transportation of contaminated sands and sediments as a vector pathway through which aquatic invasive species may be introduced to a new area (CDFG, 2008b). However, compared to other vector pathways, introduction of new aquatic invasive species into an area from construction activities is low: Of the 584 species whose introduction vector was identified in a 2008 CDFG study, 313 species introductions were attributed to shipping and 3 were attributed to construction activities (associated with habitat restoration) (CDFG and OSPR, 2008). While construction of the marine terminal may potentially serve as a vector for aquatic invasive species, the waters in the vicinity of the marine terminal are used by recreational boaters, commercial shippers, and sand miners. It is likely that aquatic invasive species introductions would occur in the absence of the project construction and that the construction machinery associated with the project would constitute a very small fraction of an increase in the number of potential vectors. In addition, construction machinery would be located primarily in the immediate vicinity of the marine terminal and would, therefore, not provide a widespread distribution of newly introduced aquatic invasive species.

The use of heavy machinery in contaminated areas can spread sedentary aquatic invasive species by moving organisms from the substrate into the water column (CDFG, 2008b). Invasive species in the bay are monitored by the Marine Invasive Species Program within the CDFW with the goal of recording baseline information about marine and estuarine nonnative species on the California Coast. Of the 34 species identified at the New York Point Survey Station[2], seven were introduced, seven were native, and the introduction status of the remaining 20 species could not be resolved (CDFG and OSPR, 2009). Introduced benthic invertebrate species found in 2010 are listed in Table 6-10. These species are widely distributed throughout San Francisco Bay, thus unintended transfer of individuals from the substrate to the water column during construction would not introduce these species outside of their current distribution.

[2] Marine Invasive Species Program Station #207NYPOIN; the station is located in a slip near the Pittsburg Yacht Club on the east side of the harbor.

Table 6-10: Introduced Benthic Invertebrates at New York Point

Species	Phylum	Vector
Alitta succinea	Annelida	Ballast water/fouling (commercial shipping and recreational boats)/oyster harvest
Amphibalanus improvisus	Arthropoda	Ballast water/fouling
Gammarus daiberi	Arthropoda	Ballast water
Sinelobus sp. (of Cohen 2007)	Arthropoda	Ballast water/fouling
Sinocorophium alienense	Arthropoda	Ballast water
Membranipora chesapeakensis	Ectoprocta	Fouling (commercial shipping)
Corbula amurensis	Mollusca	Ballast water

Source: CDFG and OSPR, 2009

While the construction machinery is located in the water at the marine terminal site, the wetted surfaces of the ships may become fouled with aquatic invasive species. Types of fouling that attach to wetted surfaces include slime, weeds, and hard shells; highly fouled surfaces provide protection and places for non-sessile species to ride along. The degree of hull fouling that a ship in the estuary is subject to is not completely understood, but is dependent in part on the length of time the ship is in port, ambient water temperature, and light intensity (Takata *et al.*, 2006; Hull Fouling Working Group, 2011). Most forms of fouling can only attach to ship surfaces at low speeds; construction operations, which involve ships loitering in place for extended periods, encourage formation of fouling. Little fouling occurs in cold waters < 13°C, while ships are particularly susceptible to fouling in water temperatures above 20°C. Fouling organisms are susceptible to water turbidity; they develop in areas where sunlight readily penetrates as most either absorb sunlight or feed on plant organisms that rely on daylight.

Construction of the marine terminal would require derricks, barges, and tugboats to be on-site from 16 weeks to 4 months, which is long enough for hull-fouling species to become established on the wetted surface of the hull. Water temperatures at the marine terminal site are expected to decrease gradually over the duration of construction from 20°C in June to 12°C in December. Thus, fouling is less likely to accumulate as construction activities move forward. Finally, water turbidity in the vicinity of the marine terminal is generally high and phytoplankton production correspondingly low. Fouling would, therefore, tend to appear in a narrow band at or near the waterline, as light intensity would reduce with increased depth from the surface, and is unlikely to reach significant levels.

Mitigation Measure: No mitigation required.

Impact AR-5: Cause impacts to species and habitat as a result of dredging. (Significant and unavoidable.) Dredging activities may cause stress on aquatic biota through changing physical and water quality factors in and adjacent to the dredge site. Dredging causes both direct and indirect effects to species and habitat, which may persist into the long or short-term. Dredging is assumed for purposes of this analysis to be conducted over the course of six weeks.

Dredging activities that occur during migratory periods could cause fish to avoid the location and potentially result in blocking migration corridors into the San Joaquin River or altering migration into less-desirable routes. This effect is expected to have a higher impact on Chinook and coho salmon and steelhead than on delta smelt (Levine-Fricke, 2004).

Mitigation Measure AR-6: Time dredging to reduce impacts to special-status species. Dredging activities shall be conducted from June 1 through November 30 or as otherwise specified by regulatory agencies such as the Dredged Material Management Office (DMMO) or CDFW. To the extent practicable, dredging shall be restricted to daylight hours to reduce the disturbance to salmonids, which are least active during daylight hours.

Impact AR-6: Cause entrainment as a result of dredging. (Less than significant.) Dredging could potentially entrain juvenile and adult fish present at the site. Fish that are present in the area and fail to move away from the bucket could be scooped up with the dredged material, resulting in mortality from entrainment. However, likely because the increased turbidity and noise from the dredger causes fish to avoid the dredging area, entrainment impacts from dredging are not generally associated with mechanical dredges (Reine and Clarke, 1998).

Mitigation Measure: No mitigation required.

Impact AR-7: Cause increased turbidity and suspended-sediment concentration as a result of dredging. (Less than significant.) Turbidity and suspended-sediment concentration (SSC) can be much greater than ambient conditions in the immediate vicinity of dredging activities. Increased turbidity increases light attenuation, which can reduce phytoplankton productivity, reduce the feeding of some fish species, and change feeding and migration patterns, while increased SSCs can bury the benthic community, reduce the water-filtration rates of filter feeders adjacent to the dredge area, or increase fish gill injury (NMFS, 2004).

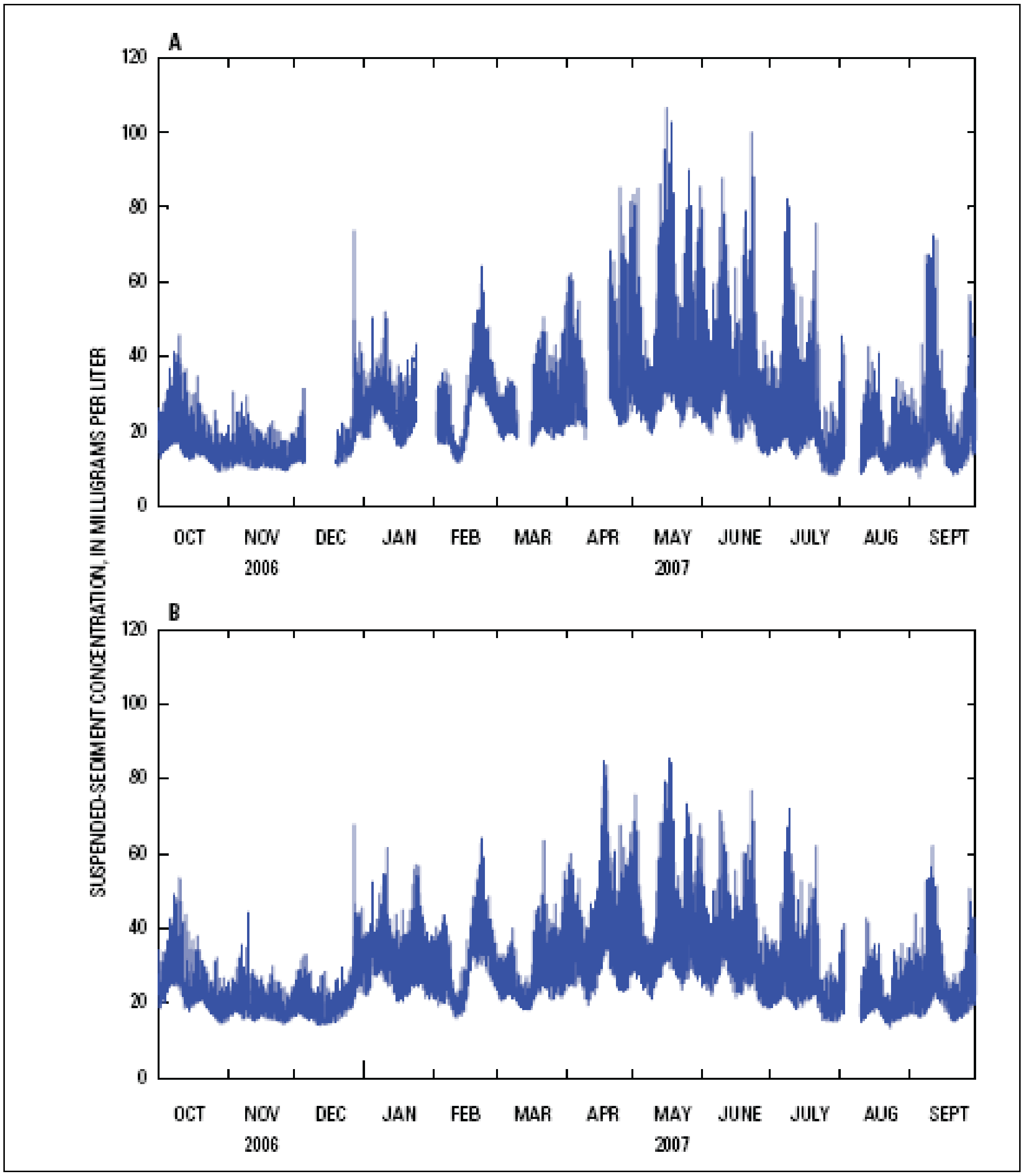
Within the bay, natural physical processes generate a great deal of daily and seasonal variability in SSC. Between June and November, sediment is carried upstream to the site by tidal waves and downstream to the site from river currents. In December, with the start of the winter season, sediment transport on river currents from the Delta becomes greater than upstream transport from tidal waves.

These processes can cause the SSC to vary over the course of a day by over 100 mg/L. Figure 6-10: Time Series of (A) Near-surface and (B) Near-bottom Suspended Sediment Concentrations Calculated from Sensor Readings at Mallard Island, Suisun Bay, Water Year 2007 depicts the concentration of SSCs at Mallard Island in Suisun Bay (approximately 1.3 miles downstream of the marine terminal). Between June and December 2006, SSC concentrations ranged from approximately 18 mg/L to 80 mg/L near the bottom of the substrate and from 15 mg/L to 100 mg/L near the water surface.

Estimates of the amount of material that is resuspended during dredging range from 0 to 5 percent (Suedel *et al*., 2008). Assuming that dredging is conducted for 10 hours a day and 5 days a week for 6 weeks, the project would potentially resuspend on average 28 cy of sediment per hour. The majority of sediment resuspended during dredging activities resettles within 50 meters of the dredge site within one hour (Anchor Environmental, 2003), though plume effects can be observed as far downstream as 400 meters (Clarke *et al*., 2007). Densities of suspended sediment over ambient levels decrease with distance from the dredge site and are more pronounced at the bottom of the water column than near the surface (Clarke *et al*., 2007). Sediment plumes are unlikely to have lasting effects given the high background turbidity; in one study in San Pablo Bay, dredging plumes were found to have only a localized effect (Schoellhamer, 2002). Therefore, impacts from dredging would have the greatest effect on the benthic community at and adjacent to the dredge site; these impacts are discussed in the context of long-term habitat alteration below. Resuspended sediments near the surface of the water column are expected to dissipate downstream, where they would not increase sediment significantly above ambient levels. Therefore, impacts from increased turbidity and increased SSC concentrations on pelagic species would be less than significant.

Mitigation Measure: No mitigation required.

Impact AR-8: Cause resuspended contaminants as a result of dredging. (Less than significant.) New dredging projects can release long-buried contaminants into the water column where they can reenter the food web. Sediments are often the sink of water column pollutants. Waters in Suisun Bay have elevated levels of chromium, copper, mercury, and nickel. Though as discussed in Impact AR-7, the sediment dissipates relatively quickly, it can increase ambient concentrations of pollutants in the water column above EPA criteria or state water quality objectives. These effects persist beyond the dissipation of the sediment plume (Levine-Fricke, 2004). Contaminants bond readily to fine silts, where they may then be ingested by zooplankton, which are the major food for juvenile fish in the bay. Among others, juvenile Chinook salmon may ingest prey organisms with high levels of contaminants during their outmigration through San Francisco Bay (58 CFR Part 114). Depending on the persistence of the contaminants in the food chain, this impact could be considered significant. WesPac Energy–Pittsburg LLC



Source: Buchanan and Morgan, 2010

Figure 6-10
Time Series of (A) Near-surface and (B) Near-bottom Suspended Sediment Concentrations Calculated from Sensor Readings at Mallard Island, Suisun Bay, Water Year 2007
City of Pittsburg
WesPac Pittsburg Energy Infrastructure Project

(WesPac) has prepared a Sediment Sampling and Analysis Plan (SAP) and test for contaminants at the dredging site, which has been approved by the DMMO and is provided in Appendix A: Characterization of WesPac Energy Pittsburg LLC Marine Terminal Dredging Project Sediments: Dredge Materials Sampling and Analysis Results. The SAP determined what contaminants are present at the site; the sediment proposed for dredging from the marine terminal site has been determined by the DMMO to be suitable for placement at Winter Island or the Montezuma Wetlands Restoration Project Site. Any required mitigation would be developed and incorporated into the terms of the dredging permit to be obtained from the USACE to reduce this impact to less than significant.

Mitigation Measure: No mitigation required.

Impact AR-9: Cause noise impacts as a result of dredging. (Significant and unavoidable.) Bucket dredging causes a stereotyped sequence of low-frequency sound that includes winching, bucket impact, bucket digging, bucket closing, and bucket emptying that are repeated on approximately a 1-minute period for the duration of the dredging (Dickerson *et al*., 2001). As sounds transmit well underwater, the increased intensity of underwater sound can startle fish, causing them to leave the area, altering schoolings patterns, and interfering with migration behaviors. The level of impact depends on the ambient noise, noise level, area of impact, and sensitivity of the species to noise.

Dredging of soft sediment produces sound that extends up to 3,000 meters from the dredge in waters with concentrations of suspended sediments above 20 mg/L such as are found at the marine terminal site (Dickerson *et al*., 2001). Noise from the dredging operations would potentially be audible in the water channel in the area from Mallard Point to Point San Joaquin in the Sacramento River during work days for the duration of the dredging operation.

The majority of native fishes present in the vicinity of the marine terminal are expected to be hearing generalists and to derive a great deal of information about their surroundings from the acoustic environment (Hastings and Popper, 2005). Though a search of the literature did not find any documented research or cases of special-status species considered in this report being affected by noise originating from dredging operations, it is generally assumed that increased levels of background noise could cause fish to avoid an area during dredging activities. There is no point between July and April in which all special-status species are expected to be absent from the Lower Estuarine River. Furthermore, noise from dredging is expected to cause non-special-status sports fish species to leave the area, and thereby adversely impacting sports fishing opportunities at the Pittsburg Jetty. Therefore this impact is expected to be significant and unavoidable.

Mitigation Measure: No additional mitigation measures available.

Impact AR-10: Cause habitat modification as a result of dredging. (Less than significant.) Dredging would directly result in long-term habitat modification by removing the existing infauna community and altering the substrate composition and topography at the marine terminal site.

Following the completion of dredging, the benthic community is expected to undergo typical ecological succession patterns. As previously described, the benthic community at any estuarine location is dependent on salinity levels. Following salinity change events, it takes several months for the initial group of benthic organisms to settle and grow. Because freshwater flows into the bay may change over the course of dredging, it is likely that the benthic community that forms in the dredged area would be composed of species with a different salinity affinity than those that were removed. However, a change in community composition would occur naturally in the absence of the dredging project due to the seasonal variation in salinity levels at the site. Therefore, this impact would be less than significant.

The dredging would alter the substrate composition and topography. Following dredging, the substrate would be composed of compacted silts and clays with a distinct irregular, cratered topography left by the clamshell bucket, and the depth to the bottom of the channel would be increased. Craters may provide micro-habitats that help benthic pioneers settle and grow, though sediment inflow from the Delta and tidal waves would in time fill the craters left by the dredge. The shoal habitat would be replaced with channel habitat. This could potentially increase habitat for species that prefer channels while reducing habitat for species that prefer shoals. However, the 54 acres that would potentially be removed at the marine terminal represent a small fraction of the abundant shoal habitat in the Lower Estuarine River; therefore, this impact would be less than significant.

Mitigation Measure: No mitigation required.

Impact AR-11: Cause indirect effects as a result of dredging. (Less than significant.) Dredging may result in indirect effects, which are defined as those effects that are caused by the action and occur later in time or are farther removed in distance, but are still reasonably foreseeable. Indirect effects that are anticipated by dredging are the potential spread of invasive species as a result of disturbing the benthic habitat and the creation of new deep-water habitat that could attract species into the marine terminal and, potentially, into harms' way.

Dredging would create newly disturbed benthic habitat, making it attractive for settlement by opportunistic and invasive aquatic species. As discussed in Impact AR-1, the benthic community at locations near the marine terminal is composed of a mix of introduced and native species. It is likely that the benthic community at the marine terminal is similarly composed. As early settlers on the site are recruited from the water column, it is likely that the benthic community that reforms would also be a mixture of native and introduced species. As discussed in

Impact AR-10, the benthic community at the site would undergo natural change in response to changing salinities. Therefore, this impact is expected to be less than significant.

The dredging would create a new area with deep water adjacent to the existing navigation channel. Special-status species could be attracted to the new habitat. Were they to be present in the area during either a minor or major spill as the result of the construction or operation of the marine terminal, they would be more likely to be harmed. However, the amount of new deep water habitat that would be created represents a minute quantity of habitat available to water column species. In addition, Environmental Commitment AR-1, described in Chapter 2.0: Proposed Project and Alternatives, Section 2.7.4, commits the project to incorporate best management practices to minimize the consequences of dredging and disposal on water quality. Therefore, this impact would be less than significant.

Mitigation Measure: No mitigation required.

Impact AR-12: Cause increased sediment resuspension in the water column due to pile removal. (Less than significant with mitigation.) The primary adverse effect of pile removal is the resuspension of sediments, which increases turbidity and, at the project site, would release likely contaminants buried in the sediment (NMFS, 2004). Steel piles would be removed during demolition of the breasting dolphins, and timber piles treated with creosote would be removed during demolition of the unloading platform and the west access platform.

The timber pilings would be removed by direct pull; they would be completely removed if possible and at minimum they would be removed 3 feet below the mudline. Direct pull to remove piles may suspend large amounts of sediment. As the piling is pulled from the substrate, sediment clinging to the piling would slough off as it is raised through the water column, creating a plume. This plume may contain contaminants deleterious to aquatic species. Environmental Commitment AR-2, described in Chapter 2.0: Proposed Project and Alternatives, Section 2.7.4, commits the project to cutting steel piles 3 feet below the mudline and removing piles by direct pull, thereby reducing sediment resuspension.

Nevertheless, creosote-coated timber piling stubs left in the mud can release contaminants into the water column that are deleterious to aquatic species. However, implementation of Mitigation Measure AR-7 would reduce this impact to less than significant.

Mitigation Measure AR-7: Minimize sediment resuspension. Before pulling the pile, the operator shall first hit or vibrate the pile to loosen the pile from the sediment. This will minimize the potential for the pile to break and reduce the amount of attached sediment that will slough during the pull. Piles shall be removed slowly to allow sediment to slough off at the mudline.

Impact AR-13: Cause increased underwater noise levels in the Lower Estuarine River as a result of pile driving. (Significant and unavoidable). Both vibratory and impact hammers would be used to drive piles during construction. In an effort to reduce impacts from underwater noise, Environmental Commitment AR-3, described in Chapter 2.0: Proposed Project and Alternatives, Section 2.7.4, commits the project to the use of vibratory hammers to the extent practicable to drive hollow steel piles. Impact hammers would be used only if resistance is encountered from the substrate and to “proof” piles. Table 6-11 describes piles that would be installed for the project.

Sound from impact pile driving has the potential to affect fish in several ways, ranging from changing behavior to causing physical injury or death. Sound from specific sound sources such as vibratory and impact hammers also has the potential to impact pinnepeds (seals and sea lions). The potential impacts include sounds that cause marine animals to alter their behavior, prevent marine animals from hearing important sounds (masking), or cause hearing loss (temporary or permanent). Therefore, the impact to special-status species from pile driving could be significant.

Table 6-11: Summary of New* Steel Piles Anticipated for Installment

Project Component	Pile Diameter	Number of Piles
Pipeline trestle	36-inch (4) 24-inch (20) 30-inch (6)	30
Main unloading platform	36-inch	15
Gangway tower	24-inch (2) 36-inch (1)	3
Breasting dolphins	84-inch	4
Mooring dolphins	24-inch	14
Walkways and access platforms	48-inch	2
Oil boom platforms	48-inch (1) 54-inch (1)	2

*Existing piles on those components anticipated for repair or retrofit work are not accounted for.

Vibratory hammers and impact hammers affect the underwater soundscape differently. Vibratory hammers cause low-intensity, rapidly repeating sound waves, while impact hammers produce intermittent, high-intensity sound pressure waves (SPLs). Fish do not habituate to the sound of vibratory hammers and would actively avoid areas when vibratory hammers are in use. Noise from an impact hammer would not, however, elicit an avoidance response in fishes, and they may remain within the range of potentially dangerous SPLs (NMFS, 2004).

Criteria for injury from vibratory driving have not been formally agreed upon. Thresholds for vibratory driving are likely to be higher than the thresholds for impact driving because vibratory driving sounds are continuous. A threshold of onset of injury of 220 decibels (dB) for accumulated Sound Exposure Level (SEL) has been proposed, though the current guidance states that ultimately the threshold would be somewhere between 178 and 220 dB (ICF Jones & Stokes, 2009).

The underwater noise threshold criteria for fish injury from a single pile impact strike such as one required to "proof" a pile is 206 dB; the cumulative SEL, which measures onset of injury for a multi-strike drive operation, is 187 dB[3] (ICF Jones & Stokes, 2009). SPLs in excess of 150 dB above the hearing threshold can alter the behavior of fish such as causing a startle response to noise or movement away from an area (NMFS, 2004).

NOAA is developing comprehensive guidance on sound characteristics likely to cause injury and behavioral disruption in the context of the MMPA, ESA, and other statutes. Until formal guidance is available, NOAA Fisheries uses conservative thresholds of received sound pressure levels from broad band sounds that may cause behavioral disturbance and injury to marine mammals. Currently the injury threshold for impulse noises (such as impact pile driving) is identified as 190 dB_{RMS} for pinnipeds. The underwater disturbance threshold for pinnipeds is 160 dB_{RMS} for impulse noises and 120 dB_{RMS} for non-impulse, continuous noises (i.e., vibratory pile driving) (NOAA, 2012).

Several studies have been conducted on the behavioral reactions of marine mammals to underwater sounds. As reported in a summary of these studies by Richardson et al. (1995), reactions often involved cessation of feeding, resting, or social interaction, and increased alertness or avoidance behaviors. Avoidance reactions in pinnipeds often involved movement from haul-out sites to water (or vice versa). The nearest known haul-out site is at Gorner Point, approximately 8.5 miles to the west of the marine terminal.

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[3] Reflecting the sensitivity of small fish to noise impacts, cumulative Sound Exposure Level is 187 decibels (dB) for fish greater than 2 grams in size and 183 dB for fish under 2 g. As all the special-status fish potentially would be found in the project area during the proposed work frame are heavier than 2 grams, the higher threshold is used.

The area of impact from pile driving and the magnitude of its effect depend on the pile composition, driving method, local hydrology and topography, and species that could potentially be located within the area.

The type of pile driver to be used, sound attenuation measures to be employed, and timing of the work have not been determined; therefore, this analysis models the potential impacts from one day in a generic pile-driving operation utilizing impact hammers that are similar to that proposed by the project.

A spreadsheet generated by the NMFS was used to calculate the extent of the project action area and the acoustic impact area. The project action area in the underwater area is defined as the areal extent in which peak pile driving noise exceeds ambient noise levels. The acoustic impact area is defined as the distance from the pile at which SPLs attenuate to levels below the criteria for injury. Estimates of underwater sound are based on measured levels from similar size and type piles. The model assumes that fish remain stationary during pile driving and that there is no tissue recovery allowance between pile strikes.

Calculating the extent of the project action area is hampered by the number of variables that influence sound attenuation at any site, including topography, water turbidity, and ambient noise. At best, the project action area can only be approximated. Predicting sound detectability beyond 1,000 meters is not possible, so this limit is commonly set as the largest action area for pile-driving noise impacts (ICF Jones & Stokes, 2009). Because ambient noise levels at the marine terminal are unknown, the levels at which ambient noise would reduce the project area to less than 1,000 meters from the pile were calculated. It was found that ambient noise levels would have to be greater than 150 dB to reduce the project area to less than its potential maximum. Since it is unlikely that ambient noise levels exceed this amount, a 1,000-meter project area was assumed.

The acoustic impact area for use of the impact hammer was modeled for the different piles using parameters derived from previous studies of unattenuated impact pile driving. The calculations use three metrics to evaluate the potential acoustic impacts on fish (ICF Jones & Stokes, 2009):

- **Peak** (Peak sound pressure): The maximum absolute value of the instantaneous sound pressure that occurs during a specified time interval.
- **SEL** (Sound exposure level): The constant sound level in one second that has the same acoustic energy as the original sound.
- **RMS** (Root Mean Square): The average amplitude of sound pressure over a given time.

Parameters were chosen from the existing literature that most closely approximated those that would be used in the project, and a transmission loss constant of 15 was chosen for all pile types (ICF Jones & Stokes, 2009). All sound levels are in dB referenced to 1 micro Pascal. Parameters used in the analysis and results of the model are found in Table 6-12.

The acoustic impact area for pile driving with a vibratory hammer was not calculated. The typical installation of a 72-inch steel pipe pile using a vibratory hammer in 5 meters of water results in a peak SPL of 183 dB, RMS of 170 dB, and SEL of 170 dB (ICF Jones & Stokes, 2009). As discussed above, there are currently no criteria for injury to fish from vibratory pile driving; however, the typical SPLs caused by vibratory hammers are below the proposed threshold of impact, which would result in an acoustic impact area equal to zero.

As modeled above, SPLs from impact pile driving are expected to exceed the criteria for SEL for fish. The greatest impact would result if impact hammers are used to drive the steel piles that would be used to support the 84-inch breasting dolphins. As described in Chapter 2.0: Proposed Project and Alternatives, a vibratory hammer would be used to drive the steel piles to the extent practicable. In the event that an impact hammer is used instead of a vibratory hammer to drive steel piles, the expected impacts to fish would exceed the criteria for peak dB up to 117 meters from the pile and for SEL dB within the 1,000-meter project action area. The use of an impact hammer to proof piles will cause the same impact in peak dB, but will reduce the SEL dB impact area by a third to a tenth. Adverse behavioral effects are expected up to 1,000 meters of the pile.

Noise from impact hammers is not expected to exceed the threshold of significance that would cause injury to pinnepeds. Although sound pressure levels could intermittently exceed 190 dB without attenuation, they are not expected to create continuous SPLs at a magnitude that would cause damage. Harbor seals or sea lions in the area of the marine terminal would likely alter their behavior as a result of vibratory and impact pile driving. There are no haul-out sites nearby but individuals that forage or rest in the vicinity would likely disperse elsewhere during construction activities. This impact to pinnepeds would be considered less than significant.

Special-status fish that could potentially be affected and the degree to which they would be impacted would ultimately depend on the in-water work period. Pile driving during August, September, and October would avoid the greatest number of sensitive fish species, whereas delta smelt and Chinook salmon individuals tend to be present in larger numbers starting in November (Morrison, 2013). Depending on the time that work is conducted and the location of X2, special-status fish may either be present within the project action area and the acoustic impact area or migrating through. Impacts from pile driving could cause injury or mortality to special-status fish species and interfere with migratory patterns. These impacts would be significant.

Table 6-12: Threshold Distances for Unattenuated Impact-Hammer Pile Driving

Pile Type[1]	Acoustic Metric in Decibels (dB)			Distance (meters) of Acoustic Metric	Typical Strikes/Day[2]	Distance in Meters (m) to Threshold		
	Peak	SEL	RMS			Peak dB (m)	Cum SEL dB (m)	B* (m)
84-inch steel, single strike (proofing)	207	195	183	100	1	117	341	1,000
Three sections of 84-inch steel	207	195	183	100	21,000	117	1,000	1,000
54-inch steel, single strike (proofing)	210	195	185	10	1	18	34	1,000
Three sections of 54-inch steel	210	195	185	10	21,000	18	1,000	1,000
48-inch steel pipe, single strike	208	195	180	10	1	14	34	1000
Three 48-inch steel pipe	208	195	180	10	1,800	14	1,000	1,000
36-inch, single strike	210	193	183	10	1	18	25	1,000
Three 36-inch steel	210	193	183	10	1,800	18	1,000	1,000
30-inch steel pipe, single strike	199	181	170	30	1	10	12	646

Five 30-inch steel pipe	199	181	170	30	3,000	10	1,000	646
24-inch steel pipe, single strike	205	190	175	10	1	9	16	464
Six 24-inch steel pipe	205	190	175	10	3,300	9	1,000	464

[1]Table 2-3 Summary of Unattenuated Sound Measurements for Marine Pile Driving, which is based on the following sound measurements:

- 96-inch steel pipe, CALTRANS Project in San Francisco Bay, Oakland, California
- 66-inch steel pipe, CALTRANS Richmond-San Rafael Bridge Project, San Rafael, San Francisco Bay
- 40-inch steel pipe, Alameda Bay Ship & Yacht Project, Alameda, California
- 36-inch steel pipe, CALTRANS Humboldt Bay Bridges Project, Eureka, California
- 30-inch steel pipe, CALTRANS Richmond-San Rafael Birdge, San Rafael California
- 24-inch steel pipe, Amorco Wharf Repair, Carquinez Straits, California

[2]Table 2-3. Summary of Typical Strike Data

*B = Behavior

Source: ICF Jones & Stokes, 2009; NMFS, 2009

Employing sound attenuation systems for impact driving such as air bubble curtains, isolation casings, cofferdams, or a sound-reduction system such as cushion blocks may reduce RMS up to 26 dB (ICF Jones & Stokes, 2009). Air bubble curtains surround the pile with air bubbles that attenuate RMS sound up to 24 dB, depending on the size of the pile and the curtain used. Air bubble curtain effectiveness increases with pile size and decreases with current speed. In areas with substantial current, a sleeve around the pile to confine bubbles would increase the air bubble curtain's effectiveness. Cushion blocks are blocks of wood, nylon, or micarta that are placed on top of pilings prior to driving to reduce the noise generated while driving the pile. They can reduce SPLs between 4 and 26 dB, depending on the material used. Wood cushion blocks are the most effective material, while nylon and micarta are at the lower end of the scale.

Additionally, the use of isolation casings over the pile being driven that leave at least 12 inches or greater of air space around the pile would greatly attenuate the shock wave of the pile driving. The California Department of Transportation states that "Dewatered isolation casings generally can be expected to provide attenuation that is at least as great as the attenuation provided by bubble curtains" (ICF Jones & Stokes, 2009). Implementation of this mitigation measure would require approval from the CDFW in the form of dewatering permits and a fish salvage protocol.

Non-special-status sport fishery species are expected to avoid the area while pile driving with impact hammer is underway. This would reduce fishing opportunities from the Pittsburg Jetty for the duration of the pile driving, which would be considered a significant impact.

No significant impacts to special-status fish or to non-special-status sport fishery species are expected from pile driving with a vibratory hammer. Impacts from pile driving with an impact hammer would be potentially reduced, though not to less than significant, through utilization of the following mitigation measures:

Mitigation Measure AR-8: Consult with agencies to determine optimal schedule. Conduct pile driving during allowable in-water work period of August, September, and October, or as determined through consultation with the USFWS, NMFS, and/or CDFW. Schedule driving of the larger piles, such as the breasting dolphins, towards the beginning of the construction period to avoid impacts to the greatest number of special-status species.

Mitigation Measure AR-9: Time impact-hammer pile driving to coincide with slack currents. Where piles must be driven with an impact hammer in deep waters (i.e., waters greater than 7 meters), drive them at times of slack current, i.e. the ninety minutes on either side of low or high tide when the tidal currents are weakest.

Mitigation Measure AR-10: Start soft. Start work with a noise attenuator (i.e., soft start) to allow time for fish to move away from the immediate project site.

Mitigation Measure AR-11: Employ a sound attenuation system for impact-hammer pile driving. Use of the sound attenuation systems as described above would potentially reduce the distance to threshold for onset of physical injury as shown in Table 6-13. It is assumed that an air bubble curtain within a sleeve would be used to attenuate noise from impact hammers on steel piles and that the maximum level of attenuation would be attained. Caution is, therefore, suggested when evaluating these results. However, the results do suggest that with the implementation of sound attenuation and sound-reduction systems, the impacts to special-status fish, though reduced, would still be significant enough to change behavior of fish within the reduced impact range and, at close quarters, to cause direct injury or mortality. The particular sound attenuation and sound reduction system to be employed during pile driving, as appropriate, shall be developed as part of permitting conditions stipulated for the dock upgrades (e.g., Section 10 or Section 404 USACE permit, or the lease agreement with the CSLC and/or City of Pittsburg).

Table 6-13: Threshold Distances for Attenuated Impact-Hammer Pile Driving

Pile Type	Potential Level of Attenuation	Distance in Meters (m) to Threshold		
		Peak Decibels (m)	Cum SEL dB (m)	Behavior (m)
84-inch steel, single strike	24 dB	3	9	398
Three sections of 84-inch steel		3	1,000	398
54-inch steel, single strike		0	1	54
Three sections of 54-inch steel		0	251	54
48-inch steel pipe, single strike		0	1	25
Three 48-inch steel pipe		0	127	25
36-inch, single strike		0	1	40
Three 36-inch steel		0	93	40
30-inch steel pipe, single strike		0	0	16
Five 30-inch steel pipe		0	62	16
Single strike 24-inch steel pipe		0	0	12
Six 24-inch steel pipe		0	88	12

Sources: ICF Jones & Stokes, 2009; NMFS, 2009

Impact AR-14: Increase the potential of hazardous material spills. (Less than significant.) Construction at the marine terminal would introduce a new point location for minor fuel, lubricant, and other construction-related spills. Minor spills would be dispersed into the waters around New York Point, degrading the quality of the water column habitat. Though minor spills are not an occurrence of normal construction operations, they are reasonably foreseeable as a result of the project. This impact would be less than significant with the implementation of a Spill Prevention, Containment, and Countermeasure Plan (SPCC Plan) as detailed in Chapter 2.0: Proposed Project and Alternatives, Chapter 7.0: Terrestrial Resources, and Chapter 10.0: Hazards and Hazardous Materials.

Mitigation Measure: No mitigation required.

Operational Impacts

Impact AR-15: Cause increase in boat wake erosion of tidal marshes due to increased vessel traffic. (Less than significant.) Boat wake erosion occurs where strong wave action created by ships travels into the narrow open-water channels in marshland and undercuts vegetation, causing the channel bank to slump. Increased ship traffic could potentially increase boat wake erosion, leading to localized habitat degradation. Marsh habitat could be lost, and the water quality in the vicinity of the bank erosion degraded. Because they are not protected from wave action, the tidal marshes along the south banks of Suisun Bay would be vulnerable to boat wake impacts. Because it is a rare habitat that presents the full distribution of a number of protected endemic species, impacts that degrade these marshlands would be significant.

The size of wake wash created by large ships such as those that would access the marine terminal is a product of speed of the ship and the surface area of the water through which the ship moves. At slow speeds in wide, open waters, large ships create very little wash. At low speeds in narrow channels, large ships displace a large volume of water and create a large wake (URS, 2003).

Under the San Francisco Bay Harbor Safety Plan, the ships accessing the marine terminal would be escorted by tugs while transiting between the Carquinez Strait and the marine terminal. The ships would move slowly and create little wash along the shoreline of Suisun Bay; therefore, the impacts to tidal marshlands from increased tanker traffic are expected to be less than significant.

The Carquinez Strait is a narrow channel and the vessels are expected to create large wash as they move through the strait. The 216 ships that are expected to dock at the marine terminal would create 432 new trips through the strait. Inbound vessel traffic in San Francisco Bay in 2009 is shown in Table 16-1 in Chapter 16.0: Marine Transportation and Marine Terminal Operations. Large ships (tankers, barges, and cargo) made 3,243 trips into the Carquinez Strait. Assuming that the ships left the bay via the strait, the total trips through the strait would be

6,486. Thus, the increase of large vessel traffic through the strait would increase the frequency of wake-wash action on the shores of the strait by 7 percent. This increase is probably enough to have a tangible effect. However, the banks of the Carquinez Strait are predominantly armored with natural rock or rip-rap. These shorelines are capable of resisting increased wave wash. Therefore, the increased shipping traffic through the Carquinez Strait would not significantly degrade habitat.

Mitigation Measure: No mitigation required.

Impact AR-16: Cause increased sediment resuspension due to increased boat traffic. (Less than significant.) The project is expected to increase shipping transit through the San Francisco Bay into the Lower Estuarine River by 216 ships per year. Large ships may raise sediment as they maneuver into the marine terminal. Frequent resuspension of sediments can bury benthic organisms and reduce the available forage at the marine terminal.

As discussed in Section 6.1.2 and with reference to dredging, river inflow is the major source of new sediment input into the estuary. Sediment plumes raised by maneuvering vessels are unlikely to have lasting effects given the high background turbidity. Therefore, this impact would be less than significant.

Mitigation Measure: No mitigation required.

Impact AR-17: Increase sediment in the water column due to routine maintenance dredging. (Less than significant.) Biannual dredging would be required to maintain the marine terminal and access channel depth to accommodate ships. An approximately 8-acre area would be dredged biannually. This area is comparable with other non-federal dredging projects in Suisun Bay, including the approximate 30-acre Pittsburg Marina, 0.3-acre River Island Boat Harbor, 2.3-acre Tosco Refinery, and the 3.3-acre Martinez Shore Terminal (Levine-Fricke, 2004). Environmental Commitment AR-4, described in Chapter 2.0: Proposed Project and Alternatives, Section 2.7.4, commits the project to seek coverage to conduct maintenance dredging under the provisions of the Long-term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region Management Plan (2001), which lays out a plan for managing dredging and disposal in an environmentally sound manner. Compliance with the provisions of this plan will ensure that impacts from maintenance dredging would be less than significant.

Mitigation Measure: No mitigation required.

Impact AR-18: Introduce or increase the spread of aquatic invasive species in the San Francisco Bay-Delta Region as a result of increased international shipping. (Significant and unavoidable.) Biological contamination can impact aquatic ecosystems as thoroughly as chemical contamination. The 1986 introduction of the overbite clam, *Corbula amurensis*, is a case in point. Thought to have been introduced in the bay by ballast water exchange from a cargo ship, this invasive species is now so abundant that the current population is capable of filtering the estuary's water column several times a day (SFEP, 2004). *Corbula* has overgrazed the bay's phytoplankton, which young fish rely on for food, and caused a cascade of ecosystem events that has contributed to the decline of all fish species in the bay. Because there are no environmentally acceptable ways to treat or remove widespread benthic invertebrates in open waters, the overbite clam is now considered a permanent member of the benthic community in Suisun Bay (CDFG, 2008b).

The San Francisco Bay and Delta region is a highly invaded ecosystem, among the most invaded aquatic ecosystems in North America. Since 1970, the rate of invasion has been one new species every 24 weeks (Cohen and Carlton, 1995). In some parts of the Estuary, including Suisun Bay, introduced species account for the majority of species diversity, dominate the Estuary's food webs, and may result in profound structural changes to habitat.

The California Aquatic Invasive Species Management Plan identifies commercial shipping as the more important vector for the introduction of aquatic invasive species (CDFG, 2008b). Commercial ships introduce aquatic invasive species through ballast water exchange or through hull fouling. These vector routes are addressed separately below.

Ballast Water Exchange

Ballast is a material placed low in a vessel to improve its stability. The amount of ballast a ship carries affects how high or low a ship's hull sits in the water; the vertical distance between the waterline and the bottom of the hull is known as a ship's draft. The draft determines the minimum depth of water a ship can safely navigate. Ships commonly use water as ballast because it is freely available and can be easily managed. Ballast water can be released to reduce draft, allowing the boat to sit higher in the water, or it can be taken on to increase draft and further submerge propellers or allow a ship to travel under a bridge or other structure. Ballast tanks are typically filled with water after discharging cargo to improve vessel stability, maneuverability, and propulsion on the ship's return to its home harbor.

In commercial ships, ballast water is taken on in large enough quantities that it is able to support a host of marine species from plankton to fish during their relatively long transit times in ballast. Ballast water is, therefore, capable of transporting live aquatic species halfway around the world. It is estimated that every day more than 10,000 marine species are transported across oceans in ballast water (Buck, 2007).

WesPac has no control over, ownership of, or authority to direct vessels that would dock at its marine terminal; therefore, specific details of how vessels manage their ballast water cannot be provided as part of the proposed project (refer to Chapter 2.0: Proposed Project and Alternatives). However, commercial ships arriving from outside the U.S. EEZ are required to manage their ballast in compliance with state and federal regulations in order to reduce the potential spread of aquatic invasive species.

Under the National Invasive Species Act of 1996, the U.S. Coast Guard (USCG) established regulations and guidelines to prevent the introduction of aquatic invasive species from ballast water discharge. All vessels would be required to manage their ballast water in accordance with the USCG-administered Ballast Water Management Program (33 CFR 151 Subparts C and D), which includes provisions for ballast water exchange, good housekeeping, and reporting. Vessels entering the state from outside the EEZ would be required to exchange ballast water in ballast tanks prior to travelling within 200 nautical miles (nm) of land, and vessels that move along the coast would be required to perform a full ballast water exchange before approaching within 50 nm of land.

The CSLC is the lead implementing agency for the state's ballast water management program. As directed by the Marine Invasive Species Act of 2003, the CSLC formulated recommendations to regulate ballast water discharge for vessels operating in state waters. California Code of Regulations Article 4.6 (Title 2, Division 3, Chapter 1) addresses ballast water management for vessels arriving in state ports from another port or place within the Pacific Coast Region; California Public Resources Code Section 71204.3 addresses requirements for vessels whose voyage originated outside of the Pacific Coast Region. All vessels coming into California from outside the EEZ are required to submit ballast water reports to the CSLC that includes information about port of origin, how the ballast water was managed, and how much ballast water was discharged.

Compliance with ballast water management requirements in California is extremely high. Between July 2008 and June 2010, ballast water inspections by CSLC staff demonstrated over 98 percent of marine arrivals were found to be in compliance with the operational aspects of the ballast management plan (Takata *et al*., 2011). The existing regulations and high levels of compliance reduce the potential threat from invasion of aquatic species to the Lower Estuary River from vessel ballast water to less than significant.

Biofouling

Ships that travel through marine environments are subject to a natural process known as biofouling. Many marine organisms that have a sessile life stage in which they are attached to hard substrata can readily colonize ship's hulls or niche areas that are inadequately protected by anti-fouling systems such as sea chests, bow thrusters, propeller shafts, and inlet gratings. The most common fouling organisms are barnacles, but mussels, seaweed, anemones, and sea squirts can also attach themselves to ships' hulls (CDFG, 2008b). Shrimps, worms, and sea snails can hide in the crevices created by colonies of barnacles and mussels. Fouling organisms are then transported into new environments where they may be transferred from the ship into the new environment by spawning, detachment, or mechanical removal.

The risk from fouling by commercial ships has not been quantified, but is assumed to be high, and is one of the primary routes through which aquatic invasive species are introduced to the estuary. The CSLC, which regulates biofouling under the Marine Invasive Species Act of 2003, states that all vessels pose some level of risk from biofouling (Takata *et al*., 2011). Beginning in 2008, the CSLC required vessels operating in state waters to submit an annual Hull Husbandry Reporting Form. This data has since been used in conjunction with results from CSLC-funded biological research to develop management requirements that would reduce introductions of aquatic invasive species through vessel fouling. The CSLC has proposed to amend California Code of Regulations Article 4.8 (Title 2, Division 3, Chapter 1) to establish the following standards for biofouling management: Vessels of 300 gross registered tons (g.r.t.) or more would be required to be free of macrofouling prior to arrival in port, to maintain documentation that certain niches of the vessel have been evaluated and are in compliance with the proposed levels of fouling, to prepare a biofouling management plan specific to the vessel, and to maintain a biofouling record book. The text of the amendment is currently under review; it is anticipated that the regulations will go into effect January 1, 2014.

WesPac has no control over, ownership of, or authority to direct vessels that would dock at its marine terminal; therefore, specific details of how vessels manage biofouling cannot be provided as part of the proposed project (refer to Chapter 2.0: Proposed Project and Alternatives). Aframax vessels are approximately 63,500 g.r.t.; Panamax vessels are approximately 42,500 g.r.t. Therefore, the vessels would be governed by the applicable CSLC standards for biofouling management, which would reduce the potential impact of aquatic species invasion from biofouling. Under Mitigation Measure AR-12, WesPac will ensure that vessels seeking to call at the marine terminal are advised of California's Marine Invasive Species Act and are submitting forms as required by the CSLC. However, the impact of introducing new non-native and invasive species via ballast water and hull fouling in the San Francisco Bay and Delta could potentially be so devastating that even a reduced risk has the potential to cause a significant and unavoidable adverse impact to special-status species and habitats.

Mitigation Measure AR-12: Marine Invasive Species Act Questionnaires. Following the adoption of the Mitigation Monitoring Program for the proposed Project, WesPac shall advise both agents and representatives of shipping companies having control over vessels that have informed WesPac of plans to call at the marine terminal about the California Marine Invasive Species Act and associated implementing regulations. WesPac shall satisfy itself that all vessels submit required reporting forms, as applicable for each vessel, to the California State Lands Commission Marine Facilities Division, including but not limited to, the Ballast Water Reporting Form, the Hull Husbandry Reporting Form, the Ballast Water Treatment Technology Reporting Form, and/or the Ballast Water Treatment Supplemental Reporting Form prior to the vessel's entry into San Francisco Bay or in the alternative, at least 24 hours prior to the vessel's arrival at the marine terminal. WesPac shall not discharge any non-segregated ballast water received at the marine terminal to San Francisco Bay. If WesPac needs to unload non-segregated ballast water, it shall be unloaded into a tanker truck or other suitable waste handling vehicle and disposed of at an appropriate facility. All vessels calling at the marine terminal must also have removed biofouling organisms from their wetted surfaces on a regular basis.

Impact AR-19: Increase the potential for minor accidental spills of fuel and other materials. (Less than significant.) Operation of the marine terminal would introduce increased boat-related activities in the San Francisco Bay-Delta. The marine terminal dock coming into use would introduce a new point location for minor fuel, lubricant, and other boat-related spills. Minor spills would be dispersed into the waters around New York Point, degrading the quality of the water column habitat. Though minor spills are not an occurrence of normal project operations, they are reasonably foreseeable as a result of the project. In an effort to reduce the potential for minor accidental spills of fuel and other materials, Environmental Commitment AR-5, described in Chapter 2.0: Proposed Project and Alternatives, Section 2.7.4, commits the project to the implementation of an SPCC Plan. The SPCC Plan shall include provisions to prevent and control potential releases that could impact biological resources. This will ensure that minor accidental spills of fuels and other materials are dealt with swiftly and appropriately before they have the opportunity to harm biological resources.

Mitigation Measure: No mitigation required.

Impact AR-20: Increase the potential for major accidental spills of fuel and other materials. (Significant and unavoidable.) Estimates of the probability of a spill based on its magnitude are presented in several chapters in this Environmental Impact Report, including Chapter 10.0: Hazards and Hazardous Materials and Chapter 17.0: Water Resources. This impact analysis discusses the potential impacts to habitats and the regulatory mechanism through which state and federal trustee agencies are enabled to seek compensation for loss of natural resources caused by oil spills.

Major spills of fuel, crude oil, or other materials can be expected to have serious adverse affects on species and habitat, including reducing protected and commercial fisheries in the bay, straits, and along the outer coast; causing lost harvesting opportunities due to harbor closures; impacting living marine resources and habitat; and causing equipment or vessel loss or damage. Migration of special-status species could be halted and spawning grounds degraded. Critical habitat for listed species and essential fish habitat would be adversely affected and degraded. Additional information relevant to this discussion is located in Appendix E.

Impacts from spills would depend on the material and quantity spilled. Light oils such as fuel oil are acutely toxic and cause the greatest impacts to species that live in the upper water column. Medium oils such as most crude oils do not mix well with water and can cause severe, long-term contamination to intertidal areas and cause oiling of waterfowl and marine mammals. Heavy oils such as heavy crude and some fuel oils weather slowly and cause severe long-term contamination of intertidal areas and sediments. These oils have severe impacts on waterfowl and marine mammals, and their cleanup is usually difficult and long-term. The heaviest oils may sink in the water, contaminating the water column and the substrate. Depending on the weight of the oil, spills may harden and wash up along the MHHW.

Clean up of the impacted site and restoration to its pre-spill condition is called primary restoration. Primary restoration includes any action, including natural recovery, that returns injured natural resources and services to baseline conditions (i.e., pre-spill state) (French *et al*., 1996).

Through OPA, federal and state natural resource trustees are authorized to seek compensatory restoration for injuries to natural resources caused by an oil spill. Compensatory restoration is restoration in addition to primary restoration that compensates the public for the interim lost ecological services between the time of the incident and full recovery to pre-spill conditions. As the responsible party, WesPac would assist representatives from NOAA, USFWS, CDFW’s Office of Spill Prevention and Response, and other federal and state trustee agencies as required to prepare a Natural Resource Damage Assessment (NRDA). The NRDA would:

- quantify injuries to wildlife, habitat, and lost human use of those resources;
- determine the amount of restoration necessary to restore the resources and compensate for the injuries and losses; and
- develop an appropriate Restoration Plan.

In the State of California, NRDAs employ Resource Equivalency Analysis (REA) to calculate damages to both habitat and/or an individual animal species (Zafonte, 2002). REA involves three steps:

1. The debit calculation involves determining the amount of “natural resource services” that the affected resources would have provided had it not been injured. Units of natural resource services vary depending on the impacted resource; various units employed include (but are not constrained to) acre-years, stream feet-years, and bird-years. For example, an oil spill event that had no effect on habitat, but which resulted in the death of a flock of migrating waterfowl might employ lost “duck-years” to calculate the debit. For large-scale oil spills, a wide variety of species and habitats are affected, and thus it is not practicable to develop REA analysis for each species and habitat. Species and habitats are therefore lumped together into suitable categories (e.g., wetlands, anadromous fish, shorebirds, etc.).

2. The credit calculation equates the quantity of the lost services with those created by the proposed compensatory restoration project. Restoration projects are typically intended to provide ecosystem services of the same type and quality and of comparable value to those that were lost due to pollution, known as in-kind restoration. In practice, a strict interpretation of in-kind restoration has limitations because it is not always possible to restore the same type and quality of ecosystem services as those that are lost. In these cases, compensatory restoration may take the form of an out-of-kind restoration project. In this case, a metric is used that is common to both the lost service and the service that is to be restored, e.g., biomass.

3. The computation of restoration project costs.

In California, debit calculations discount the cost of future years of an ecosystem resource at 3 percent per year. For pollution injuries with short-lived impacts, future-use discounting is negligible. However, discounting becomes significant if injuries persist many years into the future because of compounding.

In the event of an oil spill, the ultimate compensatory cost of the NRDA would depend on the extent and severity of the spill. Three examples serve to illustrate the application of the NRDA to hazardous material spills in the Bay-Delta region: Shell-Martinez 1988, Kinder-Morgan 2004, and Cosco Busan 2007.

At the Shell oil refinery in Martinez in 1988, a crude oil tank began to leak and a hose meant to remove rain water from the top of a crude oil storage tank began to drain crude oil into the stormwater basin; the valve of the stormwater basin had been left open, allowing the oil to drain into a nearby creek, from which it ran into an adjacent marsh and into the bay. Because it was night time when the spill occurred, the problem was not noticed until the morning, by which point approximately 400,000 gallons of heavy crude oil had been drained from the tank and into the environment. In this case, the Shell Oil Company settled the NRDA portion of the case for $10.8 million. Restoration funds were used to support studies of rare plants and to purchase and restore marshes and wetlands throughout the bay (Shell Trustee Committee, 2001).

In 2004, a Kinder-Morgan pipeline ruptured, spilling upwards of 100,000 gallons of diesel into Suisun Slough and Marsh near Roos Cut in Solano County. The spill was contained in a privately owned and managed 224-acre salt marsh enclosed with levees and tidally influenced via tide gates. Kinder-Morgan Energy Partners settled the NRDA portion of the case for $1.15 million. Areas impacted by the spill were estimated to recover between two and four years depending on the severity of impact. Two restoration projects were identified by trustees that provided equivalent ecosystem function based on comparison of marsh acre-years (USFWS and CDFG, 2010).

Most recently, in 2007 the container ship Cosco Busan struck a support tower in the Bay Bridge, puncturing the vessel and spilling upwards of 50,000 gallons of fuel oil into the bay. Tidal waves spread the fuel throughout the Central and South Bays and out along the coastline. Primary restoration was completed one year and two days after the spill, though most of the active response ended within two months of the spill. The responsible party, Regal Stone, settled the NRDA portion of the case for $32.3 million, which included $5 million for bird restoration; $4 million for habitat restoration; $2.5 million for fish and eelgrass restoration; $18.8 million for recreational improvements, and $2 million for administration and oversight. The cost of the lost ecosystem services was calculated based on birds killed, fish lost due to widespread egg mortality, acreage of shoreline habitat impacts, and recreational and commercial use-days lost. Habitats affected by the spill were estimated to recover within five years depending on the severity of impact (CDFW and CSLC, 2011).

These examples illustrate that while large-scale spills of hazardous materials into the environment are unfortunately not unknown in the project area, regulatory mechanisms exist to ensure that major spills are cleaned up appropriately and fully mitigated.

Under the Section 112.20 of OPA, the project would be considered to pose “significant and substantial harm” because it transfers oil over water to/from vessels. As described in Section 2.7.7, Environmental Commitment HM-12, WesPac would be required to prepare an FRP to demonstrate preparedness to respond to a worst-case oil discharge. WesPac would have a contractual agreement with a regional spill response cooperative that would serve as the emergency response contractor with primary responsibility for containment, cleanup, and health and safety at the marine terminal. In addition to preparing an SPCC Plan and FRP, WesPac would be required to apply for a Certificate of Financial Responsibility from the Office of Spill Protection and Response to demonstrate that it has adequate financial resources to pay cleanup and damage costs arising from an oil spill. As of July 6, 2011, facilities are required to demonstrate $12,500 per barrel to cover cleanup and damage cost (OSPR, 2011b).

Mitigation Measure: No additional mitigation measures available.

Impact AR-21: Cause significant impacts to special-status species and sensitive habitats under modeled sea rise projections. (Less than significant.) Sea level in the bay is projected to rise 16 inches by 2050 and 55 inches by 2100 (CSLC, 2009a). The existing facility site lies within the area modeled as vulnerable to an approximated 55-inch sea level rise; all of the wetlands in the San Pablo Bay study corridor are within an area modeled as vulnerable to an approximate 16-inch sea level rise (Knowles, 2010).

As sea levels rise, the marine and wetland habitats around the marine terminal will undergo a natural process known as estuarine transgression (Goals Project, 1999). Estuarine transgression will move the salinity gradients inland: The freshwater habitats of the Delta will become more brackish like those found now in Suisun Bay, while Suisun Bay will become more saline and its habitats will resemble those around the San Pablo or Central bays. Rising sea levels will also move the tidal wetlands upward and landward into adjacent undeveloped land. This is expected to cause serious impacts to species, especially endemic species and isolated populations that inhabit the marshes along the south shores of Suisun Bay. It is also expected that owners of developed lands will seek to protect their properties from the rising sea. Thus there are two potential impacts to address with respect to sea level rise: (1) The commitment of shoreline property to industrial use for a 50-year span, which means removing it from areas of potential restoration; and (2) the potential impacts from future projects needed to protect the facility from flooding.

The project site is located at an existing facility in an area that is zoned for industrial use. Were the project not to be implemented, other industrial uses would still be allowable at the site. Likewise, the San Pablo Bay Pipeline lies within a right-of-way dedicated for pipeline transmission of crude oil, and is, therefore, an allowable use for the right-of-way. Because the land use is already committed for the purposes to which it would be put, no additional impact exists.

No flood-control projects are currently required to protect the storage terminal or the San Pablo Bay Pipeline from flooding due to sea level rise. At this point, it would be speculative to analyze potential impacts from these projects. All future flood control projects would be subject to regulation under existing state and federal regulations, at which point environmental review would be conducted to ensure that the projects were in compliance with relevant regulations. Therefore, no significant impacts are expected from future flood control projects.

Mitigation Measure: No mitigation required.

Impact AR-22: Substantially affect threatened or endangered species, or protected species (including candidate, sensitive or special-status species); cause the loss of sensitive native plant communities; or cause the loss of wetlands as a result of routine maintenance. (Less than significant.) Pipeline maintenance along the San Pablo Bay Pipeline could require soil disturbing activities with the potential to impact special-status plants, animals, or wetlands. Operation of the crude oil pipeline would not cause impacts to special-status plants, animals, or wetlands. However, maintenance of the pipelines could require excavation of a section of the pipeline for inspection and/or repair. Regular inspection of the pipeline would be performed using remote-sensing pigs, which run inside of the pipeline, and therefore would not require excavation. Excavations of the pipeline for maintenance would occur infrequently. Any maintenance activities requiring excavation would be conducted in accordance with applicable federal, state, and local regulations. Therefore, routine maintenance of the San Pablo Bay Pipeline would not be considered a significant impact to biological resources.

Mitigation Measure: No mitigation required.

Impact AR-23: Cause a degradation in water quality such that criteria for the protection of aquatic life and the prevention of bioconcentration of pollutants in aquatic organisms are exceeded (Less than significant). As discussed in Impact AR-18 above, ships that travel through marine environments are subject to a natural process known as biofouling. Fouling causes drag, which reduces ship speed and increases fuel expenditure. To inhibit fouling, most vessels visiting the San Francisco Bay use biocidal antifouling paints that leach copper from the vessel's surface into the surrounding water. Levels of the biocide are higher next to the hull and decrease rapidly with distance from the vessel. By design, small organisms are directly affected by the biocides contained in antifouling coatings. Larger organisms are less susceptible to injury from the small amount of direct exposure to biocides, but may be affected through the bioaccumulation of biocides in their trophic environment.

Ninety percent of biocide-based coatings on oil tankers entering California's water are copper-based and approximately 8 percent use biocide-free coatings (CLSC, 2009b). Biocide-free coatings generally contain silicon, which increases the slickness of the hull so fouling organisms fall off as the vessel travels at speeds. The environmental impacts of copper-based antifouling coatings and biocide-free coatings are evaluated separately below.

Copper-based Antifouling Coatings

Water quality near the marine terminal is assessed by the Suisun Bay Water Quality Monitoring Project (BACWA, 2011). The average summer concentration of dissolved copper between April and June is 3.2 micrograms per liter (µg/L) (see Table 6-14). The fate of copper in the environment is not well characterized. Copper is found naturally in seawater at levels of 0.5 – 3 µg/L (Dafforn et al, 2011). It binds easily to particles of sediment, which tend to settle on the substrate at variable distances from the release site depending on sediment availability and water flow. A study conducted by the CDPR indicated that dissolved copper concentrations in over half the water samples taken from salt and brackish water marinas exceeded state water quality standards for copper (CDPR, 2009). The issue of copper release from marine vessels is therefore of great concern to the State. The marinas included in the CDPR study were typically crowded recreational marines in enclosed waters with low water exchange and are not representative of the project site. However, the introduction of new vessels calling at the marine terminal will introduce copper-based fouling paints in a new location, which has the potential to impact aquatic species by increasing the concentration of copper in the water and sediment.

The concentrations at which dissolved copper in the water column begins to impair aquatic life depend on whether the copper is delivered in a pulse or its concentrations are elevated over the course of several days. Elevated copper concentrations that persist over days can be injurious at a lower threshold than a temporary increase in concentration. This distinction has led to the development of two thresholds for determining harm: the criteria maximum concentration (CMC) and the criteria continuous concentration (CCC). The CMC sets the maximum allowable range for the average 1-hour concentration of dissolved copper, and the CCC sets the maximum allowable range for the average 4-day concentration of dissolved copper. The EPA sets the CMC threshold for dissolved copper in saltwater at 4.8 µg/L and the CCC threshold at 3.1 µg/L, but advises that copper is substantially less toxic when the concentration of dissolved organic carbon is high (EPA, 2007). Because the heavy sediment load entering the Bay from the Delta increases organic carbon levels in the water, the San Francisco RWQCB (SFRWQCB) sets the CMC threshold for copper in Suisun Bay at 9.4 µg/L and the CCC threshold at 6.0 µg/L. If the project degrades water quality such that these thresholds are exceeded, this would be considered a significant impact.

Table 6-14: Water Quality for Copper

Data Source	Total Dissolved Cu (micrograms per liter)
Pittsburg Station	3.2
SFRWQCB Criteria Continuous Concentration[1]	6.0
SFRWQCB Criteria Maximum Concentration[2]	9.4

[1]Four-day average

[2]One-hour average

Sources: BACWA, 2011; SFRWQCB, 2008

Criteria Continuous Concentration

Studies of in situ copper release from antifouling coatings in natural seawater show rates that vary from 3.2 to 4.7 µg/cm^2 per day depending on the type of epoxy used in the coating, with coatings produced for commercial vessels generating higher release rates (Valkirs, 2003; Ytreberg, 2010). Because the exact antifouling coating used by the oil tankers visiting the marine terminal is unknown, the higher value of the range was presumed for this evaluation. Were there no flow through the terminal, a leach rate of 4.7 µg/cm^2 would increase the hourly concentration of copper within one meter of the hull by approximately 1.95 µg/L. The concentration of copper near the terminal is 3.2 µg/L. Thus, even without factoring in water flow, the increase in concentration of copper at the marine terminal site would not cause the water to reach the SFRWQCB CCC standard of 9.4 µg/L. However, because water flows past the terminal, the likely increase in copper concentration will be substantially lower. Thus, the project will not cause CCC standards to be exceeded, and this impact would therefore be considered less than significant.

Criteria Maximum Concentration

The amount of copper leached into the water is related to the underwater surface area of the vessel. Following Davidson, 2006, wetted surface area (WSA) for Aframax and Panamax type oil tankers was calculated using Van Maanen & Van Oossanen's method and Lewis' 1998 coefficients for Geometrical Characteristics of Typical Ships, Crude Oil Carrier, included below. The wetted surface coefficient of a ship generally takes into account those parts of the ship which contribute to drag, such as bilge keel, propeller bossing, and rudder. Results are provided in Table 6-15.

$$WSA = L\,(2T + B)\,C_M\,0.5\left(0.4530 + 0.4225\,C_B - 0.2862\,C_M - \frac{0.003467 * B}{T} + 0.3696\,C_{WP}\right) + \frac{2.38 A_{BT}}{C_B}$$

WSA = Wetted Surface Area
L = length
T = draft
B = breadth
C_M = midship coefficient
C_B = blocking coefficient
C_{WP} = waterplane coefficient
A_{BT} = cross-sectional area of bulbous bow

The mass loading of copper was then calculated:

$$Mass\ Loading\left(\frac{g}{day}\right) = Release\ Rate\left(\frac{\mu/cm^2}{day}\right) Surface\ Area\ (m^2)\left(\frac{10^4\,cm^2}{m^2}\right)\left(\frac{g}{10^6\,\mu g}\right)$$

Results are provided in Table 6-15.

Table 6-15: Wetted Surface Area for Oil Tankers Docking at the Marine Terminal

Tanker	Beam (meters)	Length (meters)	Draft (meters)	Wetted surface area (square meters)	Mass Loading (g/day)
Aframax	34	266.7	20	11,272	530
Panamax	32	243.8	12	7,824	368

As stated in Chapter 2.0: Proposed Project and Alternatives, the maximum number of vessels to call at the marine terminal would be approximately 18 vessels per month, only one tanker called at the marine terminal at any time. Most oil tankers will not dock at the terminal for more than two days, though they may spend two to four days in the Bay per visit (CSLC, 2010).

In order to determine if the CMC standard of 6.0 µg/L averaged over four days will be exceeded, it is necessary to take into account the dilution factor of the water flowing through the Lower Estuarine River. Water flow through the terminal varies by season. The lowest flows occur during the summer, when average daily Delta outflows drop just below 5,000 cfs (Figure 6-2).

With an average outflow of 5,000 cfs, approximately 432 million cubic feet of water (about three billion gallons) flows from the Delta through the Lower Estuarine River each day. Because of tidal flow, the flow through in the Lower Estuarine River is much higher. However, even when considering only the flow from the Delta, the amount of water moving past the terminal during the months of lowest flow is great enough that concentration in copper would cause an increase of less than 0.04 µg/L. Therefore, because of the washing effects of continual flow of water past the vessel hulls, the project will not cause the CMC for copper to be exceeded and this impact would be considered less than significant.

Sediment Concentration

There are no regulatory criteria set for limits of copper in sediment, but a concentration of 30 milligram/kilogram (mg/kg) has been shown to reduce infaunal diversity (Dafforn, 2011). Levels of copper in the sediment at the marine terminal site range from 13.1 to 17.9 mg/kg (see Table 6-16). Although the environmental fate of copper in the marine environment is not well characterized, copper binds readily to particles of sediment and once within the sediment load would be subject to the same cycles of deposition and transport that regulate the sediment cycle in the Lower Estuarine River.

Table 6-16: Sediment Quality for Copper

Sample Number	**Result (mg/kg)[1]**
TR-DU1-Comp	13.1
TR-DU2-Comp	16.6
TR-DU3-Comp	13.4
TR-DU4-Comp	17.9
Reduced infaunal diversity[2]	**30**

[1] milligram/kilogram
[2] Dafforn *et al*., 2011

For this analysis, it was assumed that all copper leached would bind to particles of sediment and enter the sediment layer directly below a Panamax vessel, an area of approximately 7,800 m^2. The upper 2 cm of the benthos is in partial contact with the water column. The increase in copper concentration can be calculated using the following equation:

$$Copper\left(\frac{mg}{kg}\right) = \frac{Mass\ Loading\ (mg)}{Impact\ area\ (m3)\ x\ \ Weight\ of\ moist\ sand\ \left(\frac{kg}{m3}\right)}$$

The weight of moist sand was estimated at 1,282 kilograms per cubic meter (Williams & Gedes, 2013).

The theoretical daily maximum increase in copper concentration directly under a Panamax will be 1.84 mg/kg, and levels of copper in the sediment will remain well below levels that reduce infaunal diversity. This simple equation does not account for the amount of dissolved copper that remains in the water column or sediment transport out of the water column and from the benthic layer into the water column. Were these variables to be taken into account, the net increase in copper concentration in the sediment would be lower by several orders of magnitude. Therefore, the increase in vessels docking at the marine terminal will not cause the levels of copper in the sediment to reach levels at which infaunal diversity is reduced, and this impact would be considered less than significant.

Biocide-free Antifouling Coatings

Silicone antifouling coatings have been proposed as a non-toxic alternative to biocidal antifouling coatings. Silicone coatings work by increasing the slickness of the vessel surface, so at high speeds marine organisms lose their hold on the vessel surface and fall off. Silicone coatings are a new technology, and their efficaciousness and impact on the environment have not been fully assessed. Silicon coatings have been shown to be most effective on vessels that routinely cruise at speeds above 15 knots. Tanker speeds in the Bay tend to be below 15 knots (CSLC, 2010), so do not reach the speed at which silicon coatings are effective. Though silicon oils leached from biocide-free coatings do not bioaccumulate, they do settle to the sediment and do not degrade, causing concerns that the oils may build up over the course of a decade into oil films thick enough to inhibit water exchange at the benthos/water column interface or cause trapping and suffocating of organisms (Nendza, 2007). Although this impact is of concern, it has not been demonstrated to result from the use of biocide-free antifouling coatings. Estimates of release rates of silicon oils are not yet available in the literature. While it is unlikely that the silicon oils released from the annual visits of a dozen vessels to the terminal would cause a significant environmental impact, this impact is too speculative for evaluation.

Mitigation Measure: No mitigation required.

6.2.3.2 Alternative 1: Reduced Onshore Capacity

Construction-related Impacts

Impact AR-24: Cause adverse impacts to special-status species or their habitats, or disrupt wildlife migratory corridors as a result of project construction or dredging. (Significant and unavoidable.) Construction of the marine terminal would not change with the implementation of Alternative 1. Therefore, the impacts to aquatic resources and proposed mitigations would be the same as for the proposed project. Mitigation Measures AR-12 through AR-15 would only reduce the impacts to most species, not all. Therefore, the impacts to migratory corridors are expected to be significant and unavoidable.

Mitigation Measure AR-13: Conduct environmental training prior to construction. Refer to Mitigation Measure AR-1.

Mitigation Measure AR-14. Special-status plant protection. Refer to Mitigation Measure AR-2.

Mitigation Measure AR-15: Conduct biological monitoring during construction. Refer to Mitigation Measure AR-3.

Mitigation Measure AR-16: Schedule work to avoid impacts to species. Refer to Mitigation Measure AR-4.

Mitigation Measure AR-17: Keep the work site clean and free of hazards. Refer to Mitigation Measure AR-5.

Impact AR-25: Introduce or spread aquatic invasive species into or within the Lower Estuarine River; cause entrainment, increased turbidity and suspended-sediment concentration, resuspended sediments, or habitat modification as a result of dredging; or increase the potential for hazardous material spills. (Less than significant.) Construction of the marine terminal would not change with the implementation of Alternative 1. Therefore, the impacts to aquatic resources and proposed mitigation measures would be the same as for the proposed project.

Mitigation Measure: No mitigation required.

Impact AR-26: Cause increased sediment resuspension in the water column due to pile removal, or cause increased underwater noise levels in the Lower Estuarine River as a result of pile driving. (Less than significant with mitigation). Construction of the marine terminal would not change with the implementation of Alternative 1. Therefore, the impacts to aquatic resources and proposed mitigations would be the same as for the proposed project.

Mitigation Measure AR-18: Minimize sediment resuspension. Refer to Mitigation Measure AR-7.

Mitigation Measure AR-19: Consult with agencies to determine optimal schedule. Refer to Mitigation Measure AR-8.

Mitigation Measure AR-20: Time impact-hammer pile driving to coincide with low tide or slack currents. Refer to Mitigation Measure AR-9.

Mitigation Measure AR-21: Start soft. Refer to Mitigation Measure AR-10.

Mitigation Measure AR-22: Employ a sound attenuation system for impact-hammer pile driving. Refer to Mitigation Measure AR-11.

Operational Impacts

Impact AR-27: Cause increase in boat wake erosion of tidal marshes or sediment resuspension due to increased vessel traffic, increase sediment in the water column due to routine maintenance dredging, introduce or increase the spread of aquatic invasive species in the San Francisco Bay-Delta Region as a result of increased international shipping, increase the potential for minor accidental spills of fuel and other materials, or cause significant impacts to special-status species and sensitive habitats under modeled sea rise projections. (Significant and unavoidable.) Under operation of the reduced onshore capacity alternative, the marine terminal is expected to receive fewer vessels, but not to the extent that it significantly changes the results of the impacts analysis for the proposed project. The potential impacts associated with the shipping would, therefore, be the same as for the proposed project.

Mitigation Measure AR-23: Marine Invasive Species Act Questionnaires. Refer to Mitigation Measure AR-11.

Impact AR-28: Increase the potential for major accidental spills of fuel and other materials. (Significant and unavoidable.) Under operation of the reduced onshore capacity alternative, the marine terminal is expected to receive fewer vessels, but not to the extent that it significantly changes the results of the impacts analysis for the proposed project. The potential impacts associated with the shipping would, therefore, be the same as for the proposed project and would require the same mitigation measures. Refer to Impact AR-20 for details.

Mitigation Measure: No additional mitigation measures available.

Impact AR-29: Cause a degradation in water quality such that criteria for the protection of aquatic life and the prevention of bioconcentration of pollutants in aquatic organisms are exceeded (Less than significant). Under operation of the reduced onshore capacity alternative, the marine terminal is expected to receive fewer vessels, but not to the extent that it significantly changes the results of the impacts analysis for the proposed project. The potential impacts associated with antifouling coatings would be the same as for the proposed project. Refer to Impact AR-23 for details.

Mitigation Measure: No mitigation required.

6.2.3.3 Alternative 2: No Project

Impact AR-30: Cause adverse impacts to special-status species or their habitats, or disrupt wildlife migratory corridors as a result of project construction, dredging, or operations. (No impact.) Under Alternative 2, no construction would occur at the marine terminal and, therefore, there would be no impacts. Marine terminal would continue its slow decay. Creosote would leak from the existing pilings, the channel floor would undergo natural sedimentation processes, and as sea levels rise, water would cover the existing marine terminal until eventually it becomes a navigational hazard and requires removal.

Mitigation Measure: No mitigation required.

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