UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404-4731

FEB 15 2018

Refer to NMFS No: WCR-2017-7306

Rick M. Bottoms, Ph.D.
Chief, Regulatory Division
Department of the Army
San Francisco District, Corps of Engineers
1455 Market Street
San Francisco, California 94103-1398

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Plains Martinez 2017 Wharf Repairs and Retrofit Project (Corps File No. 2013-00172S)

Dear Dr. Bottoms:

Thank you for your letter of June 12, 2017, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 *et seq.*) for the Plains Martinez 2017 Wharf Repairs and Retrofit Project. The U.S. Army Corps of Engineers proposes to authorize Plains Products Terminals, LLC (Applicant) to repair and retrofit the Martinez Marine Oil Terminal in order to comply with the California State Lands Commission's Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS) in Suisun Bay located at 2801 Waterfront Road, in the City of Martinez, Contra Costa County, California, under Section 10 of the Rivers and Harbors Act of 1899, as amended (33 USC Section 403 *et seq.*).

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action.

The enclosed biological opinion is based on our review of the work proposed by the Applicant, and describes NMFS's analysis of potential effects on threatened Southern distinct population segment (Southern DPS) of North American green sturgeon (*Acipenser medirostris*), threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*), threatened Central Valley spring-run Chinook salmon (*O. tshawytscha*), threatened California Central Valley steelhead (*O. mykiss*), endangered Sacramento River winter-run Chinook salmon (*O. tshawytscha*), and designated critical habitat in accordance with section 7 of the ESA.

In the biological opinion, NMFS concludes that the project is not likely to jeopardize the continued existence of Southern DPS green sturgeon, nor is the project likely to result in the

destruction or adverse modification of critical habitat for Southern DPS green sturgeon. However, NMFS anticipates take of green sturgeon in the form of injury or mortality during the use of an impact hammer for pile installation. An incidental take statement with non-discretionary terms and conditions is included with the enclosed biological opinion. NMFS has also found that the proposed project is not likely to adversely affect threatened CCC steelhead, threatened Central Valley spring-run Chinook salmon, threatened California Central Valley steelhead, endangered Sacramento River winter-run Chinook salmon, or salmonid designated critical habitat in accordance with section 7 of the ESA.

Regarding EFH, NMFS has reviewed the proposed project for potential effects and determined that the proposed project would adversely affect EFH for various federally managed fish species under the Coastal Pelagic and Pacific Coast Groundfish Fishery Management Plans (FMPs). However, the anticipated effects are minor, temporary, and localized. Therefore, we have no practical EFH Conservation Recommendations to provide and no EFH Conservation Recommendations are included in this document.

Please contact Daniel Logan of NMFS North-Central Coast Office in Santa Rosa, California at (707) 575-6053, or via e-mail at dan.logan@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

for

Barry A. Thom
Regional Administrator

Enclosure

cc: Danielle Mullen, US Army Corps of Engineers, San Francisco, California
John-Paul Nepote, Plains Products Terminals, LLC, Richmond, California
Copy to ARN File # 151422WCR2017SR00176
Copy to Chron File

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation

Plains Martinez 2017 Wharf Repairs and Retrofit

NMFS Consultation Number: WCR-2017-7306

Action Agency: Army Corp of Engineers, San Francisco District

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
California Central Valley steelhead (*Oncorhynchus mykiss*)	Threatened	No	N/A	N/A	N/A
Central California Coast steelhead (*O. mykiss*)	Threatened	No	N/A	N/A	N/A
Sacramento River Winter-run Chinook (*O. tshawytscha*)	Endangered	No	N/A	No	N/A
Central Valley Spring-run Chinook (*O. tshawytscha*)	Threatened	No	N/A	N/A	N/A
Southern DPS of North American Green Sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	Yes	No

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Groundfish	Yes	No
Pacific Coast Salmon	No	No
Coastal Pelagic	Yes	No

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By: for

Barry A. Thom
Regional Administrator

Date: FEB 15 2018

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LIST OF ACRONYMS

BOR	Bureau of Reclamation
CCC	Central California Coast
CDFW	California Department of Fish and Wildlife
cSEL	cumulative sound exposure level
dB	decibel
DPS	distinct population segment
DQA	Data Quality Act
DWR	Department of Water Resources
EFH	Essential Fish Habitat
ESA	Endangered Species Act
FHWG	Fisheries Hydroacoustic Working Group
ft	foot
GCID	Glenn-Colusa Irrigation District
ITS	incidental take statement
m	meter
µPa	micropascal
mm	millimeter
MOTEMS	Marine Oil Terminal Engineering and Maintenance Standards
NMFS	National Marine Fisheries Service
PAHs	polycyclic aromatic hydrocarbons
PBF	physical or biological features
PCE	primary constituent element
RBDD	Red Bluff Diversion Dam
RMS	root-mean-squared
SEL	sound exposure level
SPL	sound pressure levels
TL	total length
TTS	temporary threshold shift

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background

NOAA's National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 *et seq*.), and implementing regulations at 50 CFR 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 *et seq*.) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). A complete record of this consultation is on file at the NMFS North-Central Coast office in Santa Rosa, California.

1.2 Consultation History

On June 14, 2017, NMFS received a letter from the U.S. Army Corps of Engineers (Corps) requesting initiation of section 7 consultation to address a proposal by Plains Product Terminals, LLC (Applicant) to repair and retrofit the Martinez Marine Oil Terminal in Suisun Bay, located at 2801 Waterfront Road in the City of Martinez, Contra Costa County, California (Project). The Project is designed to repair and retrofit the marine terminal in order to comply with the California State Lands Commission's Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS). The Corps requested consultation to address the Project's potential impacts to Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley spring-run Chinook salmon (*O. tshawytscha*), California Central Valley steelhead (*O. mykiss*), Central California Coast (CCC) steelhead (*O. mykiss*), and the Southern distinct population segment (Southern DPS) North American green sturgeon (*Acipenser medirostris*). Pursuant to the MSA, the Corps made a finding that the Project may adversely affect EFH and requested EFH consultation with NMFS. With the Corps' letter dated June 2, 2017, the Corps provided a copy of the Applicant's April 3, 2017, application and a May 16, 2017, memorandum prepared by COWI North America, Inc. with estimates of underwater sound levels likely to be generated by the Project's pile driving activities.

By email dated July 21, 2017, NMFS requested the Corps provide additional information regarding the Project's potential impacts on listed salmonids. By email dated July 26, 2017, the Corps modified their determinations for listed anadromous salmonids and requested informal

consultation for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, California Central Valley steelhead, and CCC steelhead.

Email messages were exchanged between NMFS, the Corps and the Applicant between July 25, 2017 and August 25, 2017 regarding the project's work schedule, construction techniques, and habitat conditions in the project area.

Via email message on January 4, 2018, the Applicant informed the Corps and NMFS of measures to be employed by the Project to prevent the accidental discharge of pollutants into the waters of Suisun Bay.

A telephone conference call with representatives of NMFS, the Corps and the Applicant was held on January 10, 2018, to discuss the operation of the fire pump at Plains Products Martinez and the potential for entrainment of fish. During this conference call, the Applicant agreed to enlarge the strainer on the fire pump intake to better protect listed fish from entrainment and impingement. Via email message to NMFS and the Corps on January 12, 2018, the Applicant committed to (1) develop a strainer design that will increase the surface area by at least 100 percent and reduce the size of the openings of the screen materials on the strainer, and (2) provide the design for the improved strainer to NMFS and the Corps at least 45 days prior to initiation of work on the fire pump platform.

1.3 Proposed Action

For section 7 of the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). For EFH consultation, federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

The Corps proposes to authorize the Applicant to conduct various repairs and retrofits to the Martinez Marine Oil Terminal in Martinez, California, pursuant to Section 10 of the Rivers and Harbors Act of 1899, as amended (33 U.S.C. § 403 *et seq*.). The Applicant proposes these activities to improve the safe operation of the terminal by complying with MOTEMS and with the conditions of the Terminal's Mitigation Monitoring Program for the State Lands Commission lease. The work area for these activities is within the tidal waters of Suisun Bay. The Marine Terminal is operated under a long-term lease with the California Lands Commission. Parcels adjacent to the work areas are also owned by the State of California.

The Project consists of three primary components: (1) Interior Breasting Dolphin Strengthening; (2) Fire Pump Station Retrofit; and (3) Trestle Operation Repairs. A brief summary of these components is presented below.

<u>Interior Breasting Dolphin Strengthening</u>
As a condition of the lease agreement with the California State Lands Commission, the Applicant must replace the existing bollards with quick release hooks and a tension monitoring system. Quick release hooks will be installed on two interior breasting dolphins, located to the east and west of the main loading platform. These dolphins must be strengthened and this will

be accomplished by the installation of two batter piles on each of the two breasting dolphins (*i.e.*, total of four batter piles). Each batter pile will consist of two 30-inch diameter steel pipe piles.

Each connection from the four batter piles to the dolphins will be approximately 25 square feet (ft^2), for a total of 100 ft^2 of new overwater structure. Quick release hooks will be installed on the two dolphins to allow for quick release of vessels in case of an emergency. Work to install the hooks will be conducted above the existing dolphin structure; thus, hook installation will not occur in water or over the water.

In total, eight 30-inch steel piles will be installed for the interior breasting dolphin strengthening (Table 1). Equipment used will include a barge, vibratory hammer, diesel impact hammer, tugboat and work skiff. This work to strengthen the interior breasting dolphins is estimated to take 25 days to complete.

Fire Pump Platform Retrofit

The existing fire pump platform is located south of the main loading platform and needs to be retrofitted to meet MOTEMS seismic requirements. The retrofit will require the installation of two pairs of 24-inch diameter steel pipe piles (*i.e.*, four piles total) on the north and south sides of the fire pump platform (Table 1). Each connection from the piles to the platform will be approximately 23 ft^2, for a total of 46 ft^2 of new overwater structure. Equipment used will include a barge, vibratory hammer, diesel impact hammer, tugboat and work skiff. This work is estimated to take 8 days to complete.

In addition to the work on the platform, the emergency fire pump requires supplemental bracing to the water intake. Friction collars will be bolted onto four existing concrete piles and the intake pipes. Once the new collars are securely fastened, new angle braces will be bolted into place. The collars will be installed underneath the platform and above the water surface.

The Applicant will replace the existing strainer on the intake to the emergency fire pump with one designed to increase the surface area by at least 100 percent and reduce the velocity across the intake strainer to 0.4 feet per second. The mesh openings of the new intake strainer will be sized to prevent the entrainment of listed salmonids and sturgeon into the fire pump system. At least 45 days prior to construction, the Applicant will provide to NMFS and the Corps for review and comment plans for the replacement intake strainer. The plans for the new strainer will include, at a minimum, the following information: (1) the dimensions of the proposed strainer; (2) the composition of the strainer materials; and (3) the mesh size of the material to be used. The fire pump has an operational capacity of 3,000 gallons per minute and the pump is operated 20-30 minutes per week for maintenance per National Fire Protection Association requirements.

Trestle Operational Repairs

Operational repairs at the terminal consist of replacing one 12-inch diameter timber pile (Table 1) and repairing an existing concrete pile. The existing creosote-treated timber pile at trestle bent 119 will be removed and replaced with a new timber pile that has been coated with a spray-on polyurea material. The existing timber pile will be cut off or broken at least three feet below the mudline. The new 12-inch timber pile with be installed with an impact hammer.

An existing concrete pile on the terminal's loading platform will be repaired by the placement of a fiberglass sleeve. The sleeve will be installed around the pile and will then be filled with cementitious grout. Equipment used will include a barge, diesel impact hammer, tugboat and work skiff. The trestle operational repairs are estimated to take 5 days to complete.

Table 1. Pile Installation Components.

Project Component	Pile Type	Pile Size (diameter)	Number of Piles
Interior Breasting Dolphin Strengthening	Steel	30-inch	8
Fire Pump Platform Retrofit	Steel	24-inch	4
Trestle Operational Repairs	Timber	12-inch	1

In total, the Project proposes to install 13 piles (Table 1). Piles will be installed with a vibratory hammer to as deep as possible, and an impact hammer will be used when necessary to attain sufficient depth. A bubble curtain will be used during operation of an impact hammer. Installation of the 30-inch steel piles is expected to require from 1,000 to 2,000 strikes for each pile and a total of 28 minutes per pile. Installation of the 24-inch steel piles is expected to require from 1,000 to 2,000 strikes and a total of 30 minutes per pile. Installation of the timber pile is anticipated to require 1,000 to 2,000 strikes and total of 25 minutes. The Project will limit the number of impact hammer strikes to not exceed 2,000 per day.

When performing work where pollutants may be accidentally discharged, the Project proposes to conduct the work over platforms and tarps to prevent materials from falling into the waters of Suisun Bay. In addition, debris barriers, absorbent booms and absorbents will be available on site if needed. All in-water work associated with the Project will be limited to the period between June 1 and November 30.

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). There are no interrelated or interdependent actions associated with this project.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, Federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitat. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures and terms and conditions to minimize such impacts.

The Corps determined the proposed action may affect but is not likely to adversely affect to Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, California Central Valley steelhead, CCC steelhead, and designated critical habitat. Our concurrence with the Corps' determination related to the ESA-listed salmonids and designated critical habitat is documented in the "Not Likely to Adversely Affect" Determinations Section 2.12 of this opinion. This opinion discusses the potential adverse effects to the Southern DPS of North American green sturgeon.

2.1 Analytical Approach

This opinion includes both a jeopardy analysis and/or an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of a listed species," which is "to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features (PBF) essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

The designation of critical habitat for the Southern DPS of green sturgeon uses the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace the term PCE with PBF. The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the range-wide status of the species and critical habitat likely to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.

- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.1.1 Use of Best Available Scientific and Commercial Information

To conduct the assessment presented in this opinion, NMFS examined an extensive amount of information from a variety of sources. Detailed background information on the biology and status of the listed species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, and governmental and non-governmental reports. Additional information regarding the potential effects of the proposed activities at the Martinez Marine Oil Terminal on the listed species in question, their anticipated response to these actions, and the environmental consequences of the actions as a whole was formulated from the aforementioned resources, the Applicant's April 3, 2017, application to the Corps for the Project, and the Applicant's May 16, 2017, hydroacoustic sound analysis memo.

Information was also provided in email messages during June and July of 2017. For information that has been taken directly from published, citable documents, those citations have been reference in the text and listed at the end of this document. A complete administrative record of this consultation is on file at the NMFS North-Central Coast Office in Santa Rosa, California (Administrative Record Number 151422WCR2017SR00176).

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential PBFs that help to form that conservation value.

2.2.1 Species Description, Life History and Status

This opinion analyzes the effects of the proposed repairs and retrofit at the Martinez Marine Oil Terminal in Suisun Bay on the Southern DPS of green sturgeon and their designated critical habitat.

2.2.1.1. Green Sturgeon General Life History

Green sturgeon is an anadromous, long-lived, and bottom-oriented fish species in the family Acipenseridae. Sturgeon have skeletons composed mostly of cartilage and lack scales, instead

possessing five rows of characteristic bony plates on their body called "scutes." On the underside of their flattened snouts are sensory barbels and a siphon-shaped, protrusible, toothless mouth. Large adults may exceed 6 feet (2 meters m) in length and 100 kilograms in weight (Moyle 1976). Based on genetic analyses and spawning site fidelity, NMFS determined that North American green sturgeon are comprised of at least two DPSs: a northern DPS consisting of populations originating from coastal watersheds northward of and including the Eel River ("northern DPS green sturgeon"), with spawning confirmed in the Klamath and Rogue river systems; and a Southern DPS consisting of populations originating from coastal watersheds south of the Eel River ("Southern DPS green sturgeon"), with spawning confirmed in the Sacramento River system (Adams *et al*. 2002).

Green sturgeon are the most marine-oriented species of sturgeon (Moyle 2002). Along the West Coast of North America, they range in nearshore waters from Mexico to the Bering Sea (Adams *et al*. 2002), with a general tendency to head north after their out-migration from freshwater (Lindley *et al*. 2011). While in the ocean, archival tagging indicates that green sturgeon occur in waters between 0 and 650 feet (ft) in depth, but spend most of their time in waters between 65-260 feet (20–80 m) and temperatures of 9.5–16.0°C (Huff *et al*. 2011; Nelson *et al*. 2010). Subadult and adult green sturgeon move between coastal waters and estuaries, but relatively little is known about how green sturgeon use these habitats (Lindley *et al*. 2011). Lindley *et al*. (2011) report multiple rivers and estuaries are visited by aggregations of green sturgeon in summer months, and larger estuaries (*e.g.*, San Francisco Bay) appear to be particularly important habitat. During the winter months, green sturgeon generally reside in the coastal ocean. Areas north of Vancouver Island are favored overwintering areas, with Queen Charlotte Sound and Hecate Strait likely destinations based on detections of acoustically-tagged green sturgeon (Lindley *et al*. 2008; Nelson *et al*. 2010).

Based on genetic analysis, Israel *et al*. (2009) reported that almost all green sturgeon collected in the San Francisco Bay system were Southern DPS. This is corroborated by tagging and tracking studies which found that no green sturgeon tagged in the Klamath or Rogue rivers (*i.e*., Northern DPS) have yet been detected in San Francisco Bay (Lindley *et al*. 2011). However, green sturgeon inhabiting coastal waters adjacent to San Francisco Bay include northern DPS green sturgeon.

Adult Southern DPS green sturgeon spawn in the Sacramento River watershed during the spring and early summer months (Moyle *et al*. 1995). Eggs are laid in turbulent areas on the river bottom and settle into the interstitial spaces between cobble and gravel (Adams *et al*. 2007). Like salmonids, green sturgeon require cool water temperatures for egg and larval development, with optimal temperatures ranging from 11 to 17˚C (Van Eenennaam *et al*. 2006). Eggs hatch after 6–8 days, and larval feeding begins 10–15 days post-hatch. Metamorphosis of larvae into juveniles typically occurs after a minimum of 45 days (post-hatch) when fish have reached 2-inches (60–80 millimeter [mm]) total length (TL). After hatching larvae migrate downstream and metamorphose into juveniles. Juveniles spend their first few years in the Sacramento-San Joaquin Delta (Delta) and San Francisco Estuary before entering the marine environment as subadults. Juvenile green sturgeon salvaged at the State and Federal water export facilities in the southern Delta are generally between 200 mm and 400 mm TL (Adams *et al*. 2002) which suggests Southern DPS green sturgeon spend several months to a year rearing in freshwater

before entering the Delta and San Francisco Estuary. Laboratory studies conducted by Allen and Cech (2007) indicated juveniles approximately 6-month old were tolerant of saltwater, but approximately 1.5-year old green sturgeon appeared more capable of successful osmoregulation in salt water.

Subadult green sturgeon spend several years at sea before reaching reproductive maturity and returning to freshwater to spawn for the first time (Nakamoto *et al*. 1995). Little data are available regarding the size and age-at-maturity for the Southern DPS green sturgeon, but it is likely similar to that of the northern DPS. Male and female green sturgeon differ in age-at-maturity. Males can mature as young as 14 years and female green sturgeon mature as early as age 16 (Van Eenennaam *et al*. 2006). Adult green sturgeon are believed to spawn every 2 to 5 years. Telemetry studies by Heublein *et al*. (2009) indicate adults typically enter San Francisco Bay from the ocean and begin their upstream spawning migration between late February and early May. These adults on their way to spawning areas in the upper Sacramento River typically migrate rapidly through the estuary toward their upstream spawning sites. Preliminary results from tagged adult sturgeon suggest travel time from the Golden Gate to Rio Vista in the Delta is generally 1-2 weeks. Post-spawning, Heublein *et al*. (2009) reported tagged Southern DPS green sturgeon displayed two outmigration strategies; outmigration from Sacramento River prior to September 1 and outmigration during the onset of fall/winter stream flow increases. The transit time for post-spawning adults through the San Francisco Estuary appears to be very similar to their upstream migration (*i.e.*, 1-2 weeks).

During the summer and fall, an unknown proportion of the population of non-spawning adults and subadults enter the San Francisco Estuary from the ocean for periods ranging from a few days to 6 months (Lindley *et al*. 2011). Some fish are detected only near the Golden Gate, while others move as far inland as Rio Vista in the Delta. The remainder of the population appear to enter bays and estuaries farther north from Humboldt Bay, California to Grays Harbor, Washington (Lindley *et al*. 2011).

Green sturgeon feed on benthic invertebrates and fish (Adams *et al*. 2002). Radtke (1966) analyzed stomach contents of juvenile green sturgeon captured in the Sacramento-San Joaquin Delta and found the majority of their diet was benthic invertebrates, such as mysid shrimp and amphipods (*Corophium* spp). Manual tracking of acoustically-tagged green sturgeon in the San Francisco Estuary indicates they are generally bottom-oriented, but make occasional forays to surface waters, perhaps to assist their movement (Kelly *et al*. 2007). Dumbauld *et al*. (2008) report that immature green sturgeon found in Willapa Bay, Grays Harbor, and the Columbia River Estuary, fed on a diet consisting primarily of benthic prey and fish common to these estuaries (ghost shrimp, crab, and crangonid shrimp), with burrowing thalassinid shrimp representing a significant proportion of the sturgeon diet. Dumbauld *et al*. (2008) observed feeding pits (depressions in the substrate believed to be formed when green sturgeon feed) in soft-bottom intertidal areas where green sturgeon are believed to spend a substantial amount of foraging time.

2.2.1.2 Status of Southern DPS Green Sturgeon and Critical Habitat

To date, little population-level data have been collected for green sturgeon. In particular, there are no published abundance estimates for either Northern DPS or Southern DPS green sturgeon in any of the natal rivers based on survey data. As a result, efforts to estimate green sturgeon population size have had to rely on sub-optimal data with known potential biases. Available abundance information comes mainly from four sources: 1) incidental captures in the California Department of Fish and Wildlife (CDFW) white sturgeon (*Acipenser transmontanus*) monitoring program; 2) fish monitoring efforts associated with two diversion facilities on the upper Sacramento River; 3) fish salvage operations at the water export facilities on the Sacramento-San Joaquin Delta; and 4) dual frequency sonar identification in spawning areas of the upper Sacramento River. These data are insufficient in a variety ways (short time series, non-target species, *etc*.) and do not support more than a qualitative evaluation of changes in green sturgeon abundance.

CDFW's white sturgeon monitoring program incidentally captures Southern DPS green sturgeon. Trammel nets are used to capture white sturgeon and CDFW utilizes a multiple-census or Peterson mark-recapture method to estimate the size of subadult and adult sturgeon population (California Department of Fish and Game 2002). By comparing ratios of white sturgeon to green sturgeon captures, estimates of Southern DPS green sturgeon abundance can be calculated. Estimated abundance of green sturgeon between 1954 and 2001 ranged from 175 fish to more than 8,000 per year and averaged 1,509 fish per year. Unfortunately, there are many biases and errors associated with these data, and CDFW does not consider these estimates reliable. For larval and juvenile green sturgeon in the upper Sacramento River, information is available from salmon monitoring efforts at the Red Bluff Diversion Dam (RBDD) and the Glenn-Colusa Irrigation District (GCID). Incidental capture of larval and juvenile green sturgeon at the RBDD and GCID have ranged between 0 and 2,068 green sturgeon per year (Adams *et al*. 2002). Genetic data collected from these larval green sturgeon suggest that the number of adult green sturgeon spawning in the upper Sacramento River remained roughly constant between 2002 and 2006 in river reaches above Red Bluff (Israel and May 2010). In 2011, rotary screw traps operating in the Upper Sacramento River at RBDD captured 3,700 larval green sturgeon which represents the highest catch on record in 16 years of sampling (Poytress *et al*. 2011).

Juvenile green sturgeon are collected at water export facilities operated by the California Department of Water Resources (DWR) and the Federal Bureau of Reclamation (BOR) in the Sacramento-San Joaquin Delta. Fish collection records have been maintained by DWR from 1968 to present and by BOR from 1980 to present. The average number of Southern DPS green sturgeon taken per year at the DWR facility prior to 1986 was 732, though from 1986 to 2001, the average per year was 47 (70 FR 17386). For the BOR facility, the average number prior to 1986 was 889, and from 1986 to 2001 the average was 32 (70 FR 17386). Direct capture in the salvage operations at these facilities is a small component of the overall effect of water export facilities on Southern DPS green sturgeon. Entrained juvenile green sturgeon are exposed to potential high levels of predation by non-native predators, disruption in migratory behavior, and poor habitat quality. Delta water exports have increased substantially since the 1970s and it is likely that this has contributed to negative trends in the abundance of migratory fish that utilize the Delta, including the Southern DPS green sturgeon.

During the spring and summer spawning period, researchers with University of California Davis have utilized dual-frequency identification sonar (*i.e.*, DIDSON) to count adult green sturgeon in the upper Sacramento River. These surveys estimated 175 to 250 sturgeon (±50) in the mainstem Sacramento River during the 2010 and 2011 spawning seasons (Mora, personal communication, January 2012).[1] However, it is important to note that this estimate may include some white sturgeon, and movements of individuals in and out of the survey area confound these estimates. Given these uncertainties, caution must be taken in using these estimates to infer the spawning run size for the Sacramento River, until further analyses are completed.

The NMFS status review completed in 2005 concluded the Southern DPS green sturgeon is likely to become endangered in the foreseeable future due to the substantial loss of spawning habitat, the concentration of a single spawning population in one section of the Sacramento River, and multiple other risks to the species such as stream flow management, degraded water quality, and introduced species (NMFS 2005). Based on this information, the Southern DPS green sturgeon was listed as threatened on April 7, 2006 (71 FR 17757). The most recent status review was completed by NMFS in 2015. This review concluded the DPS remains likely to become endangered in the foreseeable future and NMFS affirmed no change to the determination that the Southern DPS of green sturgeon is a threatened species (NMFS 2015).

Critical habitat was designated for the Southern DPS of green sturgeon on October 9, 2009 (74 FR 52300), and includes coastal marine waters within 60 fathoms depth from Monterey Bay, California to Cape Flattery, Washington, including the Strait of Juan de Fuca to its United States boundary. Designated critical habitat also includes the Sacramento River, lower Feather River, lower Yuba River, Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, and San Francisco Bay in California. PBFs of designated critical habitat in estuarine areas are food resources, water flow, water quality, mitigation corridor, depth, and sediment quality. In freshwater riverine systems, PBFs of green sturgeon critical habitat are food resources, substrate type or size, water flow, water quality, migratory corridor, depth, and sediment quality. In nearshore coastal marine areas, PBFs are migratory corridor, water quality, and food resources.

The current condition of critical habitat for the Southern DPS of green sturgeon is degraded over its historical conditions. It does not provide the full extent of conservation values necessary for the recovery of the species, particularly in the upstream riverine habitat of the Sacramento River. In the Sacramento River, migration corridor and water flow PCEs have been impacted by human actions, substantially altering the historical river characteristics in which the Southern DPS of green sturgeon evolved. In addition, the alterations to the Sacramento-San Joaquin River Delta may have a particularly strong impact on the survival and recruitment of juvenile green sturgeon due to their protracted rearing time in brackish and estuarine waters.

2.2.2 Factors Responsible for Green Sturgeon Stock Declines

NMFS cites many reasons (primarily anthropogenic) for the decline of southern DPS of green sturgeon (Adams *et al*. 2002; NMFS 2005). The foremost reason for the decline is the

[1] January 10, 2012, telephone conversation between Ethan Mora (University of California, Davis) and Susan Wang (NMFS), regarding estimates of green sturgeon abundance in Southern DPS rivers in 2010 and 2011.

degradation and/or destruction of freshwater and estuarine habitat. Additional factors contributing to the decline of this population include: commercial and recreational harvest, natural stochastic events, marine mammal predation, reduced marine-derived nutrient transport, ocean conditions, and global climate change. The NMFS 2015 five-year status review found that evaluation of new information since the previous status review does not suggest a significant change in the status of Southern DPS green sturgeon and, with respect to threats, the available information indicates that some threats, such as those posed by fisheries and impassable barriers, have been reduced (NMFS 2015).

2.2.2.1 Habitat Degradation and Destruction

The best scientific information presently available demonstrates a multitude of factors, past and present, have contributed to the decline of green sturgeon by reducing and degrading habitat by adversely affecting essential habitat features. Most of this habitat loss and degradation has resulted from anthropogenic watershed disturbances (Adams *et al*. 2002). A significant conservation measure implemented in 2012 is the change in operation of the RBDD (now open from mid-September to mid-May) to allow access to spawning areas above the dam. Originally, RBDD was closed year around and was a significant barrier for green sturgeon to access spawning areas upstream of the dam.

2.2.2.2 Commercial and Recreational Harvest

For many decades, the commercial and recreational harvest of southern DPS green sturgeon was allowed under State and Federal law. Since 2006, the threat posed by commercial and recreational fishing has decreased given that intentional lethal take of green sturgeon has been prohibited through fishing regulations (NMFS 2015). Regulations in California, Oregon and Washington prohibit retention of green sturgeon and these regulations pertain to the range of both southern and northern DPS green sturgeon. Lethal take still occurs as a result of by-catch mortality associated with the California halibut bottom trawl fishery and incidental catch of green sturgeon occurs in the west coast Pacific Groundfish fisheries. The impact of by-catch in these fisheries on the overall population abundance of the southern DPS is still unknown (NMFS 2015).

2.2.2.3 Natural Stochastic Events

Natural events such as droughts, landslides, floods, and other catastrophes have adversely affected sturgeon populations throughout their evolutionary history. The effects of these events are exacerbated by anthropogenic changes to watersheds such as logging, roads, and water diversions. These anthropogenic changes have limited the ability of sturgeon to rebound from natural stochastic events and depressed populations to critically low levels.

2.2.2.4 Global Climate Change

One factor affecting the rangewide status of threatened Southern DPS of North American green sturgeon is climate change. Impacts from global climate change are already occurring in California. For example, average annual air temperatures, heat extremes, and sea level have all

increased in California over the last century (Kadir *et al.* 2013). Snow melt from the Sierra Nevada has declined (Kadir *et al.* 2013). However, total annual precipitation amounts have shown no discernable change (Kadir *et al.* 2013). Green sturgeon may have already experienced some detrimental impacts from climate change. NMFS believes the impacts on listed species to date are likely fairly minor because natural and local climate factors likely still drive most of the climate conditions species experience, and many of these factors have much less influence on green sturgeon abundance and distribution than human disturbance across the landscape.

The threat to listed green sturgeon from global climate change will increase in the future. Modeling of climate change impacts in California suggests that average summer air temperatures are expected to continue to increase (Lindley *et al*. 2007; Moser *et al.* 2012). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe *et al.* 2004; Kadir *et al.* 2013; Moser *et al.* 2012). Total precipitation in California may decline; critically dry years may increase (Lindley *et al.* 2007; Moser *et al.* 2012; Schneider 2007).

In the San Francisco Bay region, warm temperatures generally occur in July and August, but as climate change takes hold, the occurrences of these events will likely begin in June and could continue to occur in September (Cayan *et al.* 2012). Climate simulation models project that the San Francisco region will maintain its Mediterranean climate regime, but experience a higher degree of variability of annual precipitation during the next 50 years and years that are drier than the historical annual average during the middle and end of the twenty-first century. The greatest reduction in precipitation is projected to occur in March and April, with the core winter months remaining relatively unchanged (Cayan *et al.* 2012).

Estuaries may also experience changes detrimental to green sturgeon. Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Ruggiero *et al.* 2010; Scavia *et al.* 2002). In marine environments, ecosystems and habitats important to sturgeon are likely to experience changes in temperatures, circulation, water chemistry, and food supplies (Abdul-Aziz *et al*. 2011; Brewer and Barry 2008; Doney *et al.* 2012; Feely *et al.* 2004; Osgood 2008; Turley 2008). The projections described above are for the mid to late 21st Century. In shorter time frames, climate conditions not caused by the human addition of carbon dioxide to the atmosphere are more likely to predominate (Cox and Stephenson 2007; Santer *et al.* 2011; Smith *et al.* 2007).

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for the proposed Project includes the Martinez Marine Oil Terminal and adjacent waters in Suisun Bay to a distance of approximately 1,359 meters (Figure 1). This action area includes approximately 1,000 acres of waters in Suisun Bay that could be affected by elevated underwater sound levels during pile driving.

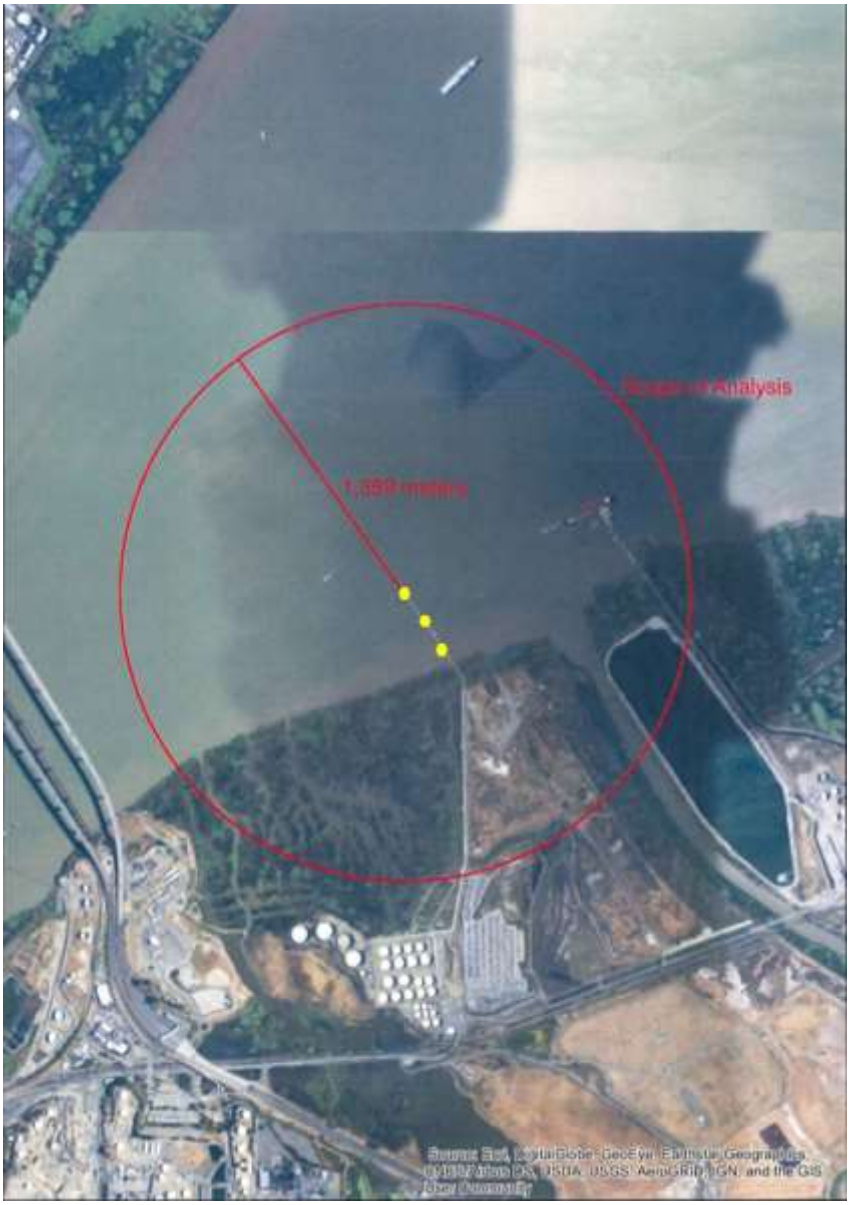

Figure 1. Action Area for the Martinez Marine Terminal Repair and Retrofit Project. Yellow dots represent the general locations of piles to be installed. The open water area inside the red line illustrate the extent within which behavioral effects may occur to fish resulting from impact hammer pile driving.

2.4 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

The Martinez Marine Oil Terminal is located just east of the Carquinez Strait on the southern shoreline of Suisun Bay, in waters ranging from 0 to 12.2 meters in depth. Carquinez Strait is a narrow channel that connects Suisun Bay to San Pablo Bay. Aquatic habitat within the action

area includes open water in Suisun Bay, shoreline/intertidal habitat, and tidal brackish marsh. Salinities in the action area generally range from 0 – 25 practical salinity units (Schoellhamer 2001). Suisun Bay is a partially mixed estuary and is the most landward subembayment of the San Francisco Estuary (Schoellhamer 2001).

The climate within the action area is Mediterranean; most precipitation falls in winter and spring as rain throughout the Central Valley and as snow in the Sierra Nevada and Cascades. The freshwater outflow pattern within Suisun Bay is seasonal; highest outflow occurs in winter and spring. Current and wave patterns in the action area are largely generated by the tides and wind interacting with the bottom and shoreline and breakwater configurations.

The land, shoreline and subtidal areas in the action area have been highly modified by urban and industrial development. Along the shoreline of the action area, there currently exists a vehicle salvage yard, sulfuric acid production facility, and an oil refinery. Upland of the action area, lands are characterized by commercial, high density development, and high use streets. The hydrology of these upland areas are modified as a result and direct precipitation flows into storm drains and into a stormwater management system. Thus, Bay water and sediment quality within the action area are affected by upland industrial activities, intensive street use, and other urban influences that discharge contaminants with stormwater runoff.

There are several small unnamed sloughs surrounding the terminal and two larger channels within the action area (Peyton Slough and Lower Walnut Creek). Peyton Slough, a restored marsh, is located to the southwest of the terminal and is managed through flood control tide gates. To the east of the terminal, the Lower Walnut Creek Flood Control Channel (also referred to as Pacheco Creek) drains an area of over 150 square miles. Lower Walnut Creek is a trapezoidal earth channel with levees on one or both sides.

The portions of the action area adjacent to the marine terminal are periodically dredged for navigation of large vessels. The last dredge episode occurred in 2012 and there are no future dredging episodes planned. No eelgrass occurs within the action area. Open water areas are influenced seasonally from freshwater discharge from the rivers and streams of California's Central Valley. The transition zone between the upland areas to the subtidal zone primarily consists of rock riprap and concrete rubble. The majority of benthic aquatic habitats within the project area are soft mud, sand, and/or clay sediments. In Suisun Bay, there is a diverse array of benthic invertebrates, such as bivalves, polychaetes, cumaceans, and isopods (Thompson *et al*. 2007) that are prey for various fish species.

2.4.1 Status of the Species and Critical Habitat in the Action Area

2.4.1.1 Green Sturgeon

Green sturgeon are iteroparous[2], and adults pass through the San Francisco Estuary during spawning and post-spawning migrations. Pre-spawn green sturgeon enter the Bay between late February and early May, as they migrate to spawning grounds in the Sacramento River (Heublein *et al*. 2009). Post-spawning adults may be present in San Francisco Bay after

[2] They have multiple reproductive cycles over their lifetime.

spawning in the Sacramento River in the spring and early summer for months prior to immigrating to the ocean. Juvenile green sturgeon move into the Delta and San Francisco Estuary early in their juvenile life history, where they may remain for 2-3 years before migrating to the ocean (Allen and Cech 2007; Kelly *et al*. 2007). Sub-adult and non-spawning adult green sturgeon utilize both ocean and estuarine environments for rearing and foraging. Due to these life-history characteristics, juvenile, sub-adult and adult green sturgeon may be present in the action area year-round.

While surveys for green sturgeon have not been conducted in the action area, shallow water and intertidal areas along the shoreline may be used as foraging habitat by green sturgeon. Within San Francisco Bay, green sturgeon likely prey on demersal fish (*e.g.*, sand lance [*Ammodytes hexapterus*]) and benthic invertebrates similar to those that green sturgeon are known to prey upon in estuaries of Washington and Oregon (Dumbauld *et al*. 2008). Green sturgeon are also known to be generalist feeders and may feed opportunistically on a variety of benthic species encountered. For example, the invasive overbite clam (*Corbula amurensis*) has become a common food of white sturgeon and green sturgeon in San Francisco Bay (California Department of Fish and Game 2002).

Based on distribution data and foraging habits of green sturgeon, NMFS assumes this species could occasionally be present in the action area to forage on benthic prey and fish commonly found in soft-bottom habitats (*e.g.*, ghost shrimp, crab, and crangonid shrimp) of the San Francisco Estuary. Although soft-bottom habitat exists in the action area, the marine terminal has been periodically disturbed by dredging which likely has reduced the quality and quantity of benthic prey organisms available for green sturgeon foraging. The action area also encompasses a large portion the channel width of Carquinez Strait adjoining western Suisun Bay (see Figure 1). Green sturgeon migrating between habitat in the Sacramento-San Joaquin Delta and San Francisco Bay must pass through the Carquinez Strait; thus, the action area includes an area that serves as an important migration corridor for Southern DPS green sturgeon.

2.4.1.2 Green Sturgeon Critical Habitat

The action area for this project is located within designated critical habitat for the Southern DPS of green sturgeon. PBFs for green sturgeon in estuarine areas are: food resources, water flow, water quality, migratory corridor, water depth, and sediment quality. These PBFs for green sturgeon critical habitat in the action area are degraded. Habitat degradation in the action area is primarily due to shoreline development, shoreline stabilization, non-native invasive species, discharge and accumulation of contaminants, loss of tidal wetlands, and periodic dredging for navigation.

2.4.2 Factors Affecting the Species Environment in the Action Area

The San Francisco Bay/Sacramento-San Joaquin Delta is one of the most human-altered estuaries in the world (Knowles and Cayan 2004). Major drivers of change in the Bay that are common to many estuaries are water consumption and diversion, human modification of sediment supply, introduction of nonnative species, sewage and other pollutant inputs, and climate shifts. Responses to these drivers in the Bay include shifts in the timing and extent of

freshwater inflow and salinity intrusion, decreasing turbidity, restructuring of plankton communities, nutrient enrichment and metal contamination of biota, and large-scale food web changes (Cloern and Jassby 2012).

The land, shoreline, and subtidal zones of the action area have been modified due to industrial development. The Martinez Marine Oil Terminal has been in operation since 1973. The action area was last dredged in 2012. Carquinez Strait is heavily trafficked with vessels for industry, military, and personal use.

2.4.3 Previous Section 7 Consultations and Section 10 Permits in the Action Area

Pursuant to section 7 of the ESA, NMFS has conducted two interagency consultations within the action area of the project. Both consultations were conducted with the Corps. The following is a brief summary of previous interagency consultations within the action area.

- To address maintenance dredging throughout the greater San Francisco Bay, NMFS completed a programmatic consultation with the Corps and the U.S. Environmental Protection Agency (EPA) on the Long Term Management Strategy for Disposal of Dredged Materials in the San Francisco Bay Region (LTMS). The LTMS programmatic consultation resulted in the issuance of an opinion on July 9, 2015, to the Corps and EPA (WCR-2014-1599). The July 9, 2015, opinion concluded the LTMS program was not likely to jeopardize the continued existence of listed fish species under the jurisdiction of NMFS, or adversely modify or destroy designated critical habitat

- Avon Marine Oil Terminal Compliance Project (PCTS #WCR-2015-2004) involved upgrading the existing terminal to be MOTEMS compliant. An April 13, 2015 biological opinion for the project concluded that the proposed action was not likely to jeopardize the continued existence of Southern DPS of North American green sturgeon or result in the destruction or adverse modification of critical habitat for southern DPS green sturgeon. NMFS provided an incidental take statement with non-discretionary terms and conditions for take of green sturgeon due to habitat loss. The biological opinion also concluded that the proposed action was not likely to adversely affect threatened Central Valley steelhead (*Oncorhynchus mykiss*), threatened CCC steelhead (*O. mykiss*), threatened Central Valley spring-run Chinook salmon (*O. tshawytscha*), endangered Sacramento River winter-run Chinook salmon (*O. tshawytscha*) and designated critical habitat.

Research and enhancement projects resulting from NMFS' Section 10(a)(1)(A) research and enhancement permits and section 4(d) limits or exceptions could potentially occur in the action area. As of December 2017, one activity requiring a Section 10(a)(1)(A) research and enhancement permit is occurring in the action area. This project is for the U.S. Fish and Wildlife Service Long-Term Delta Juvenile Fish Monitoring Program.

2.4.4 Climate Change Impacts in the Action Area

Information discussed above in the Range-wide Status of the Species and Critical Habitat section of this opinion (Section 2.2) indicates that green sturgeon in the action area may have already

experienced some detrimental impacts from climate change. These detrimental impacts across the action area are likely to be minor because natural and local climate factors continue to drive most of the climatic conditions green sturgeon experience. These natural factors are likely less influential on fish abundance and distribution than anthropogenic impacts across the action area. However, in the future impacts in the action area from climate change are likely to increase as air and water temperatures warm, and precipitation rates change.

2.5 Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

In this opinion, our approach to determine the direct and indirect effects of the proposed action, and interrelated or interdependent activities, on Southern DPS green sturgeon was based on knowledge and review of the ecological literature and other relevant materials. We used this information to gauge the likely effects of the proposed project via an exposure and response framework that focuses on what stressors (physical, chemical, or biotic) directly or indirectly caused by the proposed action to which Southern DPS green sturgeon are likely to be exposed. Next, we evaluated the likely response of green sturgeon to these stressors in terms of changes to survival, growth, and reproduction, and changes to the ability of PBFs to support the value of critical habitat in the action area. Where data to quantitatively determine the effects of the proposed action on sturgeon and their critical habitat were limited or not available, our assessment of effects focused mostly on qualitative identification of likely stressors and responses.

Approximately 40 days of project activities are proposed to occur at the Martinez Marine Oil Terminal between June 1 and November 30 and Southern DPS green sturgeon may occur in the action area during this construction period. Elevated underwater sound levels from pile installation and degradation of water quality are expected to occur during construction.

2.5.1 Effects of Construction Activities on Listed Species and Critical Habitat

2.5.1.1 Overview of Pile Driving Impacts

Green sturgeon may be affected by exposure to high underwater sound pressure levels (SPLs) produced by pile driving with an impact hammer. Fish may be injured or killed when exposed to impulsive sound sources such as pile driving with impact hammers. Pathologies of fish associated with very high sound level exposure and drastic changes in pressure are collectively known as *barotraumas.* These include hemorrhage and rupture of blood vessels and internal organs, including the swim bladder and kidneys. Death can be instantaneous, occur within minutes after exposure, or occur several days later. Fish can also die when exposed to lower, continuous SPLs if exposed for longer periods of time. Hastings (1995) found death rates of 50 percent and 56 percent for gouramis (*Trichogaster* spp.) when exposed for two hours or less to

continuous sound at 192 decibels (dB) root-mean-square pressure (RMS) (re: 1 micropascal [μPa]) at 400 Hertz (Hz) and 198 dB (re: 1 μPa) at 150 Hz, respectively, and 25 percent for goldfish (*Carassius auratus*) when exposed to sounds of 204 dB (re: 1 μPa) at 250.[3] Hastings (1995) also reported that acoustic "stunning" a potentially lethal effect resulting in a physiological shutdown of body functions, immobilized gourami within eight to thirty minutes of exposure to these sound levels.

Hearing loss in fishes can occur from exposure to high intensity sounds, which can over-stimulate the auditory system of fishes and may result in temporary threshold shifts (TTS). TTS is considered a non-injurious temporary reduction in hearing sensitivity. Physical ear injury may also occur for fish exposed to high levels or continuous sound, manifested as a loss of hair cells, located on the epithelium of the inner ear (Hastings and Popper 2005). These hair cells are capable of sustaining injury or damage that may result in a temporary decrease in hearing sensitivity. However, this type of noise-induced hearing loss in fishes is generally considered recoverable, as fish possess the ability to regenerate damaged hair cells (Lombarte *et al.* 1993; Smith *et al.* 2006). Permanent hearing loss has not been documented in fish. Even if threshold shifts in hearing do not occur, loud sounds can mask the ability of fish to hear their environment. This effect from loud sound exposure is referred to as acoustic or auditory masking. Masking generally results from an unwanted or unimportant sound impeding a fish's ability to hear sounds of interest.

Underwater sound exposures have also been shown to alter the behavior of fishes (see review by Hastings and Popper 2005). The observed behavioral changes include startle responses and increases in stress hormones. Exposure to pile driving SPLs may also result in "agitation" of fishes indicated by a change in swimming behavior detected by Shin (1995) or "alarm" detected by Fewtrell (2003). Other potential changes include reduced predator awareness and reduced feeding. The potential for adverse behavioral effects will depend on a number of factors, including the sensitivity to sound, the type and duration of the sound, as well as life stages of fish that are present in the areas affected by underwater sound produced during pile driving. A fish that exhibits a startle response to a sudden loud sound may not necessarily be injured, but it is exhibiting behavior that suggests it perceives a stimulus indicating potential danger in its immediate environment. However, fish do not exhibit a startle response every time they experience a strong hydroacoustic stimulus.

In order to assess the potential effects to fish exposed to pile driving sound, a coalition of federal and state resource and transportation agencies along the West Coast, the Fisheries Hydroacoustic Working Group (FHWG), used data from a variety of sound sources and species to establish interim acoustic criteria for the onset of injury to fishes from impact pile driving exposure (FHWG 2008). Most historical research has used peak pressure to evaluate the effects on fishes from underwater sound. Current research, however, suggests that sound exposure level (SEL), a measure of the total sound energy expressed as the time-integrated, sound pressure squared, is also a relevant metric for evaluating the effects of sound on fishes. An advantage of the SEL metric is that the acoustic energy can be accumulated across multiple events and expressed as the cumulative SEL (cSEL). Therefore a dual metric criteria was established by the FHWG and

[3] Pressures will not be added to each metric for the remainder of the section: dB peak has a pressure of 1 μPa, dB sound exposure level (SEL) has a pressure of 1 μPa^2 sec, and a root-mean-square (RMS) dB has a pressure of 1 μPa.

includes a threshold for peak pressure (206 dB) and cSEL (187 dB for fishes 2 grams or larger and 183 dB for fishes smaller than 2 grams). Injury would be expected if either threshold is exceeded. There is uncertainty as to the behavioral response of fish to underwater sound produced when driving piles in or near water. Until new information indicates otherwise, NMFS believes a 150 dB RMS threshold for behavioral responses for green sturgeon is appropriate.

Currently, there are few data available regarding effects of pile driving directly focused on green sturgeon. There is some evidence of pile driving-related underwater sound pressures resulting in mortality of white sturgeon during the construction of the Benicia-Martinez Bridge. In 2002, unattenuated piles driven with a large impact hammer at the Benicia-Martinez Bridge Project resulted in the mortality of a 24" white sturgeon. The piles for the bridge piers were 98-inch diameter steel piles and were driven in water ranging from 40 and 50 feet deep in the main channel of Carquinez Strait. Peak underwater SPLs ranged from 227 dB at approximately 16 feet from the pile to 178 dB at approximately 3,600 feet from the pile (Buehler *et al.* 2015).

2.5.1.2 Project Specific Considerations

Several site-specific conditions should be considered when conducting an assessment of the potential effects of pile driving associated with construction projects. Effects on an individual fish during pile driving are dependent on variables such as environmental conditions at the project site, specific construction techniques, and the construction schedule. A dual metric criteria of 206 dB peak SPL for any single strike and a cSEL of 187 dB are currently used by NMFS as thresholds to correlate physical injury to fish greater than 2 grams in size from underwater sound produced during the installation of piles with impact hammers. Green sturgeon that may be present within the action area of this project are significantly greater than 2 grams in size.

Different types of piles (*e.g.*, wood, steel, concrete) result in different levels of underwater sound when struck with a pile driver. For the proposed Project, 12 steel piles and one timber pile will be used for construction. In the updated Compendium of Pile Driving Sound Data (Buehler *et al.* 2015), the most recent pile driving monitoring results are compiled in order to provide information regarding the potential levels of underwater SPLs generated with the installation of different pile and hammer types. Several pile driving case studies conducted within the San Francisco Bay region using steel, concrete, and composite piles are included in the compendium. Impact hammers produce the highest elevated underwater sound levels, particularly when used in combination with steel piles. Vibratory hammers produce less sound than impact hammers and are often employed as a measure to reduce the sound generated by pile driving, and in turn, the potential for adverse effects on fish (Buehler *et al.* 2015).

Water depth at the pile driving site will also influence the rate of sound attenuation. In deep water areas high sound pressure waves are likely to travel further out into San Francisco Bay. Within shallow water, the rate of attenuation is expected to be much higher, reducing the area of adverse effects as compared to deeper water. Pile driving for the proposed project will occur in water 0 to 40 feet deep, depending on the specific location and tidal phase. Additionally, as distance from the pile increases, sound attenuation reduces SPLs and the potential harmful effects to fish also decreases.

For this Project, the Applicant proposes to use a vibratory hammer to install the piles as deep as possible and an impact hammer will be used when the vibratory hammer cannot complete installation to the desired depth. During use of an impact hammer, the Applicant proposes to use a bubble curtain to attenuate underwater sound levels. Based on the use of a bubble curtain and pile sizes proposed for this Project, the assessment of acoustic impacts presented in this opinion assumes an estimated reduction of 10 dB in sound pressure. Although reductions as high as 20 dB have been measured, as a general rule, sound reductions of greater than 10 dB with attenuation systems cannot be reliably predicted (ICF Jones and Stokes and Illingworth and Rodkin, Inc. 2009).

The season and duration which pile driving occurs can also greatly influence the level of potential impact on green sturgeon. Some species of fish occur seasonally in San Francisco Bay and in-water construction activities can be scheduled to avoid periods when the target fish species is mostly likely to be present. The duration of pile driving also influences the level of risk to fish. If pile driving extends continuously for hours or days, the chance of encounters with fish in the vicinity increases, accordingly. If pile driving is occurring near shore at low tide then fewer large fish are likely to be present due to shallow water depths. Pile driving activities for the proposed Project are expected to occur during daylight hours between June 1 and November 30. Per day pile driving with an impact hammer is expected to occur for 30 minutes or less. Installation of all of the 30-inch steel piles will take up to 8 days of pile driving, the 24-inch steel piles will take up to 4 days of pile driving, and the 12-inch timber pile will take one day of pile driving to install. Given the need to position the pile driving equipment, typically one pile is driven per day. However, sometimes more than one pile can be driven in a day. Even if more than one pile is driven per day, the Applicant will limit the number of strikes of an impact hammer to not exceed 2000 per day. In total, approximately 6.5 hours of impact hammer pile driving is anticipated to be performed, spread over many days, during the duration of the Project.

2.5.1.3 Assessment of Pile Driving Effects at Martinez Marine Oil Terminal

For the purposes of this analysis we have used the maximum distances peak SPLs and accumulated SELs could travel as a reasonable worst case scenario. The highest sound levels associated with the Project will occur during driving of the 30-inch steel piles with an impact hammer and the second highest will occur during the installation of the 24-inch piles. NMFS, the Corps, and the Applicant examined hydro-acoustic monitoring results for similar sized piles and in similar conditions presented in the Compendium of Pile Driving Sound Data (Buehler *et al*. 2015) and generated estimates with a spreadsheet model to estimate peak SPLs and cSELs during impact hammer pile driving at various distances from the source (Table 2).

Table 2. Anticipated sound levels associated with impact hammer pile driving with sound attenuation using a bubble curtain. Assumes maximum number of strikes per day (2000 strikes).

Pile Type and Size	Max Single Strike Peak at 10 m	Single Strike SEL at 10 m	Single Strike RMS at 10 m	Distance (m) to 206 dB Peak	Distance (m) to 187 dB Accumulated SEL/Day	Distance (m) to 150 dB RMS
30-inch steel	197 dB	172 dB	182 dB	3	159	1,359
24-inch steel	195 dB	167 dB	179 dB	2	74	858
12-inch wood	170 dB	150 dB	160 dB	0	5	46

Typically one pile would be installed per day and each pile will require up to 2,000 blows by an impact hammer for installation. Driving time for each pile is estimated to be less than 30 minutes. Thus, 13 piles to be installed at 30 minutes each would generate up to a total of 6.5 hours of elevated underwater sound levels over several separate days. The days of impact hammer operation for installation of the piles may not be consecutive and will be limited to the period between June 1 and November 30.

To complete the majority of the pile installations, the Project proposes to use a vibratory hammer. Vibratory hammers use counter-rotating eccentric weights to transmit vertical vibrations into the pile, causing the sediment surrounding the pile to liquefy and allow the pile to penetrate the substrate. The vibratory hammer produces sound energy that is spread out over time and is generally 10 to 20 dB lower than impact pile driving (Buehler *et al.* 2015). Based on the results of hydroacoustic monitoring of vibratory hammer pile installations (Buehler *et al.* 2015), the sound levels generated by vibratory hammer use will be considerably below the injury and mortality thresholds for both single strike and cumulative SEL, and no adverse effects to green sturgeon are anticipated. However, pile driving activities by vibratory hammer could result in noise that may startle green sturgeon and result in temporary dispersion from the action area. The potential behaviorally effects of pile driving on green sturgeon are presented below.

Although the spreadsheet utilized by NMFS can predict SPLs at a distance of less than 33 ft. (10 m) from a pile, hydroacoustic measurements in the field generally cannot be made this close to a pile. Near-field effects of sound waves, on-site equipment, the air bubble curtain, and safety typically don't allow for hydroacoustic monitoring to be performed within a few feet of a pile. The spreadsheet model predicts the 206 dB peak single strike threshold is exceeded within 3 meters from a driven 30-inch diameter pile, and 2 meters from a 24-inch diameter pile. At this close range, NMFS believes it is very unlikely that a green sturgeon will be present due the placement of an air bubble curtain system which will occupy several feet of the radial distance immediately outward from the pile. Thus, SPLs created by a single strike are not expected to result in the injury or mortality of green sturgeon.

Although sound levels associated with the single strike of an impact hammer on a 30-inch and 24-inch pile will not cause injury or mortality, cumulative SEL has the potential to result in injury or mortality of green sturgeon during impact hammer pile driving by the Project. The spreadsheet model predicts the extent of SPLs above an accumulated SEL of 187 dB would extend up to a radial distance of approximately 159 meters from the pile. For the purposes of this analysis, the zone of potential injury or mortality to threatened green sturgeon is associated with accumulated SEL and is defined as the area in which fish could experience a range of barotraumas, including the damage to the inner ear, eyes, blood, nervous system, kidney, and liver. These injuries have the potential to result in the mortality of an individual fish either immediately or later in time.

Depending on the time of year, green sturgeon may be commonly found within Suisun Bay and Carquinez Strait, as indicated by the results of acoustic tag monitoring conducted by the California Fish Tagging Consortium. Tag monitoring results reported by Hearn *et al.* (2010) indicated that most adult green sturgeon that are detected in the summer and fall occur from the

Golden Gate and up to the Carquinez Bridge. To date, tagging studies provide little information on juvenile green sturgeon distribution and behavior, but sampling has indicated juveniles mostly occur in small groups in the Bay/Delta region (Adams *et al.* 2002; Hearn *et al.* 2010) and are unlikely to occur in more than small numbers in the action area. The action area of this Project provides sites with soft bottom substrate that is suitable for green sturgeon foraging.

Based on the foraging behavior and movements of green sturgeon within San Francisco Bay, some individuals may be subjected to elevated sound levels during pile driving activities at the Martinez Marine Oil Terminal. However, NMFS estimates that only a very small number of threatened Southern DPS green sturgeon may be injured or killed by the proposed pile driving because few individuals are likely to be exposed to an accumulated SEL of 187 dB or greater. To incur injury or mortality, an individual would need to be exposed to a cumulative SEL of 187 dB or greater. This would occur when an individual sturgeon remains continuously within a certain distance from a 30-inch diameter pile for several hundred strikes or more. For example, an individual sturgeon at a distance of 159 meters from the pile would need to be exposed continuously for at least 2,000 pile strikes (estimated to be about 30 minutes) to incur injury or mortality. At closer distances, the exposure time is reduced to reach an accumulated SEL of 187 dB. For example, a sturgeon at 50 meters from the pile would be exposed to an accumulated SEL of 187 dB if they remained continuously within this distance for 350 pile strikes. The Project proposes to install eight 30-inch diameter piles which would have a cumulative pile driving time of four hours over eight days. For the installation of the 24-inch diameter piles, an individual green sturgeon would need to remain continuously within 74 meters of the pile for 2,000 impact hammer strikes (estimated to be 30 minutes) to incur injury or mortality. The Project proposes to install four 24-inch diameter piles which would have a cumulative pile driving time of two hours over four days. During the single day of installation of a 12-inch timber pile, no injuries or mortality is anticipated because underwater sound levels will not exceed the dual metric criteria was established by the FHWG.

Within the zone of accumulated SEL of 187 dB at the Martinez Marine Oil Terminal, most exposed sturgeon are unlikely to remain in the same location for an extended period of time due to tidal currents and behavioral movements. Thus, few sturgeon are expected to remain stationary long enough to accumulate SEL to levels which cause injury or mortality. Although no data are available to quantify the risk of exposure to the accumulated SEL threshold of 187 dB, NMFS believes that, for the reasons stated herein, the potential risk of injury and mortality to green sturgeon is low. Most sturgeon within the action area will be expected to temporarily disperse with the intrusion of construction work, or move with tidal currents and behavioral movements. The zone of physical injury during pile driving is relatively small in comparison to the size of Suisun Bay and the duration of pile driving activities is short (Project total of 6.5 hours over 13 days). Thus, the likelihood of an individual green sturgeon's presence in the area subject to exceedance of the cumulative SEL of 187 dB is low; the likelihood of injury or mortality is proportionate to the low likelihood of presence.

Beyond the zone of potential injury or mortality, elevated sound levels may result in disturbance and behavior effects during impact hammer pile driving and during use of a vibratory hammer. During use of the impact hammer, sound levels are projected to exceed 150 dB RMS to a maximum distance of 1,359 meters. Fish may demonstrate temporary abnormal behavior within

this zone during pile driving indicative of stress or exhibit a startle response. A fish that exhibits a startle response may not be injured, but is exhibiting behavior that suggests it perceives a stimulus indicating potential danger in its immediate environment. The behavioral impact zone extends about 1,359 meters from the 30-inch diameter steel pipe piles (Table 1), and would be impacted for a period of about 30 minutes per day for about 8 days. The behavioral impact zone for the 24-inch diameter steel pipe piles extends about 858 meters from the pile and would be impacted for a period of about 30 minutes per day for about 4 days. The project includes installation of one 12-inch diameter wood pile. The behavioral impact zone for installation of that wood pile extends about 46 meters from the pile and would impact that area for about 30 minutes of one day.

If any green sturgeon enter or transit the behavior impact zone described above during pile driving, there could be behavioral reactions. Green sturgeon may avoid the area due to the elevated underwater sound levels. As noted above, many fish species demonstrate an avoidance reaction in the near-field (Dolat 1997). While behavioral impacts to green sturgeon during pile driving have not been specifically studied, NMFS anticipates that green sturgeon, like other fish studied, will exhibit startle and avoidance behavioral reactions. Due to the availability of estuarine habitat directly adjacent to the action area, and anticipated behavioral responses, green sturgeon are expected to react to the sound produced by impact hammer pile driving by swimming away from the action area. Adequate water depths and the open water area of Suisun Bay adjacent to the action area will provide startled fish sufficient area to escape and elevated sound levels should not result in significant effects on these individuals. Areas adjacent to the Project's action area provide habitat of similar or higher quality and provide adequate carrying capacity to support individual sturgeon that are temporarily displaced during pile driving by the Project. Since the zone of behavioral effects does not span the full width of the channel, the portion of the migration corridor to the north of the action area will be unaffected by elevated levels of underwater sound. Based on the size of the migration corridor and the short duration of all pile driving activities performed by an impact hammer (not to exceed cumulative total of 6.5 hours), delays or disruption in migration behavior by green sturgeon is not expected to result in a significant effect.

2.5.1.4 Assessment of Effects on Water Quality

Water quality in the action area may be degraded during construction activities. Disturbance of soft bottom sediments during the installation of piles are expected to result in temporary increased levels of turbidity. Additionally, water quality may be degraded through the suspension of sediment-associated contaminants or release of contaminants in the water column. The effects of elevated levels of turbidity and suspended or released contaminants on green sturgeon as a result of construction activities are presented below.

Turbidity

High levels of turbidity may affect fish by disrupting normal feeding behavior, reducing growth rates, increasing stress levels, and reducing respiratory functions (Benfield and Minello 1996; Nightingale and Simenstad 2001). There is little direct information available to assess the effects of turbidity in the San Francisco Estuary on juvenile or adult green sturgeon. However, this

benthic species is well adapted to living in estuaries with a fine sediment bottom and is tolerant of high levels of turbidity, because they have adapted to forage for prey organisms in soft bottom sediments.

As piles are driven into the substrate, fine-grain sediments such as the clay and silt material found under and along the Martinez Marine Oil Terminal will be disturbed and generate increased levels of turbidity in the adjacent water column. The extent of turbidity plumes resulting from the Project will depend on the tide, currents, and wind conditions during pile driving activities. Based on observations of similar pile removal and installation activities in San Francisco Bay, increased levels of suspended sediment and turbidity during pile removal and driving are anticipated to be minor, localized, and short-term. With strong tidal currents in the action area, any elevated levels of suspended sediment or turbidity are anticipated to rapidly return to background levels after work ceases.

Based on the above, the extent and levels of turbidity associated with construction activities by the Project are not expected to result in harm or injury, or behavioral responses that impair migration, foraging, or make green sturgeon more susceptible to predation. If sturgeon temporarily relocate from areas of increased turbidity, habitat of similar value is available in Suisun Bay adjacent to the action area, and other areas in the Bay offer equal or better habitat value for displaced individuals. Adjacent habitat areas also provide adequate carrying capacity to support individual sturgeon that are temporarily displaced during in-water construction activities that cause increases in turbidity. For these reasons, the potential effects of minor and localized areas of elevated turbidity associated with this Project's construction activities are not expected to harm green sturgeon.

Contaminants

As described above in the Environmental Baseline, water and sediment quality within the action area are affected by upland stormwater runoff, industrial activities, and urban influences. Environmental contaminants discharged into aqueous systems tend to associate with particulate material in the water column and with consolidated bedded sediments.

During the installation of piles, bottom sediments will be suspended and sediment-borne contaminants may be released to the water column. However, based on the project description (including the type of activities conducted, the work span, and equipment used) the suspended plumes of sediment and potential contaminants released during construction are expected to be localized and the concentration is expected to diminish quickly. Any minor and localized elevations in contaminants which might result from those suspended plumes are expected to be quickly diluted by tidal circulation to levels that are unlikely to adversely affect green sturgeon.

Filling of the timber pile's sleeve with cementitious grout, equipment refueling, fluid leakage, equipment maintenance, and construction activities near open waters pose some risk of contamination of aquatic habitat and subsequent injury or death to green sturgeon. Oils and similar substances from construction equipment can contain a wide variety of polycyclic aromatic hydrocarbons (PAHs) and metals. Both can result in adverse impacts to green sturgeon. When performing work where pollutants may be accidentally discharged, the Project proposes to conduct the work over platforms and tarps to prevent materials from falling into the waters of the

bay. In addition, debris barriers, absorbent booms and absorbents will be available on site if needed. These measures are anticipated to avoid the discharge of construction debris into the waters of Suisun Bay and adequately protect water quality from contaminants.

2.5.1.5 Assessment of Effects of Fire Pump Operations

Upon completion of construction, the Project will have seismically retrofitted the fire pump platform and installed supplemental bracing on the pump's intake at the marine terminal. In addition, the Applicant will have installed a larger strainer/screen on the fire pump intake which is designed to reduce the water velocity entering the intake to less than 0.4 feet per second. In the event of a fire emergency, operation of the system would involve pumping water directly from Suisun Bay. Water diverted from the Bay passes through the intake pipeline to the pump connection installed on the platform. The pump is operated weekly from 20 to 30 minutes for maintenance purposes.

Based on the pumping capacity of the system and the surface area of the proposed enlarged strainer, the approach velocity at the strainers should not exceed 0.4 feet per second (fps). Listed salmonids and green sturgeon in the action area are expected to be of sufficient size that their swimming abilities would allow them to avoid impingement on the strainer surface. The mesh size openings on the strainer would prevent the entrainment of listed fish into the pump intake. Thus, listed fish are unlikely to be harmed by water diverted from Suisun Bay during the operation of the fire pump system. Additionally, the system would only be operated when there is a fire emergency or during system maintenance. Since the fire pump was installed in the early 1970's, there has never been a fire requiring its use. Thus, the system is expected to be operated infrequently. Based on the above, the future operation of the fire pump is not expected to entrain or impinge listed fish.

2.5.1.6 Assessment of Effects on Critical Habitat

The action area is designated as critical habitat for Southern DPS green sturgeon and Project implementation is anticipated to impact designated critical habitat. Construction activities are expected to temporarily alter water quality and foraging habitat for green sturgeon designated critical habitat.

Water Quality

The effects of Project construction activities on water quality are discussed above in section 2.5.1.4, Assessment of Effects on Water Quality, of this opinion and also apply to designated critical habitat in the action area. As described above, the effects of the proposed Project may result in increased levels of turbidity and the suspension of sediment-associated contaminants or release of contaminants. The impacts on water quality from turbidity and contaminants are not expected to degrade PBFs of green sturgeon because the level of potential contaminant exposure is low and elevated turbidity is expected to be short-term, minor, and localized.

Disturbance of the Benthic Community

The Project's installation and repair of piles will disturb bottom sediments and disturb the associated benthic community in the action area. Benthic invertebrates that are directly in the

footprint of the 13 new piles may be injured or killed. Although information on green sturgeon foraging behavior and their prey organisms in the San Francisco Estuary is limited, it is known that green sturgeon prey on demersal fish and benthic invertebrates in estuaries. Radtke (1966) analyzed stomach contents of juvenile green sturgeon captured in the Sacramento-San Joaquin Delta and found the majority of their diet was benthic invertebrates, such as mysid shrimp and amphipods (*Corophium* spp).

Pile activities during this Project are expected to remove some prey organisms for green sturgeon and foraging by sturgeon in the action area may be temporarily affected. However, the extent of impacts to the benthic community is expected to be small due to the very small area affected by an individual pile and the small number of piles.

NMFS does not expect the temporary reduction of benthic prey in the action area to prevent sturgeon from finding suitable forage at the quantities and quality necessary for normal behavior (*e.g.*, maintenance, growth, reproduction). Specifically, the area of benthic disturbance due to new permanent pile installation is a very small portion of the action area. Collie *et al.* (2000) reported some aquatic invertebrates re-colonize areas within a few months of a disturbance activity and this is expected at individual sites following the completion of pile installation. Given the small portion of the action area disturbed, the likely availability of forage elsewhere in the action area, and the recovery of the benthic community after disturbance, impacts to prey resource availability due to Project construction are expected to be insignificant.

Reduced Use of Action Area during Pile Driving

As described above in Section 2.5.1.3 of this opinion, elevated SPLs within the action area are expected to create a zone of injury/mortality and behavioral impacts. Within the area of accumulated SEL levels of 187 dB and above, green sturgeon may be subject to injury or mortality as described above. For sound levels beyond the zone of injury/mortality but greater than 150 dB RMS, a level of disturbance may cause green sturgeon to avoid using the area for foraging and migrating during pile driving. Assuming the worst case scenario, elevated sound levels result in an adverse behavioral response during pile driving and the action area is rendered unusable by green sturgeon for a total of 6.5 hours when impact hammer pile driving operations are underway. The 6.5 hours of impact hammer pile driving is anticipated to not exceed 30 minutes per day and occur over a period of 13 days.

The action area is thought to provide foraging habitat for sturgeon because the site includes soft bottom subtidal habitat. Although impact hammer pile driving will not exceed 30 minutes in one day, this temporal loss of foraging area could be an adverse effect on PBFs for adequate prey/food resources. During the periods of pile driving over the Project's 13 days of driving activities, green sturgeon may avoid foraging in portions of the action area. However, when each day's pile driving activities have concluded, this area and its food resources will again be fully accessible to green sturgeon. Due to the short duration of a single pile driving episode (*i.e.*, up to 30 minutes per day), this temporary impact is not anticipated to prevent sturgeon from finding suitable forage at the quantities and quality necessary for normal behavior (*e.g.*, maintenance, growth, reproduction). When all of the Project's pile driving activities have been completed, NMFS does not expect any lasting reduction in habitat value related to elevated sound levels from pile driving.

Overwater Shading

Implementation of the Project will increase the footprint of overwater structures in the action area. Overwater structures, such as docks and piers, result in shading of the water column and benthic habitats. Shading of the water column has the potential to reduce growth of submerged aquatic vegetation, decrease primary productivity, alter predator-prey interactions, change invertebrate assemblages, and reduce the density of benthic invertebrates (Glasby 1999; Helfman 1981; Struck *et al*. 2004; Stutes *et al*. 2006), all of which may lead to an overall reduction in the quality of fish habitat.

For construction of the Plains Martinez 2017 Wharf Retrofit, the Project will increase overwater square footage by 146 ft^2. Water depths at the marine terminal range from 0 to 40 feet and the shoreline consists of abrupt transitions from subtidal to hardened shorelines or unmanaged marsh. With this configuration, there are limited surfaces of suitable shallow subtidal zones to support submerged aquatic vegetation in the action area. Although a small increase in the amount of shading of benthic habitat is anticipated, completion of the Project will have negligible effects on the action area's ability to support submerged aquatic vegetation. In addition, the marine terminal site has limited habitat value for green sturgeon as it has been highly modified by maritime development and frequent dredging. For the above reasons, the creation of new overwater structure by the Project will not significantly increase the amount of overwater shading and the effects of additional shading are expected to be negligible.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult, if not impossible, to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild

by reducing its numbers, reproduction, or distribution; or (2) appreciably diminishes the value of designated or proposed critical habitat for the conservation of the species.

Southern DPS green sturgeon have experienced serious declines in abundance and long-term population trends that suggest a negative growth rate. Human-induced factors have reduced populations and degraded habitat, which in turn has reduced the population's resilience to natural events, such as droughts, floods, and variable ocean conditions. Global climate change presents another real threat to the long-term persistence of the population, especially when combined with the current depressed population status and human caused impacts. Within the Project's action area in Suisun Bay, the effects of shoreline stabilization, industrialization, and urbanization are evident. As a result, forage species that green sturgeon depend on have been reduced in the action area and throughout the greater San Francisco Bay Estuary.

During construction activities at the Martinez Marine Oil Terminal, water quality in the action area is expected to be degraded through the disturbance of bottom sediments as piles are removed, sleeved, and installed. Elevated levels of turbidity, the suspension of sediment associated contaminants, and the release of contaminants in the water column are anticipated, but are not expected to adversely affect green sturgeon because levels will be minor, localized and short-term.

If foraging behavior and movements of green sturgeon bring some individuals into the action area during pile driving activities by the Project, individuals could be exposed to elevated levels of underwater sound during the Project's 6.5 hours of impact hammer pile driving. The effects of pile driving could range from behavioral disturbance to barotrauma. Injury or mortality of individuals due to barotrauma may occur; however, NMFS expects the number of green sturgeon exposed to this effect to be very small because the duration of pile driving is short (up to 30 minutes per day over a period of 13 days). Furthermore, to incur injury or mortality from accumulated SEL, an individual would need to remain continuously within the zone of physical injury for a minimum of several hundred strikes of the impact hammer. No injury or mortality is expected from peak sound levels generated by a single strike.

The use of a bubble curtain to attenuate generation of underwater sound levels while pile driving is projected to significantly reduce the SPLs, and reduce the extent of area where the accumulated SEL could potentially result in barotrauma if fish remain within that zone for an extended period of time. Pile driving activities could result in noise that may startle green sturgeon and result in temporary dispersion from the action area. Behavioral effects during impact hammer pile driving may extend up to 1,359 meters. If green sturgeon were to react behaviorally to the sound produced by pile driving, adequate water depths and area within the adjacent open waters of Suisun Bay and Carquinez Strait are expected to provide fish sufficient area to disperse. This noise may discourage green sturgeon from utilizing the action area during pile driving, but this area represents a small portion of the San Francisco Estuary and these habitat areas will become available again once the Project's 6.5 hours of impact hammer pile driving is completed.

The action area is designated critical habitat for Southern DPS green sturgeon. Critical habitat is expected to be impacted through temporary degradation of water quality and temporary impacts

to foraging habitat. Water quality may be degraded through increased turbidity and release of contaminants into the water column. Foraging habitat will be temporarily affected during Project activities through elevated SPLs, physical disturbance of benthic habitat, and the associated impacts to food resources. Temporary impacts from the small areas of benthic habitat disturbed by the removal, sleeving, and placement of piles are expected to recover rapidly due to the small number of piles and the small footprint of an individual pile.

Based on the above, a very small number of green sturgeon could be adversely affected by the Project's proposed pile driving activities. However, it is unlikely that the small potential loss of individuals as a result of the Project will impact future adult returns due to the proportionally large number of green sturgeon unaffected by the Project compared to the small number of sturgeon likely affected by the Project. Due to the life history strategy of green sturgeon that spawn every 3-5 years over an adult lifespan of as much as 40 years (Moyle 2002), the few individuals injured or killed during pile driving are likely to be replaced in subsequent generations of green sturgeon.

Regarding future climate change effects in the action area, California could be subject to higher average summer air temperatures and lower total precipitation levels. Reductions in the amount of snowfall and rainfall would reduce stream flow levels in Northern and Central Coastal rivers. Estuaries may also experience changes in productivity due to changes in freshwater flows, nutrient cycling, and sediment amounts. For this Project, in-water activities will occur in 2018 or 2019, and the above effects of climate change are not likely to be detected within that time frame. If the effects of climate change are detected, they will likely materialize as moderate changes to the current climate conditions within the action area. These changes may place further stress on green sturgeon populations. The effects of the proposed action combined with moderate climate change effects may result in conditions similar to those produced by natural ocean-atmospheric variations (as described in the Environmental Baseline) and annual variations. The species are expected to persist throughout these phenomena, as they have in the past, even when concurrently exposed to the effects of similar projects.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' opinion that the Plains Martinez 2017 Wharf Repairs and Retrofit Project is not likely to jeopardize the continued existence of threatened Southern DPS green sturgeon or destroy or adversely modify its designated critical habitat.

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly

impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1 Amount or Extent of Take

In the opinion, NMFS determined that incidental take is reasonably certain to occur as follows: NMFS anticipates that the take of threatened green sturgeon associated with the Plains Martinez 2017 Wharf Repairs Project in Suisun Bay, Contra Costa County, California will be in the form of injury or mortality to green sturgeon caused by impact hammer pile driving over a period of up to 6.5 hours spread over a period of 13 days.

Due to the relatively small area of potential effect and its location underwater with low visibility, NMFS is not able to estimate the specific number green sturgeon that may be in the action area during the proposed action. Monitoring or measuring the number of listed fish actually injured or killed by elevated sound levels during pile driving is also not feasible. Observation of injured or killed fish is unlikely because they may not float to the surface or may be carried away by the strong currents in and near the action area into the larger portions of Suisun Bay. Due to the difficulty in quantifying the number of listed green sturgeon that could be affected by pile driving, a surrogate measure of take is necessary to establish a limit to take the exempted by this incidental take statement. For this action, compliance with the expected elevated underwater sound levels during pile driving is the best surrogate measure for incidental take associated with Project implementation. Therefore, NMFS will consider the extent of take exceeded if elevated sound levels during pile driving indicates that accumulated SPLs greater than 187 dB SEL extend beyond 159 meters during the installation of any of the piles. This distance represents the maximum area where green sturgeon injury or death is reasonably certain during impact hammer pile driving by this Project.

2.9.2 Effect of the Take

In the opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the Southern DPS of green sturgeon or destruction or adverse modification of critical habitat.

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of green sturgeon:

1. Monitor underwater sound levels during use of an impact pile driving hammer to evaluate the Project's effects on green sturgeon.

2. Ensure the Project's bubble curtain system is properly operated to maximize sound attenuation.

3. Prepare and submit a report regarding the construction of the Project and the results of the hydroacoustic monitoring program.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the Corps or any applicant must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). The Corps or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement reasonable and prudent measure 1:

   a. At least four weeks prior to the initiation of construction, the Applicant shall develop and submit to NMFS for review a hydroacoustic monitoring plan that includes underwater sound measurements at various distances and depths from impact hammer pile driving operations. At a minimum, the plan must include the following: (1) all hydrophones will be placed at least 1 meter (3.3 feet) below the surface; (2) if only one hydrophone is used, it will be placed 10 meter (33 feet) from the pile at midwater depth; (3) if more than one hydrophone is used to calculate transmission loss over distance, water depth where the hydrophone will be located will be at least 4 meter (13 ft); and (4) if waters are less than 4 meter (13 ft) deep, a single hydrophone will be placed at midwater depth.

   b. The following acoustic metrics shall be recorded at a distance of 10 meters: single strike peak, single strike SEL, and RMS. Post-analysis and calculation shall be determined as described in Underwater Noise Monitoring Template developed by the Fisheries Hydroacoustic Working Group (see Enclosure 2). If single strike SEL values exceed 172 dB at 10 meters or impact hammer strikes exceed 2,000 per day, NMFS shall be notified within 24 hours (Daniel Logan at 707-575-6053 or dan.logan@noaa.gov). The Applicant shall make available to NMFS data from the hydroacoustic monitoring program on a real-time basis (*i.e.*, daily monitoring data should be accessible to NMFS upon request).

   c. The Corps and the Applicant shall allow any NMFS employee(s) or any other person(s) designated by NMFS to accompany field personnel to visit the project site during the activities described in this opinion.

2. The following terms and conditions implement reasonable and prudent measure 2:

    a. A designated monitor shall be on-site daily while impact hammer pile driving is taking place to ensure that the bubble curtain system is operating efficiently. The Applicant shall be prepared to maintain and repair the bubble curtain system, if the system is not functioning properly and fully.

    b. No impact hammer pile driving will occur at times when the bubble curtain system is not functioning properly and fully.

3. The following terms and conditions implement reasonable and prudent measure 3:

    a. The Corps or Applicant shall provide a written report to NMFS within 120 days of the completion of the Project. The report shall be submitted to NMFS North Central Coast Office, Attention: San Francisco Bay Branch Supervisor, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The report must contain, at a minimum, the following information:

        i. Project related activities – The dates pile installation occurred and a description of any and all measures taken to minimize effects on green sturgeon (*e.g*., utilization of bubble curtain or vibratory hammer).

        ii. Bubble curtain monitoring – a description of the methods used to monitor the functioning of the bubble curtain; a description of any events during which the bubble curtain was not functioning properly and fully, including times of excessive water currents; and a description of methods used to maintain or repair the bubble curtain, if undertaken.

        iii. Hydroacoustic monitoring – a description of the methods used to monitor underwater sound levels during impact hammer use; the locations (depths and distance from point of impact) where monitoring was conducted; the total number of pile strikes per pile; total number of strikes per day; the interval between strikes; the peak/SPL, RMS and SEL per strike; and accumulated SEL per day.

2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

NMFS has the following conservation recommendation:

1. The Corps and/or Applicant should support the California Fish Tracking Consortium's effort to detect tagged salmonids and green sturgeon in Suisun Bay and Carquinez Strait by

funding the installation and maintenance of tag receiving monitors. For information regarding the California Fish Tracking Consortium, see http://californiafishtracking.ucdavis.edu/.

2.11 Reinitiation of Consultation

This concludes formal consultation for the Plains Martinez 2017 Wharf Repairs and Retrofit Project.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12 "Not Likely to Adversely Affect" Determinations

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

NMFS does not anticipate the proposed action will adversely affect:

Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*) **Evolutionarily Significant Unit (ESU)**
endangered (70 FR 37160; June 28, 2005)
critical habitat (58 FR 33212; June 16, 1993);
Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) **ESU**
threatened (70 FR 37160; June 28, 2005);
Central California Coast steelhead (*Oncorhynchus mykiss*) **DPS**
threatened (71 FR 834; January 5, 2006); and
California Central Valley steelhead (*Oncorhynchus mykiss*) **DPS**
threatened (71 FR 834; January 5, 2006).

The effects of the proposed action are reasonably likely to include elevated underwater sound levels during pile driving, temporary degradations to water quality, and habitat disturbance as described above. By restricting pile driving activities to the period between June 1 and November 30, the project avoids the majority of the migration seasons of adult and juvenile

ESA-listed salmonids in Suisun Bay. Thus, NMFS anticipates ESA-listed salmonids are unlikely to be present in the action area during the Project's in-water construction activities.

The use of an impact hammer to install piles is anticipated to generate elevated levels of underwater sound during construction of the Plains Martinez 2017 Wharf Repairs and Retrofit Project. The hydroacoustic effects of the Project's pile driving activities are described in Section 2.5.1.3 of this opinion. However, the effects on fish associated with elevated SPLs only occur during the actual pile driving events and effects will cease when operation of the pile driving hammer is terminated. With the Project's in-water work activities restricted to the period of June 1 through November 30, ESA-listed salmonids will not be present in the action area to experience elevated underwater sound levels and the temporary effects of pile driving will have concluded prior to the seasonal presence of listed anadromous salmonids in the action area.

Effects to water quality associated with Project activities are described in Section 2.5.1.4. As with elevated sound levels during pile driving, effects of degraded water quality are anticipated to cease prior to the seasonal occurrence of listed salmonids in the action area. Pile removal, sleeving, and installation will likely create temporary increases in turbidity and may suspend sediment-associated contaminants into the adjacent water column. However, these effects to water quality are expected to rapidly dissipate with tidal circulation when the work ceases. Filling of the timber pile's sleeve with cementitious grout and construction activities near open waters pose some risk of contamination of aquatic habitat and subsequent injury or death to listed salmonids. However, with the Project's in-water work activities restricted to the period of June 1 through November 30, listed salmonids will not be present to experience degraded water quality conditions in the action area. Based on the above, the effects of the Project's construction activities on listed salmonids are anticipated to be discountable.

The action area is designated as critical habitat for Sacramento winter-run Chinook salmon. The PBFs essential for the conservation of Sacramento River winter-run Chinook salmon are: (1) access from the Pacific Ocean to appropriate areas in the upper Sacramento river, (2) availability of clean gravel for spawning substrate, (3) adequate river flows for spawning, incubation of eggs, fry development and emergence, and downstream transport of juveniles, (4) water temperatures between 42.5 and 57.5 °F (5.8 and 14.1 °C) for successful spawning, egg incubation, and fry development, (5) habitat areas and adequate prey that are not contaminated, (6) riparian habitat that provides for successful juvenile development and survival, and (7) access downstream so that juveniles can migrate from spawning grounds to San Francisco Bay and the Pacific Ocean.

The Project's removal, sleeving, and installation of pilings will disturb bottom sediments and the associated benthic community in a small portion of the Project's action area. This disturbance may injure or kill benthic organisms, some of which may be prey for listed salmonids. However, once construction activities are completed, the benthic community in disturbed areas is expected to recover rapidly due to the small footprint of each pile. Collie *et al.* (2000) reported some aquatic invertebrates re-colonize areas within a few months of a disturbance activity. Because of the small size of disturbed areas, NMFS expects that the effects of disturbance to the benthic community from this Project's pile activities will be minor and not affect foraging by listed salmonids. There will be an increase in overwater shading of 146 ft^2, which has the potential to negatively affect critical habitat. However, the additional overwater structures will be adjacent

to the existing wharf, which supports minimal suitable foraging habitat. Furthermore, 146 ft^2 is a very small portion of available foraging habitat in the action area. Based on the above, effects of benthic disturbance and shading on designated critical habitat is expected to be insignificant. For the above reasons, the potential effects of the Project are considered insignificant or discountable and are not expected to result in either a net change to existing habitat values in the action area or result in adverse impacts to designated critical habitat for Sacramento River winter-run Chinook salmon.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on information provided by the Corps and the Applicant, and descriptions of EFH for Pacific Coast Groundfish (Pacific Fishery Management Council [PFMC] 2005), Coastal Pelagic Species (PFMC 1998), and Pacific Coast Salmon (PFMC 1999) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

Effects of the proposed Project will impact EFH for various federally managed fish species within the Pacific Coast Groundfish (PFMC 2005), Pacific Coast Salmon (PFMC 1999), and Coastal Pelagic Species (PFMC 1998) FMPs. Furthermore, the Project area is located in an estuary Habitat Areas of Particular Concern for various federally managed fish species within the Pacific Coast Groundfish and Pacific Coast Salmon FMPs.

3.2 Adverse Effects on Essential Fish Habitat

Adverse effects to EFH will occur through (1) increased turbidity in the water column, (2) suspension of sediment-associated contaminants, and (3) disturbance of benthic habitat. EFH will also be temporarily impacted by elevated underwater sound levels during pile driving.

Turbidity

In-water work activities (*i.e.*, pile installation) may result in elevated levels of turbidity and suspended sediment in the water column (Section 2.5.1.4 in the above opinion). The finer grain

sediments, silts and clays, are more readily suspended and settle out slower than course sediments, such as sand and gravel. In-water work in areas with fine sediments are likely to have greater turbidity impacts than in areas with coarse sediments (Sabol *et al.* 2005). The action area is expected to have primarily fine grain sediments with only a minimal amount of sand and gravel.

The frequency and duration of elevated turbidity generally depends upon the size and quality of the bottom sediments and the frequency and duration of the activity. Elevated levels of turbidity are expected during pile removal, sleeving, and installation activities. Typically, only one pile will be installed per day, and the area of Project activities where increased turbidity will occur is small. Therefore, in-water work is expected to have localized, minor, and temporary periods of elevated turbidity that dissipate with tidal circulation.

Release of Contaminants

The suspension of contaminated sediments during pile removal, sleeving, and installation activities presents the potential for release of contaminants to the water column (Section 2.5.1.4 in the above opinion). However, most contaminants are tightly bound in the sediments and are not easily released during short-term resuspension (Corps 2004).

This Project does not include any activities that will disturb large surface areas on the bay substrate. This will avoid the creation of newly exposed surface layers of sediment that allow for contaminants to be made available to organisms and assimilation into the food chain. Furthermore, the potential for suspension of contaminated sediment is low with this Project as the area of disturbed sediment is small.

Benthic disturbance

Pile installation are expected to disturb the benthic community in the action area (Section 2.5.1.5 in the above opinion). This disturbance will impact forage species, such as infaunal and bottom-dwelling organisms like polychaete worms and crustaceans, by directly contacting or burying these organisms (Newell *et al.* 1998; Van der Veer *et al.* 1985). Recolonization studies suggest that recovery may not be linear, and can be regulated by physical factors including particle size distribution, currents, and compaction/stabilization processes following disturbance. Rates of recovery listed in the literature range from several months to several years for estuarine muds (Currie and Parry 1996; Oliver *et al.* 1977; Tuck *et al.* 1998; Watling *et al.* 2001) and can take up to 1 to 3 years in areas of strong currents (Oliver *et al.* 1977). At the Martinez Marine Oil Terminal, benthic organisms are expected to recover rapidly at disturbed sites due to the small footprint of each pile. Because of the small size of disturbed areas (directly under and adjacent to pilings removed or installed), NMFS expects that the effects of disturbance to the benthic community from this Project's pile installation will be minor.

Overwater Shading

Implementation of the Project will increase the footprint of overwater structures in the action area. Overwater structures, such as docks and piers, result in shading of the water column and benthic habitats. As discussed in Section 2.5.1.5., shading can lead to an overall reduction in the quality of aquatic habitat. However, the addition of overwater structures (146 ft^2) is not expected to impact EFH due to the small footprint and the location of the structures.

Elevated Underwater Sound Levels

Pile driving will increase underwater sound pressures and will effect open water column habitat for fishes (Section 2.5.1.3 of the above opinion). During use of an impact hammer for pile driving, the action area to a distance of up to 1,359 meters from the pile being installed will be impacted for approximately 30 minutes a day for 13 days. However, it is expected that adjacent habitats will be unaffected during pile driving activities and the elevated SPLs will have no permanent impact on EFH.

3.3 Essential Fish Habitat Conservation Recommendations

There are no practical EFH Conservation Recommendations to provide because impacts to EFH are expected to minor, temporary, localized, or addressed through avoidance and minimization measures.

3.4 Supplemental Consultation

The Corps must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The DQA specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this opinion is the U.S. Army Corp of Engineers (Corps). Other interested users could include Plains Products Terminals LLC, U.S. Fish and Wildlife Service, San Francisco Bay Conservation and Development Commission, the California Department of Fish and Wildlife, and the San Francisco Bay Regional Water Quality Control Board. Individual copies of this opinion were provided to the Corps. This opinion will be posted on the Public Consultation Tracking System web site (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources', Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity

Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 *et seq*., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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