UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4700

Refer to NMFS No: WCR0-2020-03210

April 12, 2021

Matthew J. Roberts
Senior Project Manager
Army Corps of Engineers
1325 J Street
Sacramento CA
95814

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Lake California Boat Launch Facility Maintenance Project

Dear Matthew J. Roberts:

Thank you for your letter on October 29, 2020, 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 permitting the Lake California Boat Launch Facility Maintenance Project (SPK-2017-00689). This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

Based on the best available scientific and commercial information, the biological opinion concludes that the Lake California Boat Launch Facility Maintenance Project is not likely to jeopardize the continued existence of the federally listed threatened Central Valley spring-run Chinook salmon evolutionarily significant unit (ESU) (*Oncorhynchus tshawytscha*), threatened California Central Valley steelhead distinct population segment (DPS) (*O. mykiss*), endangered Sacramento River winter-run Chinook salmon ESU (*O. tshawytscha*) or the threatened southern DPS of North American green sturgeon (*Acipenser medirostris*) and is not likely to destroy or adversely modify the designated critical habitats of the above listed species. For the above species, NMFS has included an incidental take statement with reasonable and prudent measures and non-discretionary terms and conditions that are necessary and appropriate to avoid, minimize, or monitor incidental take of listed species associated with the project.

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. We have concluded that the action would adversely affect the EFH of Pacific Coast Salmon. Therefore, we have included the results of that review in Section 3 of this document.

As required by section 305(b)(4)(B) of the MSA, the action agency must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)). In your response to the EFH portion of this consultation, we ask that you clearly identify the number of conservation recommendations accepted.

Please contact Savannah Bell, savannah.bell@noaa.gov, (916)930-3721 if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

A. Catherine Marcinkevage

Cathy Marcinkevage
Assistant Regional Administrator for
California Central Valley Office

CC: Copy to File: 151422-WCR2021-SA00042

Enclosure

Mr. Scott Nielsen, Lake California POA, snielsen@lakecalifornia.net
Mr. Jeff Souza, Tehama Environmental, jeff@tehamaenvironmental.com

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4700

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

Lake California Boat Launch Facility Maintenance Project

NMFS Consultation Number: WCRO-2020-03210

Action Agency: U.S. Army Corp of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	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?
Central Valley spring-run Chinook Salmon Evolutionary Significant Unit (ESU) (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
California Central Valley steelhead Distinct Population Segment (DPS (*O. mykiss*)	Threatened	Yes	No	Yes	No
Southern DPS of North American green sturgeon (*A.medirostris*)	Threatened	Yes	No	Yes	No
Sacramento River winter-run Chinook salmon ESU (*O. tshawytscha*)	Endangered	Yes	No	Yes	No

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

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

Issued By: A. Catherine Marcinkevage

Cathy Marcinkevage
Assistant Regional Administrator for California Central Valley Office

Date: April 12, 2021

TABLE OF CONTENTS

1. Introduction 1
1.1. Background 1
1.2. Consultation History 1
1.3. Proposed Federal Action 1
1.3.1. Project Background 1
1.3.2. Project Purpose 2
1.3.3. Project Description 2
1.3.4. Timing 3
1.3.5. Avoidance and Minimization Measures 3
2. Endangered Species Act: Biological Opinion And Incidental Take Statement 4
2.1. Analytical Approach 5
2.2. Rangewide Status of the Species and Critical Habitat 6
2.2.1. Species Distribution and Decline 11
2.2.2. Central Valley Spring-Run Chinook Salmon 11
2.2.3. Sacramento River Winter-run Chinook Salmon 12
2.2.4. Central Valley Steelhead 13
2.2.5. Southern Green Sturgeon 14
2.2.6. Recovery Plan and Goals 15
2.2.7. Climate Change 16
2.3. Action Area 17
2.3.1. Riverine 18
2.3.2. Freshwater Emergent Wetland 18
2.3.3. Lacustrine 18
2.3.4. Valley Foothill Riparian 18
2.3.5. Annual Grassland 19
2.3.6. Urban 19
2.4. Environmental Baseline 19
2.4.1. CV Spring-Run Chinook 19
2.4.2. Sacramento River Winter-run Chinook Salmon 20
2.4.3. Central Valley Steelhead 21
2.4.4. Southern Green Sturgeon (Acipenser medirostris) 22
2.4.5. Status of Critical Habitat in the Action Area 23
2.5. Effects of the Action 24
2.5.1. Effects to Species 25
2.5.2. Effects to Critical Habitat 27
2.6. Cumulative Effects 27
2.6.1. Agricultural Practices 28
2.6.2. Aquaculture and Fish Hatcheries 28
2.6.3. Increased Urbanization 28
2.6.4. Rock Revetment and Levee Repair Projects 29
2.7. Integration and Synthesis 29
2.7.1. Summary of the Sacramento River Winter-Run Chinook ESU and Designated Critical Habitat 29

2.7.2. Status of the CV Spring-Run Chinook salmon ESU and Designated Critical Habitat 30
2.7.3. Status of the CCV Steelhead DPS and Designated Critical Habitat 30
2.7.4. Status of the Green Sturgeon southern DPS and Designated Critical Habitat 31
2.7.5. Status of the Environmental Baseline and Cumulative Effects in the Action Area 31
2.7.6. Summary of Project Effects on Listed Salmonids and Green Sturgeon 31
2.7.7. Summary of Project Effects on Designated Critical Habitat for All Species 32
2.7.8. Risk to ESUs/DPSs 32
2.8. Conclusion 35
2.9. Incidental Take Statement 35
2.9.1. Amount or Extent of Take 35
2.9.2. Effect of the Take 36
2.9.3. Reasonable and Prudent Measures 36
2.9.4. Terms and Conditions 37
2.10. Conservation Recommendations 38
2.11. Reinitiation of Consultation 38
3. Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response 39
3.1. Essential Fish Habitat Affected by the Project 39
3.2. Adverse Effects on Essential Fish Habitat 40
3.3. Essential Fish Habitat Conservation Recommendations 40
3.4. Statutory Response Requirement 40
3.5. Supplemental Consultation 41
4. Data Quality Act Documentation and Pre-Dissemination Review 41
4.1. Utility 41
4.2. Integrity 41
4.3. Objectivity 41
5. References 42

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

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) 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, as amended.

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 within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at NMFS Central Valley Office.

1.2. Consultation History

- 2017: The U.S. Army Corps of Engineers (Corps) contacted Lake California Property Owners Association to inform them of unauthorized work performed in 2014.
- October 29, 2020 Corp submits letter to NMFS requesting formal consultation of proposed action.
- On November 20, 2020 NMFS requested additional information on the timing of the dredging.
- On December 1, 2020 the Corps provided the needed information and consultation was initiated.

1.3. Proposed Federal Action

Under 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). Under MSA, 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). We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not.

1.3.1. Project Background

The Lake California Property Owners Association (LCPOA) owns and maintains a private boat launch facility located on the west bank of the Sacramento River. During yearly periods of high flow, the launch is filled with sediment, which renders the boat launch unusable during low flow periods. The LCPOA has removed sediment in the past under California Department of Fish and Wildlife (CDFW) Streambed Alteration Agreements.

In 2017, the Corps contacted the LCPOA to inform them that they had performed unauthorized work at the boat ramp by placing fill material below the Ordinary High Water Mark (OHWM) of the Sacramento River without a permit. The unauthorized work was conducted in 2014 to reduce sediment deposition at the facility under a CDFW Streambed Alteration Agreement (1600-2009-0289-R1). That work has since been authorized after-the-fact under Section 10 of the Rivers and Harbors Act and Sections 404 (SPK-2017- 00689) and 401 of the Clean Water Act. During that process, the Corps also informed the LCPOA that Clean Water Act and/or Rivers and Harbors Act authorizations would be required for future sediment removal activities. The LCPOA is now seeking authorization to conduct annual maintenance sediment removal activities.

1.3.2. Project Purpose

The purpose of the Lake California Boat Launch Facility Maintenance Project (Project) is to annually dredge and maintain the boat launch facility to allow access for navigation on the Sacramento River for multiple uses including recreation, commercial (guided) fishing, state and federal resource agency fish monitoring, and state and local law enforcement patrol and emergency response.

1.3.3. Project Description

The Project involves the dredging and removal of sediment from the Lake California boat launch facility on an as-needed basis. Each year, sediment that has been deposited at the facility would be removed from the ramp, in the harbor and at the mouth of the harbor. The amount of material to be removed would vary from year to year. The estimated annual amount of sediment removal from the site is approximately 200 to 300 cubic yards in a wet year. The amount would be less in a dry year.

The dredging and sediment work would involve using heavy equipment (excavator, haul trucks, skid steers and/or loaders, etc.) to excavate and remove the material. The depth of dredging is estimated to be an average of four feet. An excavator would remove sediment with a bucket and side-cast the material on the floodplain to allow it to dry. It is anticipated that the bucket would be a typical dredging style bucket with perforated holes for the release of water prior to side-casting the sediment. Water in the side-casted material would infiltrate into the floodplain materials. It is not anticipated that a berm would be necessary to decant sediment prior to relocation to the placement site. Sedimentation controls, such as berms, fiber rolls, wattles, and other kinds would be installed around the temporary stockpile until the material is hauled to the placement site. Once the material is dry, it would be transferred to haul trucks with a loader or skid steer and hauled to the offsite placement site where the material would be stored and used for future authorized uses.

Temporary ramps may be constructed out into the water to allow equipment to reach areas that are inaccessible from land. All temporary ramps would be removed at the end of each annual maintenance event. The temporary ramps, if needed, would be constructed out of clean, silt-free gravel in accordance with the requirements of the CDFW Streambed Alteration Agreement

(CDFW 1998). Temporary ramps would be constructed using clean salmon-sided spawning gravel, at the water's edge, with the equipment remaining in the dry. The temporary ramp would be extended out from the shore as far as needed so that the excavator can reach areas to be dredged. The ramp would be wide enough to accommodate an excavator at an estimated 15 feet. Only the excavator would work on the ramp. It is anticipated that the temporary ramp would remain in place for less than two days. When removing the temporary ramps, the excavator would remove material from the farthest point from shore first, removing the ramp as the excavator proceeds. Although the majority of the ramp would be removed, it is anticipated that some gravel would remain and be washed downstream, to augment downstream salmon spawning habitat.

In-water work would occur in such a way as to minimize the amount of time that disturbance occurs. It is anticipated that in-water activities would last approximately one to two days, depending on the amount of sediment that is deposited during the prior water year. Equipment would operate from the shoreline or gravel ramp and only the bucket arm would enter the water. No woody vegetation would be removed. A few trees or shrubs may be trimmed to allow access for the excavator. Because the dredge materials are composed of annual sediment deposits from Sacramento River flow events, no contamination is anticipated. Best Management Practices (BMPs) would be used to control turbidity, erosion and sedimentation. BMPs would also be used to control the release of any hazardous materials such as fuel and oil.

1.3.4. Timing

Sediment removal would occur once annually, if needed, during the period between February 1 to April 30 of each year.

1.3.5. Avoidance and Minimization Measures

The Project includes a number of Avoidance and Minimization Measures (AMMs) that were developed to protect sensitive resources that could potentially be impacted by the Project, and are incorporated into the Project description and plans.

These AMMs and project components are summarized below:

1. No removal of woody riparian vegetation.
2. Construction crews would be informed about the importance of avoiding sensitive areas, including riparian habitat.
3. All heavy equipment would be thoroughly cleaned prior to mobilization onsite to remove any soil, weed seeds and plant parts to reduce the importation and spread of invasive exotic plant species.
4. Only certified weed-free straw would be used for erosion control or other purposes to reduce the importation and spread of invasive exotic plant species.
5. Prior to any in-water work, qualified fish biologists, in consultation with CDFW and NMFS, would determine the most appropriate means and methods, if any, to ensure that efforts are made to avoid to the extent practicable adverse effects to listed fish. The determination would be based on the specific site conditions including river flow levels and topography. No capture, handling or electrofishing of fish would occur.

6. Sediment removal would begin in the dry portion of the site and gradually work toward the water's edge to encourage any juvenile fish at the water's edge to volitionally move away from the area.
7. Sediment removal activities would occur during daylight hours to avoid times when juvenile green sturgeon may be more active.
8. Project activities would occur between February 1 and April 30 of each year. The LCPOA would annually work with qualified fish biologists, in consultation with CDFW and NMFS, to determine the specific timing of dredging activities in order to minimize work at times when juvenile anadromous fish are present. An attempt would be made to schedule the dredging as late in the work window as possible, with consideration given to current and predicted river flow conditions and annual weather patterns/hydrologic conditions (e.g., to avoid heavy rain events).
9. If ramps are required, ramps would be constructed out of silt free, clean spawning-size gravel. Gravel would be placed at the water's edge first, gradually extending the ramp out into the harbor to encourage any juvenile fish at the water's edge to volitionally move away from the area. All temporary ramps would be removed at the end of each annual maintenance event.
10. Adequate pollution control measures would be taken to ensure that petroleum products or other harmful chemicals do not enter the Sacramento River as a result of Project activities. Standard BMPs would be used.
11. Monitoring of water turbidity and settleable materials would be conducted in accordance with the Clean Water Act Section 401 Certification through consultation with the Central Valley Regional Water Quality Control Board (RWQCB) and the Fish and Game Code Section 1600 Lake or Streambed Alteration Agreement with CDFW. Standard BMPs would be used to control turbidity and settleable material.
12. All equipment and machinery that contains fuel, oil or other petroleum products used during construction-related activities would be checked for petroleum leaks immediately prior to being mobilized to the Project site and again each day prior to use.
13. All equipment refueling and/or maintenance would take place at least 100 feet from the channel and any elderberry shrubs.
14. An emergency spill kit would be onsite during construction activities.
15. A Clean Water Act Section 404 permit would be obtained from the Corps. A Clean Water Act Section 401 Certification would be obtained from RWQCB. A California Fish and Game Code Section 1600 Lake or Streambed Alteration Agreement would be obtained from CDFW.

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, each Federal agency must ensure that its 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 provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1. Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably 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 biological 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 as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). 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 biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms "effects" and "consequences" interchangeably.

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

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly 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, or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.

- If necessary, suggest a reasonable and prudent alternative to the proposed action.

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' "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 function of the PBFs that are essential for the conservation of the species.

Table 1. Description of species, current ESA listing classification and summary of species status.

Species	Listing Classification and Federal Register Notice	Status Summary
Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*)	Endangered 6/28/2005 70 FR 37160	According to the NMFS 2016, 5-year species status review (NMFS 2016), the overall status of Sacramento River winter-run Chinook salmon has declined since the 2010 status review, with the single spawning population on the mainstem Sacramento River no longer at a low risk of extinction. New information indicates an increased extinction risk to winter-run Chinook salmon. The larger influence of the hatchery broodstock in addition to the rate of decline in abundance over the past decade has placed the population at a moderate risk of extinction and because there is only one remaining population, the extinction risk for the ESU has increased from moderate risk to high risk of extinction.
Central Valley (CV) spring-run Chinook salmon (*O. tshawytscha*)	Threatened 9/2/2005 70 FR 52488	According to the NMFS 2016, 5-year species status review (NMFS 2016), the status of the CV spring-run Chinook salmon ESU, until 2015, has improved since the 2010 5-year species status review. The improved status is due to extensive restoration, and increases in spatial structure with historically extirpated populations (Battle, Clear creeks) trending in the positive direction. Recent declines of many of the dependent populations, high pre-spawn and egg mortality during the 2012 to 2015 drought, and uncertain juvenile survival during the drought are likely increasing the ESU's extinction risk.
California Central Valley (CCV) steelhead (*O. mykiss*)	Threatened 9/2/2005 70 FR 52488	According to the NMFS 2016, 5-year species status review (NMFS 2016), the status of CCV steelhead appears to have changed little since the 2010 status review that concluded that the DPS was in danger of extinction. Most wild CCV populations are very small, are not monitored, and may lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change. The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to wild fish. The life-history diversity of the DPS is mostly unknown, as very few studies have been published on traits such as age structure, size at age, or growth rates in CCV steelhead.
Southern Distinct Population Segment (sDPS) Green sturgeon (*Acipenser medirostris*)	Threatened 8/9/2009 74 FR 52300	According to the NMFS 2015, 5-year species status review (NMFS 2016), some threats to the species have recently been eliminated, such as take from commercial fisheries and removal of some passage barriers, but the species viability continues to be constrained by factors such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The species continues to face a moderate risk of extinction.

Critical Habitat	Designation Date and Federal Register Notice	Description
Sacramento River winter-run Chinook salmon ESU	June 16, 1993; 58 FR 33212	Designated critical habitat includes the Sacramento River from Keswick Dam (river mile (RM) 302) to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta (Delta) including the areas westward from Sherman Island to Chipps Island, which includes Kimball Island, Winter Island, and Browns Island.; all waters from Chipps Island westward to the Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and the Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay north of the San Francisco-Oakland Bay Bridge from San Pablo Bay to the Golden Gate Bridge. However it excludes waters within estuarine sloughs within San Francisco Bay or San Pablo Bay. Within the Sacramento River, this designation includes the river water, river bottom (including those areas and associated gravel used by winter-run Chinook salmon as spawning substrate), and adjacent riparian zone used by fry and juveniles for rearing. In the areas westward from Chipps Island, including San Francisco Bay to the Golden Gate Bridge, it includes the estuarine water column and essential foraging habitat and food resources used by winter-run Chinook salmon as part of their juvenile outmigration or adult spawning migration. PBFs considered essential to the conservation of the species include: Access from the Pacific Ocean to spawning areas; availability of clean gravel for spawning substrate; adequate river flows for successful spawning, Incubation of eggs, fry development and emergence, and downstream transport of juveniles; water temperatures at 5.8–14.1°C (42.5–57.5°F) for successful spawning, egg incubation, and fry development; habitat areas and adequate prey that are not contaminated, riparian and floodplain habitat that provides for successful juvenile development and survival; and access to downstream areas so that juveniles can migrate from spawning grounds to the San Francisco Bay and the Pacific Ocean. Although the current conditions of PBFs for winter-run Chinook salmon critical habitat in the Sacramento River are significantly limited and degraded, the habitat remaining is considered highly valuable.

Critical Habitat	Designation Date and Federal Register Notice	Description
Central Valley spring-run Chinook salmon ESU	September 2, 2005; 70 FR 52488	Critical habitat for CV spring-run Chinook salmon includes stream reaches of the Feather, Yuba and American rivers, Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear creeks, the Sacramento River, as well as portions of the northern Delta. Critical habitat includes the stream channels in the designated stream reaches and the lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation. Critical habitat includes portions of the San Francisco Bay- San Pablo Bay- Suisun Bay estuarine complex occupied by this ESU [approximately 254 square miles, with the South San Francisco Bay hydrologic sub area being excluded (70 FR 52531)]) which provides rearing and migratory habitat for this ESU. In estuarine areas the extreme high water is the best descriptor of lateral extent. This is the area inundated by extreme high tide and encompasses habitat areas typically inundated and regularly occupied during the winter, spring and summer when juvenile salmon are migrating in the nearshore zone and relying heavily on forage, cover, and refuge qualities provided by these occupied habitats. PBFs considered essential to the conservation of the species include: 1) freshwater spawning habitat with adequate water quality and substrate to support spawning, egg incubation, and larval development; 2) freshwater rearing habitat with floodplain connectivity supporting sheltering, movement, feeding, and growth; 3) freshwater migration corridors free of obstructions, and providing sheltering and holding for both adults and juveniles, and adequate prey resources for juvenile foraging; and 4) estuarine areas free of obstructions with adequate water quality to support adult and juvenile physiological transitions, shelter to provide protection, and prey for juvenile and adult foraging to sustain growth and maturation. Although the current conditions of PBFs for CV spring-run Chinook salmon critical habitat in the Central Valley are significantly limited and degraded, the habitat remaining is considered highly valuable.

Critical Habitat	Designation Date and Federal Register Notice	Description
California Central Valley steelhead DPS	September 2, 2005; 70 FR 52488	Critical habitat for CCV steelhead includes stream reaches of the Feather, Yuba and American rivers, Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear creeks, the Sacramento River, the Yolo Bypass, as well as most portions of the legal Delta and the San Joaquin River basin upstream of the confluence of the Merced River and major tributaries up to the first impassable dam. In addition, portions of the San Francisco Bay-San Pablo Bay-Suisun Bay estuarine complex [approximately 254 square miles, with the South San Francisco Bay hydrologic sub area being excluded; (70 FR 52531)] which provides rearing and migratory habitat for this ESU are included. Critical habitat also includes the stream channels in the designated stream reaches and the lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation. In estuarine areas the extreme high water is the best descriptor of lateral extent. This is the area inundated by extreme high tide and encompasses habitat areas typically inundated and regularly occupied during the winter, spring and summer when juvenile salmon are migrating in the nearshore zone and relying heavily on forage, cover, and refuge qualities provided by these occupied habitats. PBFs considered essential to the conservation of the species include: Spawning habitat; freshwater rearing habitat; freshwater migration corridors; and estuarine areas as previously described for CV spring-run Chinook salmon. Although the current conditions of PBFs for CCV steelhead critical habitat in the Central Valley are significantly limited and degraded, the habitat remaining is considered highly valuable.

Critical Habitat	Designation Date and Federal Register Notice	Description
Southern DPS of North American green sturgeon	October 9, 2009; 74 FR 52300	Critical habitat includes the stream channels and waterways in the legal Delta to the ordinary high water line. Critical habitat also includes the main stem Sacramento River upstream from the I Street Bridge to Keswick Dam, the Feather River upstream to the fish barrier dam adjacent to the Feather River Fish Hatchery, and the Yuba River upstream to Daguerre Dam. Critical habitat in coastal marine areas include waters out to a depth of 60 fathoms, from Monterey Bay in California, to the Strait of Juan de Fuca in Washington. Coastal estuaries designated as critical habitat include San Francisco Bay, Suisun Bay, San Pablo Bay, and the lower Columbia River estuary. Certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor) are included as critical habitat for sDPS green sturgeon. PBFs considered essential to the conservation of the species for freshwater and estuarine habitats include: food resources, substrate type or size, water flow, water quality, migration corridor; water depth, sediment quality. In addition, PBFs include migratory corridor, water quality, and food resources in nearshore coastal marine areas. Although the current conditions of PBFs for sDPS green sturgeon critical habitat in the Central Valley are significantly limited and degraded, the habitat remaining is considered highly valuable.

2.2.1. Species Distribution and Decline

2.2.2. Central Valley Spring-Run Chinook Salmon

Current and Historical Distribution

Historically, the Central Valley spring-run Chinook salmon was one of the most abundant and widely distributed salmon races. The Central Valley drainage as a whole has supported spring-run Chinook salmon runs as large as 600,000 fish between the late 1880s and the 1940s (California Department of Fish and Game 1998). This race once migrated into headwaters of tributaries to the Sacramento and San Joaquin Rivers. They now only exist in the mainstem and a few tributaries to the Sacramento River. Gold mining and agricultural diversions caused the first major declines in spring-run Chinook populations (Moyle et al. 1995). Further extirpations followed construction of major water storage and flood control reservoirs on the Sacramento and San Joaquin Rivers and their major tributaries in the 1940s and 1950s (Moyle et al. 1995). Spring-run Chinook salmon were completely extirpated in the San Joaquin River drainage until recent reintroduction efforts in 2014. Life History and Habitat Requirements Central Valley spring-run Chinook salmon adult migration occurs in the Sacramento River from late March to July. Spring-run Chinook salmon migrate upstream in the spring and over-summer in cold-water habitats and then spawn from August to October, with peak spawning occurring in September. Incubation occurs from mid-August to mid-March with rearing and emigration occurring from mid-August through April. Chinook salmon require cold, freshwater streams with suitable gravel for reproduction. Females deposit their eggs in nests in gravel-bottom areas of relatively swift water. For maximum survival of incubating eggs and larvae, water temperatures must be between 39°F and 57°F. After emerging, Chinook salmon fry tend to seek shallow, near shore habitat with slow water velocities and move to progressively deeper, faster water as they grow. Spring-run juveniles frequently reside in freshwater habitat for 12 to 16 months, but many young migrate to the ocean during the spring within five to eight months after hatching. The Bay and Delta are important rearing areas for these migrants. Chinook salmon spend two to four years maturing in the ocean before returning to their natal streams to spawn. All adult salmon die after spawning. Suitable water temperatures for adult spring-run Chinook salmon migrating upstream to spawning grounds reportedly range from 57°F to 67°F (National Marine Fisheries Service 1997). However, spring-run Chinook salmon are immature when upstream migration begins and need to hold in suitable habitat for several months prior to spawning. The maximum suitable water temperature for holding is reported to be approximately 59°F to 60°F (National Marine Fisheries Service 1997).

Reasons for Species Decline
Factors related to the decline of spring-run Chinook salmon populations include gold mining and agricultural diversions (Moyle et al. 1995), loss of habitat in upper elevation headwaters blocked by dams, degradation of habitat conditions (e.g., water temperature), entrainment in water diversions, and overharvest. The human-caused factor that has had the greatest effect on the abundance of spring-run Chinook salmon runs is loss of habitat, primarily in the rivers upstream of the Delta. Major dams have blocked upstream access to most spring-run Chinook salmon habitat in Central Valley rivers and streams, and smaller dams contribute to migration delay. On most Central Valley streams, spring-run Chinook salmon are restricted to habitats with marginal water temperature conditions and limited deep holding areas. Water diversions and reservoir operations affect stream flow, which influences the quantity, quality, and distribution of Chinook salmon spawning and rearing habitat. Water diversions also reduce survival of emigrating juvenile salmonids through direct entrainment losses in unscreened or inadequately screened diversions. Predation on emigrating salmonids at diversion dams, such as the Red Bluff Diversion Dam (RBDD), may also be an important survival factor (U.S. Bureau of Reclamation 1983).

2.2.3. Sacramento River Winter-run Chinook Salmon

Current and Historical Distribution
Historically, winter-run Chinook salmon were abundant in the McCloud, Pit and Upper Sacramento rivers as well as in Battle Creek (Yoshiyama et al. 1996). Construction of Shasta Dam in the 1940s eliminated access to historic spawning habitat for winter-run in the Sacramento River basin. Since then, the ESU has been reduced to a single spawning population, supplemented by hatchery production which spawns outside of its historic range (National Marine Fisheries Service 2014). This ESU is generally comprised of a single population which

primarily spawn in the mainstem of the Sacramento River between Keswick Dam and the RBDD. From the late 1960s to the 1990s, the population escapement fell from approximately 100,000 to approximately 200 (National Marine Fisheries Service 2014). The population has rebounded somewhat since then but has fluctuated significantly and experienced low annual numbers in recent drought years (Azat 2018).

Life History and Habitat Requirements
Adult winter-run chinook salmon migrate up the Sacramento River from December through July with spawning occurring between mid-April and mid-August, peaking in June and July. Spawning occurs in the mainstem of the Sacramento River between Keswick Dam and the RBDD (National Marine Fisheries Service 2014). With appropriate water temperature, incubation takes between 40 to 60 days and emergence from the gravel occurs from mid-June to mid-October (National Marine Fisheries Service 2014). Juveniles distribute throughout the system and rear from late-summer to early-spring depending on water flow and temperature conditions (National Marine Fisheries Service 2014).

Reasons for Species Decline
The winter-run Chinook salmon decline has been related to a variety of factors including the loss of and blocked access to historic spawning and rearing habitat. All historical spawning habitats (approximately 200 river miles) upstream of Keswick Dam and approximately 47 of the 53 miles of potential habitat in Battle Creek have been eliminated due to watershed development (Yoshiyama et al. 1996). Other factors include the fact that there is only a single population remaining, overutilization for commercial, recreational, scientific, or educational purposes, disease or predation, other human factors, such as hatchery production, flow fluctuations, water pollution and water temperature impacts in the Sacramento River during embryo incubation, predation during juvenile rearing and outmigration and ocean harvest.

2.2.4. Central Valley Steelhead

Current and Historical Distribution
Unlike Chinook salmon, steelhead typically rear in freshwater for at least two years before migrating to the Pacific Ocean. Steelhead may spawn more than once and return to the Pacific Ocean between spawning. From 1967 to 1993, the estimated number of steelhead passing the RBDD ranged from a low of 470 to a high of 19,615 (California Department of Fish and Game 1994, McEwan and Jackson 1996). While estimates vary, perhaps ten percent of these fish spawned in Battle Creek and approximately 28 percent were believed to have spawned at the Coleman National Fish Hatchery (U.S. Fish and Wildlife Service 1984b). Steelhead are generally distributed from southern California to the Aleutian Islands. In the Central Valley, naturally producing populations only occur in the Sacramento River and its tributaries. More than 90 percent of the adult steelhead in the Central Valley are produced in hatcheries (Reynolds et al. 1990).

Life History and Habitat Requirements
Steelhead are generally classified into two runs, depending on whether they begin their upstream migration in winter or summer. Winter steelhead typically begin their spawning migration in fall and winter, and spawn within a few weeks to a few months from the time they enter freshwater. Summer steelhead typically enter freshwater in spring and early summer, hold over in deep pools

until mature, and spawn in late fall and winter. Steelhead stocks in the Central Valley are considered winter-run steelhead (McEwan and Jackson 1996). Central Valley steelhead adult migration occurs from July through February. In most years in streams with cool, year-round, well-oxygenated water, spawning occurs from December through April and, possibly in May. Incubation generally occurs from December through April. Following emergence, fry live in small schools in shallow water along streambanks. As the steelhead grow, they establish individual feeding territories. Juvenile steelhead typically rear for one to two years in streams before emigration, which generally occurs in spring. Steelhead may remain in the ocean from one to four years, growing rapidly as they feed in the highly productive currents along the continental shelf (Barnhart 1986). Steelhead return to natal streams to spawn as two- to four-year-old adults.

Reasons for Species Decline
Population declines are attributed to blockage from upstream habitats, entrainment from unscreened diversions, hatchery practices, and degraded habitat conditions due to water development and land use practices. Dams at low elevations on all major tributaries block access to an estimated 95 percent of historical spawning habitat in the Central Valley (Reynolds et al. 1993).

2.2.5. Southern Green Sturgeon

Current and Historical Distribution
The North American green sturgeon is distributed along the west coast of the United States from Alaska to Baha California, Mexico. Two DPSs are recognized, the northern green sturgeon and the southern green sturgeon. These two populations intermingle with each other in marine and estuarine waters but spawn in distinct, separate natal rivers. The only known historic and current spawning distribution of the southern green sturgeon is the Sacramento River watershed which includes the Sacramento, Feather and Yuba Rivers (National Marine Fisheries Service 2018a). In the Sacramento River, adults have been observed upstream to the mouth of Cow Creek near Redding, California while spawning activity has been confirmed from the Glenn Colusa Irrigation District facilities, located north of Hamilton City, California, as far upstream as near the mouth of Ink's Creek, north of Red Bluff, California (National Marine Fisheries Service 2018a).

Life History and Habitat Requirements
The life history of southern green sturgeon has not been well studied until recent years so information about this species is still evolving and relies to some extent on existing information about northern green sturgeon and white sturgeon (*Acipenser transmontanus*). Green sturgeon utilize marine, riverine and estuarine habitats all along the coast of North America and spend a significant amount of time in marine waters. They have been documented to live over 50 years and are late maturing at around the age of 15, when they begin to spawn every three to four years. The adult fish usually enter the San Francisco Bay in late-winter through early-spring and then spawn from April through July. The spawning period can be influenced by water flow and temperature and takes place in deep pools (eight to nine meters in depth) that contain small to medium sized sand, gravel, cobble or boulder substrate. The eggs primarily adhere to gravel or cobble substrates or settle into crevices. According to lab-based data, the eggs hatch after 144-192 hours when incubated at ideal temperatures. The post-spawn fish will hold in the river

system for several months and migrate out during the spring and summer months and will sometimes hold in the San Francisco Bay Delta estuary, but this behavior is variable. Green sturgeon larvae disperse around 12 days post-hatch in a laboratory setting. The larvae are primarily nocturnal and frequent benthic structure and will utilize crevices for refuge but will also forage over hard surfaces. This species is an opportunistic feeder on a variety of prey. Information is lacking about the diet of larvae but likely includes microbenthic invertebrates, much like white sturgeon (National Marine Fisheries Service 2018a). Juveniles in the estuary feed on shrimp, amphipods, isopods, clams, annelid worms, crabs and fish. Adults in freshwater likely feed on such items as lamprey ammocoetes (juveniles) and crayfish.

Reasons for Species Decline
The species was listed due to several factors including 1) the Sacramento River system contains the only spawning population, 2) loss of spawning habitat in the upper Sacramento and Feather Rivers, 3) mounting threats to habitat quality and quantity in the Sacramento River and Delta, and 4) an observed decline in the number of juveniles (National Marine Fisheries Service 2018a). Additional potential threats under consideration include entrainment, contaminants, fisheries bycatch, poaching, marine and estuarine energy projects and non-native species (National Marine Fisheries Service 2018a).

2.2.6. Recovery Plan and Goals

The recovery plan that includes winter-run Chinook salmon (National Marine Fisheries Service 2014) has the overarching goal of the removal of winter-run Chinook salmon from the Federal List of Endangered and Threatened Wildlife (50 CFR 223.102). As part of the recovery strategy, conservation principles have been identified that will support viable winter-run Chinook populations, which include providing habitat capacity and diversity, ensuring the viability of winter-run Chinook populations (which are abundant, productive, diverse and spatially structured), having viable ESUs and delineating recovery units. The recovery plan also highlights California and Central Valley recovery actions for Central Valley spring-run Chinook salmon and Central Valley steelhead. These actions include implementation of water conservation programs, climate change and smart growth programs, development and implementation of an ecosystem based management approach that integrates harvest, hatchery, habitat, and water management, in consideration of ocean conditions and climate change. The plan also identifies actions such as implementation of a comprehensive winter-run Chinook monitoring plan to better understand their abundance and distribution and the development and implementation of state and national levee vegetation policies to maintain and restore riparian corridors.

NMFS has prepared a recovery plan for the southern green sturgeon (National Marine Fisheries Service 2018a). The recovery objectives are to increase southern green sturgeon abundance, distribution and diversity. This would be accomplished by reducing threats associated with habitat degradation and access, contaminants and other adverse effects to species.

2.2.7. Climate Change

One factor affecting the range-wide status of Sacramento River winter-run Chinook salmon, CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon, and aquatic habitat at large is climate change.

The world is about 1.3°Fahrenheit (ºF) warmer today than a century ago and the latest computer models predict that, without drastic cutbacks in emissions of carbon dioxide and other gases released by the burning of fossil fuels, the average global surface temperature may rise by two or more degrees in the 21st century [Intergovernmental Panel on Climate Change (IPCC) 2001, 2007]. Much of that increase likely will occur in the oceans, and evidence suggests that the most dramatic changes in ocean temperature are now occurring in the Pacific (Noakes et al. 1998). Using objectively analyzed data, Huang and Liu (2001) estimated a warming of about 0.9°F per century in the Northern Pacific Ocean.

Sea levels are expected to rise by 0.5 to 1.0 meters (1.6 to 3.3 feet) in the northeastern Pacific coasts in the next century (Cayan et al. 2008, 2009; Hayhoe et al. 2004; Parris et al. 2012), mainly due to warmer ocean temperatures, which lead to thermal expansion much the same way that hot air expands. This will cause increased sedimentation, erosion, coastal flooding, and permanent inundation of low-lying natural ecosystems (*e.g*., salt marsh, riverine, mud flats) affecting listed salmonid and green sturgeon PBFs. Increased winter precipitation, decreased snow pack, permafrost degradation, and glacier retreat due to warmer temperatures will cause landslides in unstable mountainous regions and destroy fish and wildlife habitat, including salmon-spawning streams. Glacier reduction could affect the flow and temperature of rivers and streams that depend on glacier water, with negative impacts on fish populations and the habitat that supports them.

Droughts along the West Coast and in the interior Central Valley of California will mean decreased stream flow in those areas, decreasing salmonid survival and reducing water supplies in the dry summer season when irrigation and domestic water use are greatest. Climate change may also change the chemical composition of the water that fish inhabit: the amount of oxygen in the water may decline, while pollution, acidity, and salinity levels may increase. This will allow for more invasive species to overtake native fish species and impact predator-prey relationships (Petersen and Kitchell 2001, Stachowicz et al. 2002).

In light of the predicted impacts of global warming, the Central Valley has been modeled to have an increase of between 2 and 7 degrees Celsius (ºC, 3.6 ºF to 12.6ºF) by 2100, with a drier hydrology predominated by rainfall rather than snowfall (Dettinger et al. 2004, Hayhoe et al. 2004, VanRheenen et al. 2004, Stewart et al. 2005). This will alter river runoff patterns and transform the tributaries that feed the Central Valley from a spring and summer snowmelt dominated system to a winter rain dominated system. Summer temperatures and flow levels will become unsuitable for salmonid survival under future temperature predictions. The cold snowmelt that furnishes the late spring and early summer runoff will be replaced by warmer precipitation runoff. This will truncate the period of time that suitable cold-water conditions exist downstream of existing reservoirs and dams due to the warmer inflow temperatures to the reservoir from rain runoff. Without the necessary cold water pool developed from melting snow pack filling reservoirs in the spring and early summer, late summer and fall temperatures downstream of reservoirs, such as Shasta Reservoir, could potentially rise above thermal tolerances for juvenile and adult salmonids that spawn, hold, and/or rear downstream of the dam over the summer and fall periods.

Projected warming is expected to affect Central Valley Chinook salmon. Because the runs are restricted to low elevations as a result of impassable rim dams, if climate warms by 5°C (9°F), it is questionable whether any Central Valley Chinook salmon populations can persist (Williams 2006). Based on an analysis of an ensemble of climate models and emission scenarios and a reference temperature from 1951- 1980, the most plausible projection for warming over Northern California is 2.5°C (4.5°F) by 2050 and 5°C by 2100, with a modest decrease in precipitation (Dettinger 2005). Chinook salmon in the Central Valley are at the southern limit of their range, and warming will shorten the period in which the low elevation habitats used by naturally-producing Chinook salmon are thermally acceptable. This would particularly affect fish, such as sDPS green sturgeon, that emigrate as fingerlings, mainly in May and June, and especially those in the San Joaquin River and its tributaries.

In summary, observed and predicted climate change effects are generally detrimental to the salmonid species (McClure 2011, Beechie et al. 2012,Wade et al. 2013), so unless offset by improvements in other factors, the status of the species and critical habitats is likely to decline over time. The climate change projections referenced above cover the time period between the present and approximately 2100. While there is uncertainty associated with projections, which increases over time, the direction of change is relatively certain (McClure et al. 2013).

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 proposed action is located at two discontiguous sites within the Lake California community, southeast of Cottonwood, in Tehama County, California. The boat ramp site is located on the Sacramento River, at approximately River Mile 272, in Section 15, Township 29 North, Range 3 West, Mount Diablo Base and Meridian, within the 7.5-minute U.S. Geological Survey (USGS) Bend quadrangle map. The placement site is located west of the boat ramp site, in Section 21, Township 29 North, Range 3 West, within the 7.5-minute USGS Bend quadrangle map.

The action area for the proposed action consists of the boat ramp site, where dredging and temporary stockpiling would occur, up to 500 feet downstream of the dredging area, which could be impacted by sedimentation, the placement site, where the dredged material would be placed, and the haul route between the sites, along with varying buffers. The applicant proposed to keep all the placement site and haul route 250-yards from the bank to minimize effects from noise, dust and other human disturbances that may occur during construction. The boat ramp site, known as Steelhead Landing, is restricted to LCPOA members for river access, recreation, fishing and boat launching during all times of the year. The site is maintained and controlled by the LCPOA. The site is also used by state and federal resource agencies to access the river for fish monitoring activities and by state and local law enforcement agencies to access the river for river patrol and emergencies. The placement site is an open field near an equestrian center.

The topography of the boat ramp site consists of varying terrain and aspects associated with the river channel, banks and floodplains. The Sacramento River drains from northwest to southeast. The elevation of the site ranges from approximately 342 feet above sea level to approximately 365 feet. Six habitat types generally occur within the Project sites as defined by the California Wildlife-Habitat Relationships classification system (Mayer and Laudenslayer 1988). The habitat types include Riverine, Fresh Emergent Wetland, Lacustrine, Valley Foothill Riparian, Annual Grassland and Urban (Tehama Environmental Solutions, Inc. 2017).

2.3.1. Riverine

Riverine habitat occurs within the Sacramento River channel at the boat ramp site. Vegetation, when present, consists primarily of reed canary grass (*Phalaris arundinacea*).

2.3.2. Freshwater Emergent Wetland

Fresh emergent wetland habitat is present at the boat ramp site, on the margin of the Sacramento River channel downstream of the boat launch, and within the margin of the constructed boat harbor. It occurs as a very thin band of herbaceous vegetation dominated by reed canary grass. Additional species include cocklebur (*Xanthium strumarium*), western goldenrod (*Euthamia occidentalis*) and several species of nutsedge (*Cyperus* spp.).

2.3.3. Lacustrine

Lacustrine habitat occurs at the boat ramp site, within the boat harbor where still backwater is present. Vegetation, when present, consists of the same species as in the fresh emergent wetland habitat.

2.3.4. Valley Foothill Riparian

Valley foothill riparian habitat is present at the boat ramp site along the banks of, and in areas adjacent to, the Sacramento River and along the higher flow margins of the boat harbor. The riparian habitat generally exists as a thin continuous corridor on the Sacramento River. The dominant woody plant species on the Sacramento River downstream of the boat launch include white alder (*Alnus rhombifolia*) and narrowleaved willow (*Salix exigua*). Other subdominant woody species include box elder (*Acer negundo*) and California grape (*Vitis californica*). A dense understory has formed from resprouting narrow-leaved willows that were cut for fire control, which shades out most herbaceous plants. Upstream of the boat launch, dominants in the tree layer include white alder, valley oak (*Quercus lobata*), Goodding’s willow (*Salix gooddingii*) and box elder. Dominants in the woody understory layer include arroyo willow (*Salix lasiolepis*) and Himalayan blackberry (*Rubus armeniacus*). Other subdominant woody species include Oregon ash (*Fraxinus latifolia*), California grape and narrow-leaved willow. Herbaceous vegetation occurs sparingly and includes mugwort (*Artemisia douglasiana*) and horsetail (*Equisetum* sp.). Within the boat harbor, woody dominants include narrow-leaved willow and arroyo willow. Other woody species include Goodding’s willow, box elder, Himalayan blackberry and scarlet wisteria (*Sesbania punicea*). Herbs include cocklebur, western goldenrod, reed canary grass and mare’s tail (*Erigeron canadensis*).

2.3.5. Annual Grassland

Annual grassland habitat occurs at both the boat ramp site and the placement site. At the boat ramp site, this habitat occurs in areas where woody vegetation is lacking, while the entire placement site is composed of this habitat. These areas are dominated primarily by non-native annual grasses and forbs.

2.3.6. Urban

Urban habitat is present at the boat ramp site. This is composed of the developed boat ramp and parking lot.

2.4. Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. 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 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

2.4.1. CV Spring-Run Chinook

Current Status in Action Area
Spring-run Chinook salmon utilize the Sacramento River within the action area primarily for adult migration, and juvenile rearing and emigration. Adult migration through the action area occurs between March and September, primarily in May and June (National Marine Fisheries Service 2018b). Spawning occurs in the upper portion of the Sacramento River and tributaries, but does not occur within the action area. Upon reaching their chosen tributary, spring-run Chinook quickly pass through the valley floor reach of the creeks or rivers to gain access to headwater reaches where water temperatures are cool enough to allow the adult fish to over summer until spawning commences in late-August through October (California Department of Fish and Wildlife 2013). Juvenile rearing primarily occurs in tributary streams. They may remain in their natal streams for a year or more and migrate out in the following fall/winter season or migrate out the spring following their hatch (National Marine Fisheries Service 2018b). Outmigration through the action area occurs in the fall through spring, peaking from November through January. Table 2 presents the temporal occurrence of Central Valley spring-run Chinook salmon in the Sacramento River system (National Marine Fisheries Service 2018b). The "Sac. River at RBDD" location is the closest site to the Action Area and demonstrates the potential for species presence throughout the Project work window.

Table 2. Temporal Occurrence of Adult and Juvenile Central Valley Spring-run Chinook Salmon in Locations in the Central Valley. Darker shades indicate months of greatest relative abundance (taken from National Marine Fisheries Service 2018b).

(a) Adult Migration												
Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Delta[a]												
San Joaquin Basin												
Sac. River Basin[b,c]												
Sac. River Mainstem[c,d]												
b) Adult Holding[b,c]												
c) Adult Spawning[b,c,d]												
(b) Juvenile Migration												
Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sac. River at RBDD[d]												
Sac. River at KL[i]												
San Joaquin basin												
Delta[j]												

RBDD = Red Bluff Diversion Dam
KL = Knights Landing
Sources: a: (California Department of Fish and Game 1998); b: (Yoshiyama et al. 1998); c: (Moyle 2002); d: (Myers et al. 1998); e: (Lindley et al. 2004); f: (California Department of Fish and Game 1998); g: (McReynolds et al. 2007); i: (Snider and Titus 2000);
j: (SacTrawl 2015).

2.4.2. Sacramento River Winter-run Chinook Salmon

Current Status in Project Area
Winter-run Chinook salmon utilize the Sacramento River within the action area for adult migration and juvenile rearing and emigration. Spawning only occurs in the upper reaches of the Sacramento River and is not expected to occur within the action area. Adult migration through the action area occurs primarily from December through April (National Marine Fisheries Service 2018b). Depending on how wet the water year is, approximately 50 to 72 percent of all adults have migrated above the RBDD by March (National Marine Fisheries Service 2015). Juveniles migrate through the action area in late-summer through the winter and the timing is thought to be highly influenced by winter rain events and subsequent river flows (National Marine Fisheries Service 2018b). Juveniles have been observed to be prevalent in the action area in October by CDFW staff while monitoring a fish screen approximately 400 feet upstream of the boat ramp facility (Souza 2020). Table 3 presents the temporal occurrence of Sacramento River winter-run Chinook salmon in the Sacramento River system (National Marine Fisheries Service 2018b). The "Sacramento River at Red Bluff" site is the closest site to the Action Area and demonstrate the potential for species presence throughout the Project work window.

Table 3. Temporal Occurrence of Adult and Juvenile Sacramento River Winter-run Chinook Salmon in the Sacramento River System. Darker shades indicate months of greatest relative abundance (taken from National Marine Fisheries Service 2018b).

a) Adults freshwater												
Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sacramento River basin[a,b]												
Upper Sacramento River spawning[c]												
Delta												
b) Juvenile emigration												
Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sacramento River at Red Bluff[d]												
Sacramento River at Knights Landing[e]												
Sacramento trawl at Sherwood Harbor[f]												
Midwater trawl at Chipps Island[g]												

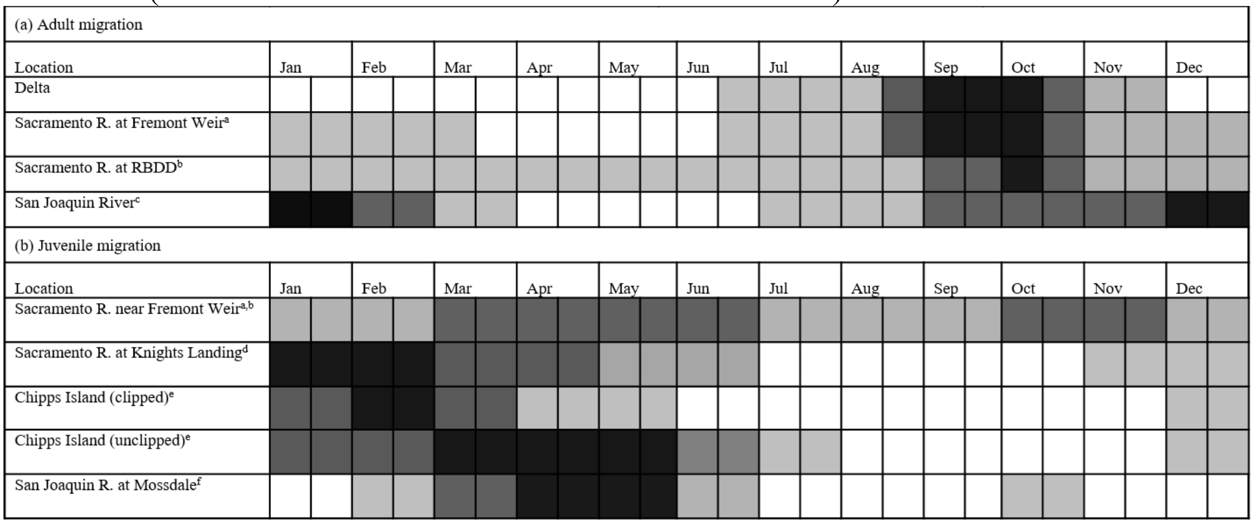
Sources: a: (Yoshiyama et al. 1998); (Moyle 2002); b: (Myers et al. 1998); c: (Williams 2006); d: (Martin et al. 2001); e: Knights Landing Rotary Screw Trap Data, (California Department of Fish and Wildlife 1999-2011); f,g: Delta Juvenile Fish Monitoring Program, (U.S. Fish and Wildlife Service 1995-2012).

2.4.3. Central Valley Steelhead

Current Status in the Action Area

Steelhead utilize the Sacramento River within the action area primarily for adult migration and juvenile emigration. Adult *O. mykiss* may be present year-round. Adult steelhead migrate through the action area in September and October and spawn in tributaries from December to April with a peak from January through March (National Marine Fisheries Service 2018b). Juveniles rear primarily in tributaries and use the action area primarily as an emigration corridor. Though Juvenile steelhead could potentially be present during project activities, the boat launch site has poor habitat attributes (*e.g*., substrates and cover) compared to natural in-river habitats. Table 4 presents the temporal occurrence of CC V steelhead in the Sacramento River system (National Marine Fisheries Service 2018b). The “Sacramento R. at RBDD” site is the closest site to the Action Area and demonstrate the potential for species presence throughout the Project work window.

Table 4. Temporal Occurrence of Adult and Juvenile California Central Valley Steelhead at Locations in the Central Valley. Darker shades indicate months of greatest relative abundance (taken from National Marine Fisheries Service 2018b).



RBDD = Red Bluff Diversion Dam

Sources: a: (Hallock 1957); b: (McEwan 2001); c: (California Department of Fish and Wildlife Steelhead Report Card Data 2007);d: National Marine Fisheries Service analysis of 1998-2011 California Department of Fish and Wildlife data; e: National MarineFisheries Service analysis of 1998-2011 U.S. Fish and Wildlife Service data; f: National Marine Fisheries Service analysis of 2003-2011 U.S. Fish and Wildlife Service data.

2.4.4. Southern Green Sturgeon (Acipenser medirostris)

Current Status in Project Area

Significant information gaps exist regarding southern green sturgeon life history in the action area. Southern green sturgeon would be expected to utilize the action area of the Sacramento River primarily for adult migration and emigration and, while not documented, potentially spawning and larval/juvenile rearing and emigration. Spawning occurs in the spring and summer and has been documented as far upstream as near the mouth of Ink’s Creek (National Marine Fisheries Service 2018a), which is approximately 7.8 river miles downstream of the boat ramp site. They are thought to rear as juveniles and subadults in the lower reaches of the Sacramento River and Delta, although the rearing portion of the life history is still only somewhat understood. If undocumented spawning is occurring in the action area, or upstream of the action area, larvae could potentially be present in the action area following hatching; however it is unknown how long juveniles may stay in the action area before moving downstream. Table 5 presents the current understanding of temporal occurrence of southern green sturgeon in the Sacramento River system (National Marine Fisheries Service 2018b). This table demonstrates the potential for species presence throughout the Project work window in the Action Area.

Table 5. Temporal Occurrence of Spawning Adult, Larval, Young Juvenile, Juvenile and Sub-adult and Non-spawning Adult Southern Green Sturgeon at Locations in the Sacramento River System (taken from National Marine Fisheries Service 2018b).

(a) Adult-sexually mature (≥145 cm TL females, ≥ 120 cm TL males), including pre- and post-spawning individuals.												
Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sac River (rkm 332.5-451)												
Sac River (< rkm 332.5)												
Sac-SJ-SF Estuary												
(b) Larval												
Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sac River (> rkm 332.5)												
(c) Juvenile (≤5 months old)												
Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sac River (> rkm 332.5)												
(d) Juvenile (≥5 months)												
Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sac River (< rkm 391)												
Sac-SJ Delta, Suisun Bay												
(e) Sub-Adults and Non-spawning adults												
Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SAC-SJ-SF Estuary												
Pacific Coast												
Coastal Bays & Estuaries												
Relative Abundance:		= High				= Medium				= Low		

River kilometer (rkm) 451 = near Cow Creek; rkm 391 = Red Bluff Diversion Dam; rkm 332.5 = just upstream of the Glenn Colusa Irrigation District intake.

2.4.5. Status of Critical Habitat in the Action Area

The Action Area includes critical habitat that has been designated for Sacramento River (SR) Winter-run Chinook, CV spring-run Chinook, CCV steelhead, and Green Sturgeon. PBFs within the Action Area for these two species include: (1) freshwater rearing sites (2) freshwater migration corridors. These PBFs have been degraded from their historical condition due to human activity on and near the Sacramento River. The construction of dams has restricted access to historical spawning and rearing habitat for both Chinook and steelhead species. Degradation of these PBFs has contributed to significant population declines within the Sacramento River. Drought conditions have also had detrimental effects to PBFs through reduced flows and increased water temperatures. These effects have led to reduced quality of rearing habitat and have likely limited migration corridors in summer months due to thermal barriers.

2.5. Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

To evaluate the effects of the Project, NMFS analyzed the physical impacts of the dredging as well as the downstream impacts of regular dredging. We also reviewed and considered avoidance and minimization measures to be taken during dredging.

Our assessment considers the nature, duration, and extent of the action relative to the rearing, and migration timing, behavior, and habitat requirements of all life stages of federally listed fish in the action area. Effects of dredging on aquatic resources include both short- and long-term impacts.

Adverse effects can include any impact that reduces the quality or quantity of critical habitat, and may include physical, chemical, or biological alterations of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components that in turn result in negative effects to the listed species. In addition, adverse effects can include any impact to an individual fish.

The three potential pathways of effects of the action identified in this analysis include physical disturbance, increased turbidity/sedimentation, and hazardous materials entering the water. The approach used for this analysis was to first identify which ESA-listed species and life stages would likely be present in the action area from February 1 through April 30 during the in-water construction activities and be exposed to the stressors associated with the Project's construction activities (Table 6).

Table 6. Presence of ESA-listed species in the action area during in-water construction (February 1 through April 30) and exposed to the stressors associated with the Project's activities.

	February		March		April	
Species	Adult	Juvenile	Adult	Juvenile	Adult	Juvenile
SR Winter-run	Yes	Low	Yes	Low	Yes	Yes
CV Spring-run	Low	Low	No	Low	No	Low
CCV Steelhead	Low	No	Low	No	Low	No
sDPS Green Sturgeon	Low	Yes	No	Yes	No	Low

Because adult fish are less likely to occur in shallow near-shore habitats and are expected to move away from disturbance activities, and no migration delays are expected, the following effects analysis is focused on juvenile fish.

2.5.1. Effects to Species

Physical Disturbance

The operation would include the use of any combination of excavators, loaders and skid steers to excavate and load sediment from the boat launch facility during annual maintenance activities. Dump trucks would be used to haul excavated material to the placement site. Equipment would be stationed on the shore or on temporary ramps (if necessary). In-water work would include placing any turbidity/sediment control devices and using the excavator bucket to dredge sediment. The in-water work would be expected to occur for approximately one to two days per year depending on the amount of sediment deposited during the prior water year. Injury or mortality could potentially occur if juvenile fish were present in the in-water work area and came in contact with the excavator.

No capture, handling, electrofishing or relocation of fish would occur. Noise, vibration and in-water disturbance associated with sediment removal activities could cause juvenile sturgeon to move away and avoid the area, which would lead to a disruption to their normal feeding or other behaviors.

The USFWS fish monitoring staff indicate that they are aware of one unconfirmed report of a juvenile sturgeon in nearshore boat ramp areas (Souza 2020). Based on the likelihood of larval fish presence, there is a likelihood that a small number of juvenile sturgeon would be killed, harmed or harassed as a result of the dredging activities by coming into direct contact with the dredge or by being displaced, resulting in reduced feeding.

Effects to winter-run Chinook are expected to be similar. The main difference in effects is that there is a higher potential for presence of juvenile winter-run Chinook in the nearshore area near the boat ramp as salmonids are more likely to use shallow areas for rearing habitat and surveys have found more evidence of species presence near the Project footprint (National Marine Fisheries Service 2018b). Due to the increased likelihood for presence, a smallnumber of juvenile winter-run Chinook would be killed, harmed or harassed as a result of the dredging activities, by coming into direct contact with the dredge or by being displaced, resulting in reduced feeding, and increased predation.

Both spring-run Chinook and CCV steelhead have a very low probability of being present due to in-water work timing. The Project site is used for a migration corridor for spring-run Chinook and CCV steelhead, but the timing of the proposed action is outside the migration timing. However, there is a low possibility of out-migrating or rearing juveniles to be present during dredging. Therefore, small numbers of juvenile spring-run Chinook or CCV steelhead present during the proposed action would be killed, harmed or harassed as a result of the dredging activities, by coming into direct contact with the dredge or by being displaced, resulting in reduced feeding, and increased predation.

Increase in Turbidity

Turbidity and suspended sediment concentrations would increase as a result of dredging activities. These effects would occur as a result of disturbance from heavy equipment within the river channel. Sedimentation and turbidity are expected to have varying effects to juvenile fish. The in-water work period coincides with when medium numbers of juvenile winter-run Chinook salmon and small numbers sDPS green sturgeon are expected to be present. Smaller numbers of rearing CV spring-run Chinook salmon and CCV steelhead are also expected to be present.

An increase in water turbidity and/or suspended sediments would cause injury or mortality to all life stages of sDPS green sturgeon if concentrations were at elevated levels for an extended period of time and sturgeon were present (NMFS 2018a). Turbid and/or elevated suspended sediment conditions could also cause a negative impact to sDPS green sturgeon by clogging gills, decreasing feeding behaviors, increasing stress levels and/or causing decreases in overall production. For salmonids, the moderate levels of turbidity expected to be generated by the proposed Project would elicit a number of behavioral and physiological responses (*i.e.,* gill flaring, coughing, habitat avoidance, and increase in blood sugar levels) which indicate some level of stress (Bisson and Bilby 1982, Sigler et al. 1984, Berg and Northcote 1985, Servizi and Martens 1992). The magnitude of these stress responses is generally higher when turbidity is increased and particle size decreased (Bisson and Bilby 1982, Servizi and Martens 1987, Gregory and Northcote 1993). Although turbidity may cause stress, Gregory and Northcote (1993) have shown that moderate levels of turbidity (35-150 NTU) accelerate foraging rates among juvenile salmonids, likely because of reduced vulnerability to predators (camouflaging effect). Increases in turbidity are also known to cause increases in predation of juvenile salmonids and green sturgeon (Bash, 201). This is caused by fish being displaced from cover due to turbidity increases or from reduced visibility making predators harder to avoid.

Project-related increases in turbidity is expected to disrupt feeding and migratory behavior activities of the small numbers of juvenile salmonids present, resulting in decreased growth and survival.

Hazardous Materials

A release of hazardous materials, such as fuel or oil, could harm or kill any fish present in the work area, or downstream of the work area. AMMs have been put in place to reduce the risk of an accidental release of hazardous materials, including using BMPs and fueling equipment away from the river. Based on the factors identified above and the incorporated AMMs, salmonids and sturgeon are not expected to be exposed to project-related hazardous materials.

2.5.2. Effects to Critical Habitat

The proposed Project's action area contains approximately 0.19 acre of critical habitat for sDPS sDPS green sturgeon, winter-run Chinook, CV spring-run Chinook, and CCV steelhead that would be continually affected by this Project. A minor change to the nearshore channel would occur as a result of annual sediment removal. Specifically, annual maintenance dredging operations would continue to maintain the degraded condition of the project footprint, resulting in up to two days of in-water work within the 3-month operational period (February through April). The remaining 9 months of the year (May through January) would allow for some recovery of benthic organisms; however, the impacts of the routine disturbance of the bottom substrates each year would not be fully ameliorated by this short reprieve, as the cyclical nature of these events do not allow for a stable, natural habitat to become re-established in the action area. There would also be a temporary increase of mobilized sediment affecting rearing and migratory corridor PBFs of critical habitat for approximately 500 feet downstream of the Project site. No long-term negative effects to food resources, substrate type or size, water flow, migratory corridor or sediment quality would occur. While minor changes to water depth would occur, they would not diminish the quality of critical habitat for sDPS green sturgeon, winter-run, CV spring-run, or CCV steelhead. Water quality would be affected by increased turbidity, the effects would be short-term, infrequent, and minimized by using BMPs. However, as this would be a recurring effect it would reduce the value of the critical habitat PBFs for the conservation of the species.

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 and 402.17(a)). 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).

The private and State activities described below are likely to adversely affect CCV steelhead, CV spring-run Chinook salmon, winter-run Chinook salmon, and sDPS green sturgeon, and the designated critical habitats of CCV steelhead, CV spring-run Chinook salmon and sDPS green sturgeon. These potential factors are ongoing and expected to continue into the future. However, the extent of the adverse effects from these activities is uncertain, and it is not possible to accurately predict the extent of the effects from these future non-Federal activities.

2.6.1. Agricultural Practices

Agricultural practices in the action area may adversely affect riparian and wetland habitats through upland modifications of the watershed that lead to increased siltation or reductions in water flow. Grazing activities from cattle operations can degrade or reduce suitable critical habitat for listed salmonids by increasing erosion and sedimentation as well as introducing nitrogen, ammonia, and other nutrients into the watershed, which then flow into the receiving waters of the associated watersheds. Stormwater and irrigation discharges related to both agricultural and urban activities contain numerous pesticides and herbicides that may adversely affect listed salmonid and green sturgeon reproductive success and survival rates (Dubrovsky 1998, Daughton 2002).

2.6.2. Aquaculture and Fish Hatcheries

More than 32 million fall-run Chinook salmon, 2 million spring-run Chinook salmon, 1 million late fall-run Chinook salmon, 0.25 million winter-run Chinook salmon, and 2 million steelhead are released annually from six hatcheries producing anadromous salmonids in the Central Valley (CV). All of these facilities are currently operated to mitigate for natural habits that have already been permanently lost as a result of dam construction. The loss of this available habitat resulted in dramatic reductions in natural population abundance, which is mitigated for through the operation of hatcheries. Salmonid hatcheries can, however, have additional negative effects on ESA-listed salmonid populations. The high level of hatchery production in the CV can result in high harvest-to-escapements ratios for natural stocks. California salmon fishing regulations are set according to the combined abundance of hatchery and natural stocks, which can lead to over-exploitation and reduction in the abundance of wild populations that are indistinguishable and exist in the same system as hatchery populations. Releasing large numbers of hatchery fish can also pose a threat to wild Chinook salmon and steelhead stocks through the spread of disease, genetic impacts, competition for food and other resources between hatchery and wild fishes, predation of hatchery fishes on wild fishes, and increased fishing pressure on wild stocks as a result of hatchery production. Impacts of hatchery fishes can occur in both freshwater and the marine ecosystems. Limited marine carrying capacity has implications for naturally produced fish experiencing competition with hatchery production. Increased salmonid abundance in the marine environment may also decrease growth and size at maturity, and reduce fecundity, egg size, age at maturity, and survival (Bigler, Welch et al. 1996). Ocean events cannot be predicted with a high degree of certainty at this time. Until good predictive models are developed, there will be years when hatchery production may be in excess of the marine carrying capacity, placing depressed natural fish at a disadvantage by directly inhibiting their opportunity to recover (NPCC 2003).

2.6.3. Increased Urbanization

Increases in urbanization and housing developments can impact habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns. Increased growth will place additional burdens on resource allocations, including natural gas, electricity, and water, as well as on infrastructure such as wastewater sanitation plants, roads and highways, and public utilities. Some of these actions, particularly those which are situated away from waterbodies, will not require Federal permits, and thus will not undergo review through the ESA section 7 consultation process with NMFS.

Increased urbanization also is expected to result in increased recreational activities in the region. Among the activities expected to increase in volume and frequency is recreational boating. Boating activities typically result in increased wave action and propeller wash in waterways. This potentially will degrade riparian and wetland habitat by eroding channel banks and mid-channel islands, thereby causing an increase in siltation and turbidity. Wakes and propeller wash also churn up benthic sediments thereby potentially re-suspending contaminated sediments and degrading areas of submerged vegetation. This, in turn, will reduce habitat quality for the invertebrate forage base required for the survival of juvenile salmonids and green sturgeon moving through the system. Increased recreational boat operation is anticipated to result in more contamination from the operation of gasoline and diesel powered engines on watercraft entering the associated water bodies.

2.6.4. Rock Revetment and Levee Repair Projects

Cumulative effects include non-Federal riprap projects. Depending on the scope of the action, some non-Federal riprap projects carried out by state or local agencies do not require Federal permits. These types of actions and illegal placement of riprap occur throughout the action area. For example, most of the levees have roads on top of the levees which are maintained either by the county, reclamation district, owner, or by the state. Landowners may utilize and modify roads at the top of the levees to access part of their agricultural land. The effects of such actions result in continued fragmentation of existing high-quality habitat, and conversion of complex nearshore aquatic to simplified habitats that affect salmonids.

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 biological 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 diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

2.7.1. Summary of the Sacramento River Winter-Run Chinook ESU and Designated Critical Habitat

Best available information indicates that the winter-run Chinook salmon ESU remains at a high risk of extinction. Key factors upon which this conclusion is based include: (1) the ESU is composed of only one population, which has been blocked from its entire historic spawning habitat; and (2) the ESU has a risk associated with catastrophes, especially considering the remaining population's dependency on the cold-water management of Shasta Reservoir (Lindley et al. 2007). The most recent 5-Year Status Review for winter-run Chinook salmon demonstrated that the ESU had further declined, and that continued loss of historical habitat and the degradation of remaining critical habitat continue to be major threats (NMFS 2016a). NMFS concludes that the Sacramento River winter-run Chinook salmon ESU remains at high risk of extinction.

2.7.2. Status of the CV Spring-Run Chinook salmon ESU and Designated Critical Habitat

In the 2016 status review, NMFS found, with a few exceptions, CV spring-run Chinook salmon populations have increased through 2014 returns since the last status review (2010/2011), which moved the Mill and Deer creek populations from the high extinction risk category, to moderate, and Butte Creek remaining in the low risk of extinction category. Additionally, the Battle Creek and Clear Creek populations continued to show stable or increasing numbers in that period, putting them at moderate risk of extinction based on abundance. Overall, the Southwest Fisheries Science Center concluded in their viability report that the status of CV spring-run Chinook salmon (through 2014) had probably improved since the 2010/2011 status review and that the ESU's extinction risk may have decreased. However, fish returns in 2015 were extremely low (1,488 adults) (CDFW GrandTab). CDFW has documented critically low returns for Butte, Deer, and Mill creeks which hold the only wild, independent populations of CV spring-run Chinook salmon (CDFW GrandTab). The effects of the December 2011 to March 2017 drought have resulted in severe rates of decline and a trend toward extirpation. The CV spring-run Chinook salmon critical habitat PBFs of freshwater rearing habitat in the action area has been degraded due to human activity. Construction of dams has led to loss and alteration of rearing habitat through reduced flows and increased water temperatures. Presence of dams also restricts access to historical spawning and rearing habitat in the Sacramento River.

2.7.3. Status of the CCV Steelhead DPS and Designated Critical Habitat

The 2016 status review (NMFS 2016c) concluded that, overall, the status of CCV steelhead appears to have changed little since the 2011 status review and should remain as a threatened species. Although there is still a general lack of data on the status of wild populations, there are some encouraging signs, as several hatcheries in the Central Valley have experienced increased returns of steelhead over recent years. There has also been a slight increase in the percentage of wild steelhead in salvage at the south Delta fish facilities, and the percentage of wild fish in those data remains much higher than at Chipps Island. The new video counts at Ward Dam show that Mill Creek likely supports one of the best wild steelhead populations in the Central Valley, though at much reduced levels from the 1950s and 60s. Restoration efforts in Clear Creek continue to benefit CCV steelhead. However, the catch of unmarked (wild) steelhead at Chipps Island is still less than 5 percent of the total smolt catch, which indicates that natural production of steelhead throughout the Central Valley remains at very low levels. Despite the positive trend on Clear Creek and encouraging signs from Mill Creek, all other concerns raised in the current status review remain. Critical habitat PBFs within the action area (freshwater rearing and migration corridors) have been degraded due to human activity. Degradation of these PBFs has contributed to significant population declines within the Sacramento River. Construction of dams has led to loss and alteration of rearing habitat through reduced flows and increased water temperatures. Migration corridors have likely been limited due to thermal barriers.

2.7.4. Status of the Green Sturgeon southern DPS and Designated Critical Habitat

The viability of sDPS green sturgeon is constrained by factors, such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The risk of extinction is believed to be moderate because, although threats due to habitat alteration are thought to be high and indirect evidence suggests a decline in abundance, there is much uncertainty regarding the scope of threats and the viability of population abundance indices (NMFS 2015). The recovery potential for this species is likely high, however, if sources of mortality and activities that decrease critical habitat quality and quantity, particularly in spawning and rearing habitat, are limited (NMFS 2018).

Although the population structure of sDPS green sturgeon is still being refined, it is currently believed that only one population of sDPS green sturgeon exists. Lindley et al. (2007), in discussing winter-run Chinook salmon, states that an ESU represented by a single population at moderate risk of extinction is at high risk of extinction over the long run. This concern applies to any DPS or ESU represented by a single population, and if this were to be applied to sDPS green sturgeon directly, it could be said that sDPS green sturgeon face a high extinction risk. However, the position of NMFS, upon weighing all available information (and lack of information) has stated the extinction risk to be moderate (NMFS 2015).

2.7.5. Status of the Environmental Baseline and Cumulative Effects in the Action Area

Salmon, steelhead and green sturgeon use the action area as an upstream and downstream migration corridor and for rearing. Within the action area, the essential features of freshwater rearing and migration habitats for salmon, steelhead and green sturgeon have been transformed from a meandering waterway lined with a dense riparian vegetation, to a highly leveed system under varying degrees of constraint of riverine erosional processes and flooding. Severe long-term riparian vegetation losses have occurred in this part of the Sacramento River, and there are large open gaps without the presence of these essential features due to the high amount of riprap. The change in the ecosystem as a result of halting the lateral migration of the river channel, the loss of floodplains, the removal of riparian vegetation have likely affected the functional ecological processes that are essential for growth and survival of salmon, steelhead and green sturgeon in the action area.

The *Cumulative Effects* section of this BO describes how continuing and future effects, such as the discharge of point and non-point source chemical contaminant discharges, aquaculture and hatcheries, and increased urbanization, affect the species in the action area. These actions typically result in habitat fragmentation, and conversion of complex nearshore aquatic habitat to simplified habitats that incrementally reduces the carrying capacity of the rearing and migratory corridors.

2.7.6. Summary of Project Effects on Listed Salmonids and Green Sturgeon

Physical disturbance
One adverse effect expected to occur is physical disturbance from the equipment used to do the dredging. Use of an excavator/bucket is expected to injure or kill a small number of each species

(1 or 2) each year. Additionally, small numbers of juveniles of each species that are startled and move away would be subject to increased predation, and reduced feeding/growth.

Increased turbidity
Dredging is expected to disturb and suspend a significant volume of benthic sediment. Previous estimates of dredge-created turbidity have indicated that dredging can result in an increase in total suspended solids downstream of the dredging action (Allen 1980). Although AMMs are in place to minimize turbidity increases, small numbers of salmonids are expected to be killed as a result of the disturbance from displacement, and increased predation..

The exposure risk to sDPS green sturgeon is less clear. No specific information is available to evaluate the likely responses of sDPS green sturgeon to low levels of increased turbidity and suspended sediment. Higher concentrations of suspended sediment and turbidity interfere with normal feeding and migratory behavior, although sturgeon may be less sensitive to short-term increases in suspended sediments or turbidity because they are a benthically oriented species, evolutionarily adapted for life in turbid flowing waters, and may rely on biomagnetic electroreception or olfactory cues more consistently than vision to locate prey. Any reductions in the availability of foraging habitat and food, because of sedimentation of benthic habitat following maintenance dredging each year, would likely have an effect on growth or survival of juveniles. Due to the temporary, localized nature of these effects, and adjacent areas providing PBFs for rearing habitat the number of fish effected by this would be small.

2.7.7. Summary of Project Effects on Designated Critical Habitat for All Species

The proposed action is expected to continue to affect the value of the action area as rearing habitat. The summary of the proposed action's effects includes a decrease in water quality. Water quality would be affected by increased turbidity, the effects would be short-term, infrequent, and minimized by using BMPs. However, as this would be a recurring effect it would reduce the value of the critical habitat PBFs for the conservation of the species. While climate change is expected to continue over the relatively short duration that the action area will be impacted by the project, we cannot distinguish changes in temperatures, precipitation, or other factor attributable to climate change from annual and decadal climate variability over this time period. For these reasons, climate change is not expected to amplify the effects of the proposed action and the project will not appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

2.7.8. Risk to ESUs/DPSs

Sacramento River Winter-run Chinook Salmon
The Sacramento River winter-run Chinook salmon ESU is made up of one population, as previously described, with all individuals originating in the Sacramento River basin. The overall annual loss of individual juvenile Sacramento River winter-run Chinook salmon due to the Project will be small, and represents a minor fraction of the ESU. However, while impacts to the ESU's abundance are low, the Project does not improve the status of the ESU or enhance its recovery. Since very few fish are expected to be lost, productivity is not expected to be altered in a meaningful way for the ESU. The loss of these few juveniles represents a small fraction of the potential adult escapement spawning stock, but the loss still represents a diminished potential in

productivity. Likewise, since the entire ESU is represented by one spawning population, any losses would come from this one population, and would not represent a loss of spatial structure or diversity. However, like abundance or productivity, the Project does not improve spatial structure or diversity, which is needed to achieve the recovery goals for winter-run Chinook salmon. The Recovery Plan (NMFS 2014) criteria includes 3 self-sustaining populations of SR winter-run Chinook salmon be established in the Basalt and Porous Lava Diversity Group region that are at a low risk of extinction; currently, there is one population with heavy support from the conservation hatchery. The Project impacts related to dredging are unlikely to affect the establishment of these groups since the loss of individual fish would be very small compared to the current population size. However, no components of the Project would enhance the creation of these additional populations, and thus enhance the potential for recovery for the Sacramento River winter-run Chinook salmon ESU. The Project represents a chronic, yet very small negative strain on the ESU's viability.

In summary, when added together with the status of the species, the environmental baseline, the cumulative effects, the minimal and more adverse effects of the action, the Project is not likely to reduce appreciably the likelihood of both the survival and recovery of winter-run Chinook salmon in the wild by reducing its numbers, reproduction, or distribution.

CV Spring-run Chinook Salmon
The CV spring-run Chinook salmon ESU is represented by multiple population groups, all but one of which are currently in the Sacramento River basin and within the three Diversity Groups previously described. There is one experimental population within the San Joaquin River basin that is still nascent and has not become self-sustaining. Only one of the population groups in the ESU is considered viable with a low risk of extinction (Butte Creek), while nine are needed according to the recovery criteria (NMFS 2014).

The majority of the CV spring-run Chinook salmon population emigrating through the Delta and San Francisco estuary originate in the Sacramento River basin. Only a small fraction of these fish would be affected by the Project as described in the previous section. Annual losses of juvenile CV spring-run Chinook salmon related to the Project's dredging impacts would be a small proportion of the entire ESU. Thus, the amount of loss associated with the Project should not have a demonstrable impact on the abundance of juvenile CV spring-run Chinook salmon out-migrating from the ESU. However, the Project does not improve the status of the ESU's abundance or productivity or chances of recovery either. Likewise, the Project does not improve the status of the spatial structure or diversity of the ESU.

In summary, when added together with the status of the species, the environmental baseline, the cumulative effects, the minimal and more adverse effects of the action, the Project is not likely to reduce appreciably the likelihood of both the survival and recovery of CV spring-run Chinook salmon in the wild by reducing its numbers, reproduction, or distribution.

CCV steelhead
Similar to the CV spring-run Chinook salmon ESU, the CCV steelhead DPS is represented by multiple populations throughout the Central Valley in both the Sacramento River and the San Joaquin River basins. And like the CV spring-run Chinook salmon ESU, the majority of these

populations are also located in the Sacramento River watershed and its tributaries. Very few populations of CCV steelhead remain in the San Joaquin River basin. For almost all of the populations comprising the CCV steelhead DPS, the extinction risk is either high or unknown. For the CCV steelhead DPS, the Recovery Plan (NMFS 2014) criteria include the establishment of 9 populations at a low risk of extinction in the Central Valley.

Similar to the CV spring-run Chinook salmon ESU, the majority of the CCV steelhead population migrating through the Delta and San Francisco estuary originates in the Sacramento River basin. Only a small fraction of these fish would be affected by the Project as described previously. The cumulative annual loss of juvenile fish related to the Project (construction and shipping) from all of these populations would be small compared to the entire DPS population of juvenile CCV steelhead moving through the Delta each year. Thus, the amount of loss associated with the Project should not have a demonstrable impact on the abundance of juvenile CCV steelhead out-migrating from the DPS. Likewise, the very small numbers of adult fish that may be lost to dredging effects would not noticeably alter the abundance or productivity of the DPS. However, while annual losses are small, the Project does not improve the status of the DPS's abundance or productivity either. Likewise, the Project does not improve the status of the spatial structure or diversity of the DPS.

In summary, when added together with the status of the species, the environmental baseline, the cumulative effects, the minimal and more adverse effects of the action, the Project is not likely to reduce appreciably the likelihood of both the survival and recovery of CCV steelhead in the wild by reducing its numbers, reproduction, or distribution.

sDPS Green Sturgeon

Like the Sacramento River winter-run Chinook salmon ESU, the sDPS of North American green sturgeon is represented by one spawning population in the Sacramento River, with occasional opportunistic spawning in the Feather and Yuba rivers. The overall cumulative annual loss of individual sDPS green sturgeon due to the Project would be small, and represents a minor fraction of the entire population of the sDPS green sturgeon present which includes juveniles, sub-adults and adults. However, while the cumulative numbers of fish lost may be small compared to the entire population; the Project represents a chronic, yet very small negative strain on the DPS's viability.

The Recovery Plan for sDPS green sturgeon (NMFS 2018) requires a running yearly average of at least 813 spawners annually for 3 generations (approximately 66 years) with an effective population size of at least 500 adult individuals in any given year. The census population is required to remain at or above 3,000 adult individuals for 3 generations. The sDPS population should have successful spawning in at least two rivers within their historical range with annual presence of larvae for at least 20 years.

In summary, the small numbers of fish lost annually from the sDPS green sturgeon population due to the effects of the Project would not substantially reduce the viability of the entire DPS. Therefore, when added together with the status of the species, the environmental baseline, the cumulative effects, the minimal and more adverse effects of the action, the Project is not likely to reduce appreciably the likelihood of both the survival and recovery of sDPS green sturgeon in the wild by reducing its numbers, reproduction, or distribution.

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, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of SR Winter-Run Chinook, CV Spring-Run Chinook, CCV steelhead and Green Sturgeon and 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 this opinion, NMFS determined that the proposed action is reasonably certain to result in the incidental take of individual winter-run Chinook, CV spring-run Chinook, CCV steelhead and sDPS green sturgeon. Incidental take associated with this action is expected to be in the form of injury, mortality, harm, or harassment of juvenile winter-run Chinook, CV spring-run Chinook CCV steelhead, and sDPS green sturgeon as a result of exposure to the annual maintenance dredging operations at the Lake California boat dock. The harm associated with this exposure is expected to result from disturbance or harm from the dredging equipment and harassment from the generation of turbidity increases resulting from the resuspension of sediments. Exposure to the adverse effects associated with maintenance dredging operations in the action area is limited to 2 days within the 3-month operational period from February 1 through April 30 when dredging would be conducted each year.

NMFS cannot, using the best available information, accurately quantify the anticipated incidental take of individual listed fish because of the variability and uncertainty associated with the population size of each species, annual variations in the timing of migration, and uncertainties regarding individual habitat use within the action area. However, it is possible to estimate the extent of incidental take by designating ecological surrogates, and it is practical to quantify and monitor the surrogates to determine the extent of incidental take that is occurring. The most appropriate ecological surrogate for providing a quantifiable metric for determining the extent of incidental take of listed fish caused by maintenance dredging operations is amount of dredged sediment removed. This includes the area of the channel that has sediment removed as well 500 linear feet downstream also impacted by the increased turbidity. The area impacted from maintenance dredging operations can be consistently and accurately measured during Project implementation and, therefore, serves as a physically measurable proxy for the incidental take of listed fish.

Ecological Surrogate

- The analysis of the effects of the proposed maintenance dredging program would result in temporary increases to the ambient background levels of turbidity in the aquatic environment within and downstream from the areas to be dredged. Based on the methods described for performing annual maintenance dredging operations, the types of equipment that would be employed to carry out those activities, and the effects analysis conducted for this consultation, the observed increases in turbidity above ambient background conditions in the aquatic environment would extend approximately 500 feet downstream from the specific locations where active dredging operations are being conducted.

Disruption of the action area will cause fish behavioral modifications leading to harm. NMFS anticipates annual incidental take (of under 5 individuals of each species) will be limited to the following forms: Harm to juvenile winter-run Chinook, CV spring-run Chinook, CCV steelhead, and sDPS green sturgeon, from the removal of 300 cubic feet of sediment, plus 500 feet of turbidity plume. The disruption will affect the behavior of listed fish, including displacement, which is reasonably certain to result in increased predation risk resulting in decreased survival; decreased feeding resulting in reduced growth; and increased competition, resulting in reduced fitness.

Incidental take will be exceeded if the amount of dredged sediment exceeds 300 cubic feet more than 3 times in 10 years, if dredged sediment exceeds more than 400 cubic feet, or if turbidity increases resulting from dredging activities extends beyond 500 feet.

2.9.2. Effect of the Take

In the biological 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 species 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).

1. The Corps and the LCPOA will avoid or minimize dredging-related impacts associated with the annual implementation of maintenance dredging operations on listed species.
2. The Corps and the LCPOA will monitor and report on the amount or extent of incidental take (see surrogate).

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 RPMs (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 term and condition implement reasonable and prudent measure 1:
   a. Monitoring of turbidity levels of the waters where the dredge is operating will be conducted to verify that water quality criteria are not exceeded, as described in the description of ecological surrogates, above. If levels are exceeded, NMFS will be notified and work halted until corrective actions are instituted to achieve surface water quality criteria.

2. The following terms and conditions implement reasonable and prudent measure 2:
   a. Report will include specific dredging operations timing each year (within the proposed work window of February 1 through April 30 each year). NMFS will be contacted for any work-window timing changes at least 30 days prior to the activity. The request will include the location and size of the work area within action area, estimates of the amount of time required and dredging material to be removed, and most recent monitoring data indicating the likely presence and magnitude of listed anadromous fish species in the action area. The request is to be sent to the following email, while the staff are situated remotely, or to the hardcopy address, after staff return to the office:

      National Marine Fisheries Service
      California Central Valley Office
      650 Capitol Mall, Suite 5-100
      Sacramento, California 95814-4706
      ccvo.consultationrequests@noaa.gov

   b. The Corps or LCPOA will visually monitor the waterway adjacent to the area being dredged (*i.e.*, within 500 feet) during all dredging operations for any affected fish, including, but not limited to, winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and the sDPS green sturgeon. Observation of affected fish will be reported to NMFS by telephone at (916) 930-3600, by FAX at (916) 930-3629, or at the address given above within 24 hours of the incident. Dredging operations will be halted immediately until the Corps coordinates with NMFS to determine the cause of the incident and whether any additional protective measures are necessary to protect listed salmonids and green sturgeon. Any protective measures that are determined necessary to protect listed salmonids and sturgeon will be implemented as soon as practicable within 72 hours of the incident. Affected fish are defined as:

i. Dead or moribund fish at the water surface;
ii. Showing signs of erratic swimming behavior or other obvious signs of distress;
iii. Gasping at the water surface; or
iv. Showing signs of other unusual behavior.

A follow-up written notification will also be submitted to NMFS, which includes the date, time, and location that the carcass or injured specimen was found, a color photograph, the cause of injury or death, if known, and the name and affiliation of the person who found the specimen. Written notification will be submitted to NMFS at the above address. Any dead specimen(s) will be placed in a cooler with ice and held for pick up by NMFS personnel or an individual designated by NMFS to do so.

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).

1. The Corps should support and promote aquatic and riparian habitat restoration within the Sacramento River and encourage its applicants to modify operation and maintenance procedures through the Corps' authorities in order to avoid or minimize negative impacts to salmonids and sturgeon.

2. The Corps should provide funding to support anadromous fish monitoring programs throughout the Sacramento River to improve the understanding of migration and habitat utilization by salmonids and sturgeon.

3. The Corps should continue to work cooperatively with other State and Federal agencies, private landowners, governments, and local watershed groups to identify opportunities for cooperative analysis and funding to support salmonid habitat restoration projects within the Sacramento River.

2.11. Reinitiation of Consultation

This concludes formal consultation for the Lake California Boat Launch Facility Maintenance Project.

As 50 CFR 402.16 states, reinitiation of consultation is required and will be requested by the Federal agency or by the Service 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 identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

3. Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA , EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). 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) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)]

This analysis is based, in part, on the EFH assessment provided by the Corps and descriptions of EFH for Pacific Coast salmon (PFMC 2014) 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

The PFMC has identified and described EFH, Adverse Impacts and Recommended Conservation Measures for salmon in Amendment 14 to the Pacific Coast Salmon FMP (PFMC 1999). The proposed Project site is within the region identified as EFH for Pacific salmon in Amendment 14 of the Pacific Coast Salmon FMP. Freshwater EFH for Pacific salmon in the California Central Valley includes waters currently or historically accessible to salmon within the Central Valley ecosystem as described in Myers et al. (1998), and includes the Sacramento River. Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley spring-run Chinook salmon (*O. tshawytscha*), and Central Valley fall-/late fall-run Chinook salmon (*O. tshawytscha*) are species managed under the Pacific Coast Salmon FMP that occur in the Sacramento River.

The Corps has determined that the proposed Project will adversely affect the EFH for federally managed fish species within the Pacific Coast Salmon FMP. The Habitat Areas of Particular Concern (HAPCs) that is expected to be adversely affected is complex channels and floodplain habitats.

3.2. Adverse Effects on Essential Fish Habitat

Maintenance dredging of the Lake California Boat Launch will adversely affect EFH through the re-suspension of sediments potentially resulting in temporary (1) increases in turbidity, (2) reductions of prey availability, and (3) increased levels of re-suspended contaminants. The effects of the proposed action on winter-run Chinook, CV spring-run Chinook, and CCV steelhead habitat are described in detail in section 2.5 (Effects of the Action) of the preceding biological opinion, and generally are expected to apply to other Pacific Coast salmon EFH. Adverse effects to ESA-listed critical habitat and EFH HAPCs are appreciably similar; therefore, no additional discussion is included. Listed below are the adverse effects on EFH reasonably certain to occur:

Sedimentation and Turbidity

1. Reduced habitat complexity
2. Degraded water quality
3. Reduction in aquatic macroinvertebrate production

3.3. Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

1. Measures should be taken to maintain, monitor, and adaptively manage all conservation measures throughout the life of the proposed program to ensure their effectiveness.
2. Measures should be taken to ensure that contractors, construction workers, and all other parties involved with this program implement the program as proposed in the biological assessment and this BO.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, for Pacific Coast salmon.

3.4. Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Corps must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of the measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5. 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 Data Quality Act (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 users of this opinion are the Army Corps of Engineers. Other interested users could include Lake California Boat Launch Facility Maintenance Project. Individual copies of this opinion were provided to the Corps. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. 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.

5. REFERENCES

Allen, K.O. and J.W. Hardy. 1980. Impacts of Navigational Dredging on Fish and Wildlife: A Literature Review. FWS/OBS-80/07, Office of Biological Services, U.S. Fish and Wildlife Service. U.S. Department of the Interior, Washington, D.C. 100 pp.

Arkoosh, M.R., E. Clemons, M. Myers, and E. Casillas. 1994. Suppression of B-Cell Mediated Immunity in Juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) after Exposure to Either a Polycyclic Aromatic Hydrocarbon or to Polychlorinated-Biphenyls. Immunopharmacology and Immunotoxicology 16(2):293-314.

Ayres Associates. 2007. Field Reconnaissance Report of Bank Erosion Sites and Site Priority Ranking, Sacramento River Flood Control Levees, Tributaries, and Distributaries.

Ayres Associates. 2008. 2008-Field Reconnaissance Report of Bank Erosion Sites and Site Priority Ranking, Sacramento River Flood Control Levee, Tributaries and Distributaries. Sacramento River Bank Protection Project, Contract No. WA91238-07-D-0038, Modification to Task Order 2. Prepared for U.S. Army Corps of Engineers, Sacramento District. December 18. Sacramento, CA, and Fort Collins, CO.

Azat, J. 2018. California Department of Fish and Wildlife 2015 GrandTab 2018.04.9 California Central Valley Chinook Population Database Report. California Department of Fish and Wildlife. Sacramento, California.

Bash, J., C. Berman, and S. Bolton. 2001. Effects of Turbidity and Suspended Solids on Salmonids.

Barnhart, R.A. 1986. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Pacific Southwest) - Steelhead. (Biological Report 82[11.60], TR EL-82-4.) Prepared for the U.S. Fish and Wildlife Service, Washington, D.C, and the U.S. Army Corps of Engineers, Vicksburg, Mississippi.

Berg, L. and T.G. Northcote. 1985. Changes in treritorial, gill flaring, and feeding behavior in juvenile Coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Sciences 42(8):1410-1417.

Bigler, B. S., D. W. Welch, and J. H. Helle. 1996. A Review of Size Trends among North Pacific Salmon (Oncorhynchus Spp). Canadian Journal of Fisheries and Aquatic Sciences 53(2):455-465.

Bisson, P. A., R. E. Bilby, M. D. Bryant, A. C. Dolloff, G. B. Grette, R. A. House, M. L. Murphy, K. V. Koski, and J. R. Sedell. 1987. Streamside Management: Forestry and Fishery Interactions. University of Washington.

Bisson, P.B. and R.E. Bilby. 1982. Avoidance of suspended sediment by juvenile coho salmon. North American Journal of Fisheries Management 2:371-374.

Boyer, K. L., D. R. Berg, and S.V. Gregory. 2003. Riparian management for wood in rivers. In American Fisheries Society Symposium 37: 407-420.

Bradley, C. E., and D. G. Smith. 1986. Plains Cottonwood Recruitment and Survival on a Prairie Meandering River Floodplain, Milk River, Southern Alberta and Northern Montana. Canadian Journal of Botany 64:1433-1442.

Brice, J. 1977. Lateral Migration of the Middle Sacramento River, California.

California Advisory Committee on Salmon and Steelhead Trout. 1998. Restoring the balance. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California. 84 pages.

California Department of Fish and Game. 1994. Central Valley Anadromous Sport Fish Annual Run-size, Harvest, and Population Estimates, 1967 through 1991. Sacramento, California.

California Department of Fish and Game. 1998. Report to the Fish and Game Commission: A Status Review of the Spring-run Chinook Salmon (Oncorhynchus tshawytscha) in the Sacramento River Drainage. Candidate Species Status Report 98-01.

California Department of Fish and Wildlife. 2007. California Steelhead Fishing Report-Restoration Card.

California Department of Fish and Wildlife. 2017. Grandtab Spreadsheet of California Central Valley Chinook Population Database Report.

California Department of Fish and Wildlife. 2020. California Natural Diversity Database – Commercial Version. Biogeographic Information and Observation System. Biogeographic Data Branch. Retrieved March 2020 from https://wildlife.ca.gov/Data/BIOS.

California Department of Transportation. 2017. Construction Site Best Management Practices (BMP) Manual. Sacramento, California. 304 pages.

Central Valley Regional Water Quality Control Board. 2009. Order No. R5-2009-0085 General Waste Discharge Requirements for Maintenance Dredging Operations Sacramento-San Joaquin Delta (General Order).

Chase, R. 2010. Lower American River steelhead (*Oncorhynchus mykiss*) spawning surveys – 2010. Department of the Interior, US Bureau of Reclamation.

Cramer Fish Sciences. 2011. Memo: Green Sturgeon Observations at Daguerre Point Dam, Yuba River, CA. FWS Grant Number: 813329G011. Auburn, California. 6 pages.

Daughton, C.G. 2003. Cradle-to-cradle stewardship of drugs for minimizing their environmental disposition while promoting human health. I. Rationale for and avenue toward a green pharmacy. Environmental Health Perspectives 111:757-774.

Dettman, D.H., D.W. Kelley, and W.T. Mitchell. 1987. The influence of flow on Central Valley salmon. Prepared for the California Department of Water Resources. Revised July 1987. (Available from D.W. Kelley and Associates, 8955 Langs Hill Rd., P.O. Box 634, Newcastle, CA 95658).

Dimacali, R. L. 2013. A Modeling Study of Changes in the Sacramento River Winter-Run Chinook Salmon Population Due to Climate Change. California State University, Sacramento.

DuBois, J. and M.D. Harris. 2015. 2014 Sturgeon Fishing Report Card: Preliminary Data Report. Available at http://www.dfg.ca.gov/delta/data/sturgeon/bibliography.asp

DuBois, J. and M.D. Harris. 2016. 2015 Sturgeon Fishing Report Card: Preliminary Data http://www.dfg.ca.gov/delta/data/sturgeon/bibliography.asp

Dubrovsky, N.M., D.L. Knifong, P.D. Dileanis, L.R. Brown, J.T. May, V. Connor, and C.N. Alpers. 1998. Water quality in the Sacramento River basin. U.S. Geological Survey Circular 1215.

Dubrovsky, N.M., C.R. Kratzer, L.R. Brown, J.M. Gronberg, and K.R. Burow. 2000. Water quality in the San Joaquin-Tulare basins, California, 1992-95. U.S. Geological Survey Circular 1159.

Eilers, C. D., J. Bergman, and R. Nelson. 2010. A Comprehensive Monitoring Plan for Steelhead in the California Central Valley. California Department of Fish and Game.

Emmett, R.L., S.A. Hinton, S.L. Stone, and M.E. Monaco. 1991. Distribution and Abundance of Fishes and Invertebrates in West Coast Estuaries Volume II: Species Life History Summaries. ELMR Report Number 8, Rockville, Maryland.

Ewing, R. 1999. Diminishing Returns: Salmon Decline and Pesticides. Journal of pesticide reform: a publication of the Northwest Coalition for Alternatives to Pesticides (USA):55.

Fisher, F. W. 1994. Past and Present Status of Central Valley Chinook Salmon. Conservation Biology 8(3):870-873.

Garman, C. 2015. Butte Creek Spring-Run Chinook Salmon, Oncoryhnchus Tshawytscha Pre-Spawn Mortality Evaluation, 2014.

Garza, J.C. and D.E. Pearse. 2008. Population Genetic Structure of *Oncorhynchus mykiss* in the California Central Valley: Final Report for California Department of Fish and Game. University of California, Santa Cruz, and National Marine Fisheries Service, Santa Cruz, California.

Good, T.P., R.S. Waples, and P. Adams. 2005. Updated Status of Federally Listed ESUs of West Coast Salmon and Steelhead. NOAA Technical Memorandum NMFS-NWFSC-66.

Gregory R.S. and C.D. Levings. 1998. Turbidity reduces predation on migrating juvenile pacific salmon. Transactions of the American Fisheries Society, 127:275-285.

Gregory, R.S. and T.G. Northcote. 1993. Surface, planktonic, and benthic foraging by juvenile Chinook salmon (*Oncorhynchus tshawytscha*) in turbid laboratory conditions. Canadian Journal of Fisheries and Aquatic Sciences 50(2):233-240.

Hallock, R.J., D.H. Fry Jr., and D.A. LaFaunce. 1957. The Use of Wire Fyke Traps to Estimate the Runs of Adult Salmon and Steelhead in the Sacramento River. California Fish and Game 43(4):271-298.

Hallock, R. J., W. F. Van Woert, and L. Shapovalov. 1961. An Evaluation of Stocking Hatchery-Reared Steelhead Rainbow Trout (Salmo Gairdnerii Gairdnerii) in the Sacramento River System. Fish Bulletin 114.

Hannon, J. and B. Deason. 2008. American River Steelhead (*Oncorhynchus mykiss*) Spawning 2001 – 2007. U.S. Department of the Interior, Bureau of Reclamation, Mid-Pacific Region.

Hannon, J., M. Healey, and B. Deason. 2003. American River Steelhead (*Oncorhynchus mykiss*) Spawning 2001 – 2003. U.S. Bureau of Reclamation and California Department of Fish and Game, Sacramento, CA.

Heublein, J., R. Bellmer, R. Chase, P. Doukakis, M. Gingras, D. Hampton, J. A. Isreal, Z. J. Jackson, R. C. Johnson, O. P. Langness, S. Luis, E. A. Mora, M. L. Moser, A. M. Seesholtz, and T. Sommer. 2017. Improved Fisheries Management through Life Stage Monitoring: The Case for Southern Green Sturgeon and Sacramento-San Joaquin White Sturgeon.

Israel, J.A., K.J. Bando, E.C. Anderson, and B. May. 2009. Polyploid Microsatellite Data Reveal Stock Complexity among Estuarine North American Green Sturgeon (*Acipenser medirostris*). Canadian Journal of Fisheries and Aquatic Sciences 66(9):1491-1504.

Jackson, Z.J. and J.P. Van Eenennaarn. 2013. San Joaquin River Sturgeon Spawning Survey 2012, Final Annual Report. 34 pp.

Johnson, M.R., and K. Merrick. 2012. Juvenile Salmonid Monitoring Using Rotary Screw Traps in Deer Creek and Mill Creek, Tehama County, California. Summary Report: 1994 – 2010. Technical Report No. 04-2012. California Department of Fish and Wildlife, Northern Region, Red Bluff Fisheries Office, Red Bluff, California.

Kjelson, M. A., P. F. Raquel, and F. W. Fisher. 1982. Life History of Fall-Run Juvenile Chinook Salmon, Oncorhynchus Tshawytscha, in the Sacramento-San Joaquin Estuary, California. Academic Press:393-411.

Kleinfelder-Geomatrix. 2009. Final Alternatives Report - 80,000 LF (107 Sites), Sacramento River Bank Protection Project. Sacramento, California.

Klimley, A. P. 2002. Biological Assessment of Green Sturgeon in the Sacramento-San Joaquin Watershed. A Proposal to the California Bay-Delta Authority.

Kondolf, G.M., J C. Vick, and T.M. Ramirez. 1996a. Salmon spawning habitat rehabilitation in the Merced, Tuolumne, and Stanislaus Rivers, California: an evaluation of project planning and performance. University of California Water Resources Center Report No. 90, ISBN 1-887192-04-2, 147 pages.

Kondolf, G.M., J.C. Vick, and T.M. Ramirez. 1996b. Salmon spawning habitat on the Merced River, California: An evaluation of project planning and performance. Transactions of the American Fisheries Society 125:899-912.

Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grand, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California. National Oceanic and Atmospheric Administration Technical Memo. NMFS-NWFSC-35.

Larson, E. W., and S. E. Greco. 2002. Modeling Channel Management Impacts on River Migration: A Case Study of Woodson Bridge State Recreation Area, Sacramento River, California, Esa. Environmental Management 30:209-224.

Lindley, S.T., R.S. Schick, B.P. May, J.J. Anderson, S. Greene, C. Hanson, A. Low, D. McEwan, R.B. MacFarlane, C. Swanson, and J.G. Williams. 2004. Population Structure of Threatened and Endangered Chinook Salmon ESUs in California's Central Valley Basin. National Oceanic and Atmospheric Administration Technical Memorandum TM-NMFS-SWFSC-360. National Marine Fisheries Service, Southwest Fisheries Science Center.

Lindley, S.T., R.S. Schick, A. Agrawal, M. Goslin, T.E. Pearson, E. Mora, J.J. Anderson, B. May, S. Greene, C. Hanson, A. Low, D. McEwan, R.B. MacFarlane, C. Swanson, and J. G. Williams. 2006. Historical Population Structure of Central Valley Steelhead and Its Alteration by Dams. San Francisco Estuary and Watershed Science 4(1):19.

Lindley, S.T., R.S. Schick, E. Mora, P.B. Adams, J.J. Anderson, S. Greene, C. Hanson, B.P. May, D. McEwan, R.B. MacFarlane, C. Swanson, and J.G. Williams. 2007. Framework for Assessing Viability of Threatened and Endangered Chinook Salmon and Steelhead in the Sacramento-San Joaquin Basin. San Francisco Estuary and Watershed Science 5(1):26.

Lindley, S. 2008. California Salmon in a Changing Climate.

Lindley, S. T., M. S. M. C. B. Grimes, W. Peterson, J. Stein, J. T. Anderson,, L.W. Botsford, D. L. Bottom, C. A. Busack, T. K. Collier, J. Ferguson, J. C. Garza,, D. G. H. A. M. Grover, R.

G. Kope, P. W. Lawson, A. Low, R. B. MacFarlane,, M. P.-Z. K. Moore, F. B. Schwing, J. Smith, C. Tracy, R. Webb,, and T. H. W. B. K. Wells. 2009. What Caused the Sacramento River Fall Chinook Stock Collapse?

Lindley, S. T., D. L. Erickson, M. L. Moser, G. Williams, O. P. Langness, B. W. McCovey, M. Belchik, D. Vogel, W. Pinnix, J. T. Kelly, J. C. Heublein, and A. P. Klimley. 2011. Electronic Tagging of Green Sturgeon Reveals Population Structure and Movement among Estuaries. Transactions of the American Fisheries Society 140(1):108-122.

Lindley, S. T., M. L. Moser, D. L. Erickson, M. Belchik, D. W. Welch, E. L. Rechisky, J. T. Kelly, J. Heublein, and A. P. Klimley. 2008. Marine Migration of North American Green Sturgeon. Transactions of the American Fisheries Society 137(1):182-194.

Lindley, S. T., R. S. Schick, A. Agrawal, M. Goslin, T. E. Pearson, E. Mora, J. J. Anderson, B. May, S. Greene, C. Hanson, A. Low, D. McEwan, R. B. MacFarlane, C. Swanson, and J. G. Williams. 2006. Historical Population Structure of Central Valley Steelhead and Its Alteration by Dams. San Francisco Estuary and Watershed Science 4(1):19.

Lindley, S. T., R. S. Schick, B. P. May, J. J. Anderson, S. Greene, C. Hanson, A. Low, D. McEwan, R. B. MacFarlane, C. Swanson, and J. G. Williams. 2004. Population Structure of Threatened and Endangered Chinook Salmon Esus in California's Central Valley Basin. U.S. Department of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-360.

Lindley, S. T., R. S. Schick, E. Mora, P. B. Adams, J. J. Anderson, S. Greene, C. Hanson, B. P. May, D. McEwan, R. B. MacFarlane, C. Swanson, and J. G. Williams. 2007. Framework for Assessing Viability of Threatened and Endangered Chinook Salmon and Steelhead in the Sacramento-San Joaquin Basin. San Francisco Estuary and Watershed Science 5(1):26.

Mackay, R.J. 1992. Colonization by lotic macroinvertebrates: a review of processes and patterns. Can. J. Aquat. Sci. 49: 617-628.

Martin, C.D., P.D. Gaines, and R.R. Johnson. 2001. Estimating the Abundance of Sacramento River Juvenile Winter Chinook Salmon with Comparisons to Adult Escapement. Red Bluff Research Pumping Plant Report Series, Volume 5. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Maslin, P., M. Lennon, J. Kindopp, and W. McKinney. 1997. Intermittent Streams as Rearing of Habitat for Sacramento River Chinook Salmon. California State University, Chico, Department of Biological Sciences.

Matala, A. P., S. R. Narum, W. Young, and J. L. Vogel. 2012. Influences of Hatchery Supplementation, Spawner Distribution, and Habitat on Genetic Structure of Chinook Salmon in the South Fork Salmon River, Idaho. North American Journal of Fisheries Management 32(2):346-359.

Mayer, K.E. and W.F. Laudenslayer, Jr., Editors. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection, Sacramento, California.

McCullough, D., S. Spalding, D. Sturdevant, and M. Hicks. 2001. Issue Paper 5. Summary of Technical Literature Examining the Physiological Effects of Temperature on Salmonids. Prepared as Part of U.S. Epa, Region 10 Temperature Water Quality Criteria Guidance Development Project.

McClure, M. 2011. Climate Change in Status Review Update for Pacific Salmon and Steelhead Listed under the Esa: Pacific Northwest., M. J. Ford, editor, NMFS-NWFCS-113, 281 p.

McClure, M. M., M. Alexander, D. Borggaard, D. Boughton, L. Crozier, R. Griffis, J. C. Jorgensen, S. T. Lindley, J. Nye, M. J. Rowland, E. E. Seney, A. Snover, C. Toole, and V. A. N. H. K. 2013. Incorporating Climate Science in Applications of the U.S. Endangered Species Act for Aquatic Species. Conservation Biology 27(6):1222-1233.

McElhany, P., M. H. Ruckelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-42, 174 pp.

McEwan, D.R. 2001. Central Valley Steelhead. Fish Bulletin 179(1):1-44.

McEwan, D. and T.A. Jackson. 1996. Steelhead Restoration and Management Plan for California. California Department of Fish and Game, 246 pp.

McReynolds, T.R., C.E. Garman, P.D. Ward, and S.L. Plemons. 2007. Butte and Big Chico Creeks SpringRun Chinook Salmon, Oncoryhnchus tshawytscha, Life History Investigation 2005-2006. Inland Fisheries Administrative Report No. 2007-2. California Department of Fish and Game, Sacramento Valley – Central Sierra Region.

McLain, J., and G. Castillo. 2009. Nearshore Areas Used by Fry Chinook Salmon, Oncorhynchus tshawytscha, in the Northwestern Sacramento–San Joaquin Delta, California. San Francisco Estuary and Watershed Science 7(2).

Michel, C. J. 2010. River and Estuarine Survival and Migration of Yearling Sacramento River Chinook Salmon (Oncorhynchus tshawytscha) Smolts and the Influence of Environment. Master's Thesis. University of California Santa Cruz, Santa Cruz, California.

Moore, A. and C. P. Waring. 1996. Sublethal Effects of the Pesticide Diazinon on Olfactory Function in Mature Male Atlantic Salmon Parr. Journal of Fish Biology 48(4):758-775.

Mora, E.A., S.T. Lindley, D.L. Erickson, and A.P. Klimley. 2015. Estimating the Riverine Abundance of Green Sturgeon Using a Dual-Frequency Identification Sonar. North American Journal of Fisheries Management 35(3):557-566.

Moser, M.L. and S. Lindley. 2006. Use of Washington Estuaries by Subadult and Adult Green Sturgeon. Environmental Biology of Fishes 79(3-4):243-253.

Mosser, C. M., L. C. Thompson, and J. S. Strange. 2013. Survival of Captured and Relocated Adult Spring-Run Chinook Salmon *Oncorhynchus Tshawytscha* in a Sacramento River Tributary after Cessation of Migration. Environmental Biology of Fishes 96(2-3):405-417.

Moyle, P.B., R.M. Yoshiyama, J.E. Williams and E.D. Wikramanayake. 1995. Fish Species of Special Concern in California. Prepared for the California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

Moyle, P.B. 2002. Inland Fishes of California. University of California Press, Berkeley and Los Angeles. 173 pp.

Murphy, M. L., and W. R. Meehan. 1991. Stream Ecosystems. American Fisheries Society Special Publication 19.:17-46.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of Chinook salmon from Washington, Idaho, Oregon, and California. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-35, 443 pages.

National Marine Fisheries Service. 2005. Final assessment of the National Marine Fisheries Service's Critical Habitat Analytical Review Teams (CHARTs) for seven salmon and steelhead evolutionarily significant units (ESUs) in California (July 2005). Prepared by NOAA Fisheries Protected Resources Division, Southwest Region. Available at: http://swr.nmfs.noaa.gov/chd/CHARTFinalAssessment/Final_CHART_Report-July_05.pdf

National Marine Fisheries Service. 2016. 5-Year Review: Summary and Evaluation of Central Valley Spring-Run Chinook Salmon. 40 pp. West Coast Region, Sacramento, California.

National Marine Fisheries Service. 2014. Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook Salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. Southwest Regional Office, Sacramento, California.

National Marine Fisheries Service. 2015. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation and Fish and Wildlife Coordination Act Recommendations: Upper Sacramento River Anadromous Fish Habitat Restoration Programmatic. NMFS Consultation Number WCR2015-2725. West Coast Region, Sacramento, California.

National Marine Fisheries Service. 2018a. Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon (Acipenser medirostris). West Coast Region, California Central Valley Office, Sacramento, California.

National Marine Fisheries Service. 2018b. Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response and Fish and Wildlife Coordination Act Recommendations: NOAA Restoration Center's Program to Facilitate Implementation of Restoration Projects in the Central Valley of California. NMFS Consultation Number WCR-2017-8532. West Coast Region, Sacramento, California.

Nelson, C., S. Cepello, J. Nelson, C. Martz, and J. Seperek. 2000. Sacramento River Riparian Vegetation (Srrv) Coverage. Draft Report., Chico Geographical Information Center (GIC), California State University, Chico.

Newbold, J.D., D.C. Erman, and K.B. Roby. 1980. Effects of Logging on Macroinvertebrates in Streams With and Without Buffer Strips. Canadian Journal of Fisheries and Aquatic Sciences 37(7):1076-1085.

Nielsen, J.L., S. Pavey, T. Wiacek, G.K. Sage, and I. Williams. 2003. Genetic Analyses of Central Valley Trout Populations 1999-2003. U.S.G.S. Alaska Science Center - Final Technical Report Submitted December 8, 2003. California Department of Fish and Game, Sacramento, California and U.S. Fish and Wildlife Service, Red Bluff, California.

Nightingale, B., and C.A. Simenstad. July 2001. Dredging Activities: Marine Issues. Research Project T1803, Task 35, Whitepaper. Found at: www.wa.gov/wdfw/hab/ahg/ahgwhite.htm

Nobriga, M. and P. Cadrett. 2001. Differences among Hatchery and Wild Steelhead: Evidence from Delta Fish Monitoring Programs. IEP Newsletter 14(3):30-38.

Pacific Fishery Management Council. 1999. Description and identification of essential fish habitat, adverse impacts and recommended conservation measures for salmon. Amendment 14 to the Pacific Coast Salmon Plan, Appendix A. Pacific Fisheries Management Council, Portland, Oregon.

Pacific Fishery Management Council. 2014. Appendix a to the Pacific Coast Salmon Fishery Management Plan, Identification and Description of Essential Fish Habitat, Adverse Impacts, and Recommended Conservation Measures for Salmon.

Phillis, C. C., A. M. Sturrock, R. C. Johnson, and P. K. Weber. 2018. Endangered Winter-Run Chinook Salmon Rely on Diverse Rearing Habitats in a Highly Altered Landscape. Biological Conservation 217:358-362.

Poytress, W. R. 2016. Brood-Year 2014 Winter Chinook Juvenile Production Indices with Comparisons to Juvenile Production Estimates Derived from Adult Escapement. Report of U.S. Fish and Wildlife Service to U.S. Bureau of Reclamation, Sacramento, Ca. U.S. Fish and Wildlife Service.

Poytress, W. R. and F. D. Carrillo. 2011. Brood-Year 2008 and 2009 Winter Chinook Juvenile Production Indices with Comparisons to Juvenile Production Estimates Derived from Adult Escapement, 51 pp.

Poytress, W. R., J. J. Gruber, F. D. Carrillo, S. D. Voss. 2014. Compendium Report of Red Bluff Diversion Dam Rotary Trap Juvenile Anadromous Fish Production Indices for Years 2002-2012. United States Fish and Wildlife Service, 138 pp.

Rand, G. M. 1995. Fundamentals of Aquatic Toxicology: Effects, Environmental Fate and Risk Assessment. CRC Press.

Reine, K., and D. Clark. 1998. Entrainment by hydraulic dredges - A review of potential impacts. Technical Note DOER-E1. U.S. Army Corps of Engineer Research and Development Center, Vicksburg, Missouri.

Reynolds, F.L., R.L. Reavis, and J. Schuler. 1990. Sacramento and San Joaquin River Chinook Salmon and Steelhead Restoration and Enhancement Plan. California Department of Fish and Game, Sacramento, California.

Reynolds, F.L., T. Mills, R. Benthin, and A. Low. 1993. Central Valley Anadromous Fisheries and Associated Riparian and Wetlands Areas Protection and Restoration Action Plan. Draft. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

Richter, A. and S. A. Kolmes. 2005. Maximum Temperature Limits for Chinook, Coho, and Chum Salmon, and Steelhead Trout in the Pacific Northwest. Reviews in Fisheries Science 13(1):23-49.

Rutter, C. 1904. The Fishes of the Sacramento-San Joaquin Basin, with a Study of Their Distribution and Variation. Pages 103-152 in Bill of U.S. Bureau of Fisheries.

Satterthwaite, W. H., M. P. Beakes, E. M. Collins, D. R. Swank, J. E. Merz, R. G. Titus, S. M. Sogard, and M. Mangel. 2010. State-Dependent Life History Models in a Changing (and Regulated) Environment: Steelhead in the California Central Valley. Evolutionary Applications 3(3):221-243.

Schaffter, R. G., P. A. Jones, and J. G. Karlton. 1983. Sacramento River and Tributaries Bank Protection and Erosion Control Investigation - Evaluation of Impacts on Fisheries. California Department of Fish and Game.

Scholz, N.L., N.K. Truelove, B.L. French, B.A. Berejikian, T.P. Quinn, E.Casillas, and T.K. Collier. 2000. Diazinon Disrupts Antipredator and Homing Behaviors in Chinook Salmon (*Oncorhynchus tshawytscha*). Canadian Journal of Fisheries and Aquatic Sciences 57(9):1911-1918.

Seesholtz, A.M., M.J. Manuel, and J.P. Van Eenennaam. 2014. First Documented Spawning and Associated Habitat Conditions for Green Sturgeon in the Feather River, California. Environmental Biology of Fishes 98(3):905-912.

Servizi, J.A. and D.W. Martens. 1992. Sublethal responses of Coho salmon (*Oncorhynchus kisutch*) to suspended sediment. Canadian Journal of Fisheries and Aquatic Sciences 49(7):1389-1395.

Sigler, J.W., T. Bjornn, and F.H. Everest. 1984. Effects of Chronic Turbidity on Density and Growth of Steelheads and Coho Salmon. Transactions of the American Fisheries Society 113(2):142-150.

Slater, D. W. 1963. Winter-Run Chinook Salmon in the Sacramento River, California with Notes on Water Temperature Requirements at Spawning. U.S. Department of the Interior, Bureau of Commercial Fisheries.

Snider, B. and R.G. Titus. 2000. Timing, Composition and Abundance of Juvenile Anadromous Salmonid Emigration in the Sacramento River near Knights Landing October 1998–September 1999. Stream Evaluation Program Technical Report No. 00-6. California Department of Fish and Game, Habitat Conservation Division.

Sogard, S., J. Merz, W. Satterthwaite, M. Beakes, D. Swank, E. Collins, R. Titus, and M. Mangel. 2012. Contrasts in Habitat Characteristics and Life History Patterns of Oncorhynchus Mykiss in California's Central Coast and Central Valley. Transactions of the American Fisheries Society 141(3):747-760.

Souza, Jeff. 2020. Biological Assessment Lake California Boat Launch Facility Maintenance Project. Tehama Environmental Solutions, Inc.

Tehama Environmental Solutions, Inc. 2017. Delineation of Waters of the U.S. and Impact Assessment: Lake California Boat Launch, Cottonwood, California. Prepared for Lake California Property Owners Association, Cottonwood, California.

Thompson, L. C., M. I. Escobar, C. M. Mosser, D. R. Purkey, D. Yates, and P. B. Moyle. 2011. Water Management Adaptations to Prevent Loss of Spring-Run Chinook Salmon in California under Climate Change. Journal of Water Resources Planning and Management 138(5):465-478.

Thomas, M.J., M.L. Peterson, E.D. Chapman, A.R. Hearn, G.P. Singer, R.D. Battleson, and A.P. Klimley. 2013. Behavior, Movements, and Habitat Use of Adult Green Sturgeon, *Acipenser medirostris*, in the Upper Sacramento River. Environmental Biology of Fishes 97(2):133-146.

U.S. Bureau of Reclamation. 1983. Central Valley Fish and Wildlife Management Study: Predation of Anadromous Fish in the Sacramento River, California. Special Report. Sacramento, California.

U.S. Bureau of Reclamation. 2015. Biological Assessment for the Lower American River Anadromous Fish Habitat Restoration Program.

U.S. Fish and Wildlife Service. 1984b. Evaluation Report of the Potential Impacts of the Proposed Lake Red Bluff Water and Power Project on the Fishery Resources of the Sacramento River. Division of Ecological Services, Sacramento, California

U.S. Fish and Wildlife Service. 1995. Sacramento-San Joaquin Delta Native Fishes Recovery Plan. Portland, OR.

U.S. Fish and Wildlife Service. 2000. Impacts of riprapping to ecosystem functioning, lower Sacramento River, California. U.S. Fish and Wildlife Service, Sacramento Field Office, Sacramento, California. Prepared for US Army Corps of Engineers, Sacramento District.

U.S. Fish and Wildlife Service. 2015. Clear Creek Habitat Synthesis Report. USFWS Anadromous Fish Restoration Program. Sacramento, California.

VanRheenen, N. T., Andrew W. Wood, Richard N. Palmer, Dennis P. Lettenmaier. 2004. Potential Implications of Pcm Climate Change Scenarios for Sacramento-San Joaquin River Basin Hydrology and Water Resources. Climatic Change 62(62):257-281.

Wade, A. A., T. J. Beechie, E. Fleishman, N. J. Mantua, H. Wu, J. S. Kimball, D. M. Stoms, J. A. Stanford, and A. Punt. 2013. Steelhead Vulnerability to Climate Change in the Pacific Northwest. Journal of Applied Ecology.

Waring, C. P. and A. Moore. 1997. Sublethal Effects of a Carbamate Pesticide on Pheromonal Mediated Endocrine Function in Mature Male Atlantic Salmon (*Salmo salar L.*) Parr. Fish Physiology and Biochemistry 17(1-6):203-211.

Williams, J.G. 2006. Central Valley Salmon: A Perspective on Chinook and Steelhead in the Central Valley of California. San Francisco Estuary and Watershed Science 4(3):416.

Williams, T. H., S. T. Lindley, B. C. Spence, and D. A. Boughton. 2011. Status Review Update for Pacific Salmon and Steelhead Listed under the Endangered Species Act: Update to January 5, 2011 Report., National Marine Fisheries Service, Southwest Fisheries Science Center. Santa Cruz, CA.

Yates, D., H. Galbraith, D. Purkey, A. Huber-Lee, J. Sieber, J. West, S. Herrod-Julius, and B. Joyce. 2008. Climate Warming, Water Storage, and Chinook Salmon in California's Sacramento Valley. Climatic Change 91(3-4):335-350.

Yoshiyama, R.M., E.R. Gerstung, F.W. Fisher, and P.B. Moyle. 1996. Historical and Present Distribution of Chinook Salmon in the Central Valley Drainage of California. In Sierra Nevada Ecosystem Project: Final report to Congress, vol. III. University of California, Davis, Centers for Water and Wildland Resources Davis, California.

Yoshiyama, R.M., F.W. Fisher, and P.B. Moyle. 1998. Historical Abundance and Decline of Chinook Salmon in the Central Valley Region of California. North American Journal of Fisheries Management 18:485-521.

Zimmerman, C. E., G. W. Edwards, and K. Perry. 2009. Maternal Origin and Migratory History of Steelhead and Rainbow Trout Captured in Rivers of the Central Valley, California. Transactions of the American Fisheries Society 138(2):280-291.

Federal Register Notices Cited:

70 FR 52488. September 2, 2005. Final Rule: Endangered and Threatened Species; Designation of Critical Habitat for Seven Evolutionarily Significant Units of Pacific Salmon and Steelhead in California. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Federal Register, Volume 70 pages 52487-52627.

71 FR 17757. April 7, 2006. Final Rule: Endangered and Threatened Wildlife and Plants: Threatened Status for Southern Distinct Population Segment of North American Green Sturgeon. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Federal Register, Volume 71 pages 17757-17766.

74 FR 52300. October 9, 2009. Final Rule: Endangered and Threatened Wildlife and Plants: Final Rulemaking to Designate Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Federal Register, Volume 74 pages 52300-52351.

81 FR 7214. February 11, 2016. Final Rule: Interagency Cooperation—Endangered Species Act of 1973, as Amended; Definition of Destruction or Adverse Modification of Critical Habitat. United States Department of Commerce, National Oceanic and Atmoshpheric Administration, National Marine Fisheries Service. Federal Register, Volume 81 pages 7214-7226.

81 FR 7414. February 11, 2016. Final Rule: Listing Endangered and Threatened Species and Designating Critical Habitat; Implementing Changes to the Regulations for Designating Critical Habitat. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Federal Register, Volume 81 pages 7414-7440.