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: WCRO-2021-00056

July 13, 2021

Laura Loeffler
Branch Chief, Environmental
Caltrans District 3
703 B Street
Marysville, California 95901

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the City of West Sacramento Broadway Bridge Construction Project.

Dear Ms. Loeffler:

Thank you for your letter of January 7, 2021, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 *et seq.*) for the City of West Sacramento Broadway Bridge Construction Project. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016). 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 (16 U.S.C. 1855(b)) for this action.

Based on the best available scientific and commercial information, the biological opinion concludes that the City of West Sacramento Broadway Bridge Construction Project is not likely to jeopardize the continued existence of the federally listed threatened Central Valley (CV) spring-run Chinook salmon evolutionarily significant unit (ESU) (*Oncorhynchus tshawytscha*), threatened California Central Valley (CCV) steelhead distinct population segment (DPS) (*O. mykiss*), endangered Sacramento River winter-run Chinook salmon (*O. tshawytscha*), or the threatened southern DPS (sDPS) 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.

NMFS recognizes that Caltrans has assumed the Federal Highway Administration's (FHWA) responsibilities under Federal environmental laws for this project as allowed by a Memorandum of Understanding (National Environmental Policy Act Assignment) with the FHWA effective December 23, 2016. As such, Caltrans serves as the lead Federal Action Agency for the proposed project.

Please contact Lyla Pirkola in NMFS California Central Valley Office via email at lyla.pirkola@noaa.gov or via phone at (916) 930-5615 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

Enclosure

cc: Copy to File: 151422-WCR2021-SA00047
Brooks Taylor, Caltrans D3 Environmental, Brooks.Taylor@dot.ca.gov

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

The City of West Sacramento Broadway Bridge Construction Project

NMFS Consultation Number: WCRO-2021-00056

Action Agency: California Department of Transportation

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 (*Oncorhynchus tshawytscha*) evolutionarily significant unit (ESU)	Threatened	Yes	No	Yes	No
Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*) ESU	Endangered	Yes	No	Yes	No
California Central Valley steelhead (*Oncorhynchus mykiss*) distinct population segment (DPS)	Threatened	Yes	No	Yes	No
Southern DPS of North American green sturgeon (*Acipenser medirostris*)	Threatened	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: July 13, 2021

TABLE OF CONTENTS

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 the NMFS California Central Valley Office.

1.2. Consultation History

- On January 7, 2021, the California Department of Transportation (Caltrans) requested formal consultation with NOAA's National Marine Fisheries Service (NMFS) for the Broadway Bridge Replacement Project (project) located in both Yolo and Sacramento Counties, California.

- On January 20, 2021, NMFS sent an insufficiency letter for Caltrans requesting more information describing project details for barge activities and sequencing.

- On February 11, 2021, Caltrans provided a memorandum with requested details. This memorandum also included an errata to Section 2.5.3 of the biological assessment. At that time, NMFS deemed the formal consultation package complete and formal 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).

The City of West Sacramento, in cooperation with the City of Sacramento and Caltrans, proposes to construct a new bridge over the Sacramento River south of the Pioneer Bridge (US 50) to provide local interconnectivity across the river and between neighborhoods. The project would be located over the Sacramento River between the cities of West Sacramento and Sacramento, approximately 1,000 feet south of the existing Pioneer Bridge. The proposed project would

realign 15th Street to connect to Jefferson Boulevard in West Sacramento and connect to Broadway at 5th Street in Sacramento.

The project may be constructed in two phases or in a single phase, with the decision to construct in one or two phases to be determined at the time project construction starts. At the interim year, the new bridge across the Sacramento River would be constructed and open to traffic. By the design year, the remaining improvements and roadway connections proposed as part of the project would be constructed to allow the full, final design of the proposed project to be operational. If the project is constructed in a single phase, the efforts needed to construct the new bridge and the ultimate (design year) roadway alignment configuration would be completed at the same time. Regardless of project phasing, two seasons of in-water work would be required to construct the project and all in-water work would be conducted between May 1 and November 30.

If constructed in two phases, an interim (opening day) phase for the proposed project would include constructing the new bridge and approach roadways with temporary pavement transitions along the existing alignment of South River Road. Construction of this first phase is expected to take approximately 36 months, with two seasons of in-water work. A subsequent phase, the design year phase, would take approximately 6 months and would complete the remaining project roadway construction. This subsequent phase would not require any additional in-water work as the bridge would be constructed during the first phase. If the project is built in a single phase, construction is expected to take 36 months and would require two seasons of in-water work to construct the bridge.

The total length of the new bridge would measure approximately 845 feet long, with an up to 83-foot-wide deck consisting of two vehicle lanes, a median, on-street bike lanes, and sidewalks along both sides of the bridge. The bridge would include two fixed-span approach structures that tie into the banks of the river; the structures would be approximately 200 feet in length on the West Sacramento bank and approximately 450 feet in length on the Sacramento bank. Rock slope protection (RSP) would be installed on the river side of the bridge abutments both above and below the ordinary high-water mark (OHWM) to stabilize approximately 400 linear feet of shoreline on each side of the river.

One of three movable span types would be constructed: a vertical lift span, a swing span, or a bascule span. The bridge could be built as any one of the three types. To address the possible impacts of the bridge type that ultimately is built, the largest in- and over-water footprint and the greatest number of construction-related impacts of the three types were assumed for the analysis. Regardless of the bridge type that is constructed over the Sacramento River as part of the proposed project, a bridge fender system would be installed around the movable span piers to protect the piers from errant watercrafts that are navigating along the river.

The project would include a redesigned intersection connection for the bridge, turn pockets for access, reconstructing existing roadways to provide connection, stormwater drainage management features, and utility relocations. Construction of the above-described project would create 2.0 acres of new impervious surface.

RSP would be installed on the river side of the bridge abutments both above and below the OHWM to stabilize the shoreline on each side of the river. The estimated linear feet and area and volume above and below the OHWM are shown in Table 1.

Table 1. Estimated Rock Slope Protection

Location	Linear Feet of Shoreline	Area (square feet)	Area below OHWM (square feet)	Volume below OHWM (cubic yards)	Volume above OHWM (cubic yards)
West Sacramento shoreline	426	31,033	12,833	1,569	2,224
Sacramento Shoreline	398	27,589	11,293	1,380	1,992
Total	824	58,622	24,126	2,949	4,216

Temporary trestles and barges would be used to provide the contractor with access to the river portion of the project area. Together, the trestles and barges would be used to stage construction materials, to provide a working platform for cranes, and for general construction support. The temporary trestles would consist of steel piles that would be driven into place with an impact hammer. Although the temporary work platforms would be removed at the end of the first construction season before the onset of winter, the temporary trestle piles would remain in place for the duration of construction. The barges would be anchored to the river bottom with piles that would be driven into place with an impact hammer. Up to two barges would be anchored in the river at one time. The barges would be repositioned in the channel throughout construction only as needed to complete the work. The barges and temporary piles would be removed after bridge construction is completed.

In-water construction activities consist of those that would occur below the OHWM. The activities would be limited to the period of May 1 to November 30 during the two construction seasons. The in-water construction window allows sufficient time for most in-water work to be completed within the first "in-water work season," thus limiting potential impacts on fish and other species from the activities to primarily one construction season. Other construction activities occurring above the OHWM (*e.g.*, work on the abutments and approach superstructure) would not be limited to the in-water window of May 1 to November 30.

Temporary falsework platforms would be required to construct the proposed bridge foundations and approach structures. The platforms would be constructed using temporary piles within the river. In addition, temporary cofferdams would be required to construct the bridge piers within the water. The cofferdams would consist of temporary sheet piles installed around the individual piers. Dewatering inside the cofferdams would be required, and a total of 0.15 acres is anticipated to be dewatered. In-water construction activities would include the following.

- Installation and removal of steel piles with a vibratory hammer and an impact hammer for the temporary falsework platforms (trestles).

- Installation and removal of steel piles with an impact hammer for anchoring barges.

- Installation of steel sheet piles with a vibratory driver for temporary cofferdams.

- Installation of steel piles for the piers with an impact hammer for the new bridge (although work would occur within dewatered cofferdams, underwater sound would propagate beyond the dewatered cofferdams).

- Installation of steel casings for the piers with a vibratory hammer or hydraulic oscillator/rotator system for the new bridge.

- Installation of concrete piles with an impact hammer for the new bridge fender system.

After the temporary cofferdams are installed around the piers, forms would be constructed and concrete poured into the dewatered cofferdams to construct the pile caps. Work then would focus on the pier column construction. After the casings are installed, a rebar cage would be placed into the pile, and concrete would be poured into the steel shell. A cast-in-place concrete pier cap would be placed atop the columns to serve as the substructure. Work then would focus on constructing the approach superstructure. The movable span superstructure would be constructed offsite, floated in, and erected when construction of the foundations is completed.

During construction, the construction contractor would be required to use temporary best management practices (BMPs, described in Section 1.3.1) to control any runoff or erosion from the project site into the surrounding storm drain systems and waterways in order to be compliant with local, state, and federal water quality regulations. Temporary BMPs would be installed prior to any construction operations and would be in place for the duration of the contract. Removal of the temporary BMPs would be the final operation, along with project site cleanup.

Stormwater and road runoff drainage for operation of the proposed roadway would be conveyed in a new storm drain system installed approximately 5 feet below the finished road grade of South River Road, 15th Street, and Circle Street in West Sacramento and of Broadway in Sacramento. New storm drain outfalls into the Sacramento River would be constructed near each of the bridge abutments in West Sacramento and Sacramento.

Staging areas would be used to store materials and equipment during construction, such as pipe materials, precast manholes and drop inlets, steel girders, piles, and rebar, along with construction equipment when not in use. Staging areas would be in use throughout the construction duration. The staging areas consist of areas already developed, and no ground-disturbing activities will take place at these locations.

1.3.1. Avoidance and Minimization Measures

Measure 1: Install Orange Construction Fencing between the Construction Area and Adjacent Sensitive Biological Resources

- The project proponent or their contractor will install orange construction fencing between the construction area and adjacent sensitive biological resource areas.

- Barrier fencing around sensitive biological resource areas will be installed as one of the first orders of work and prior to equipment staging. Before construction begins, the construction contractor will work with the project engineer and a resource specialist to identify the locations for the orange construction fencing and will place stakes around the sensitive resource sites to indicate these locations. The protected areas will be designated as environmentally sensitive areas and clearly identified on the construction plans and described in the specifications.

- Barrier fencing will be installed before construction activities are initiated, maintained throughout the construction period, and removed after completion of construction

Measure 2: Conduct Environmental Awareness Training for Construction Employees

- The project proponent will retain a qualified biologist to conduct environmental awareness training for construction crews before project implementation. The awareness training will be provided to all construction personnel and will brief them on the need to avoid effects on sensitive biological resources.

- The education program will include a brief review of the special-status species with the potential to occur in the action area (including their life history, habitat requirements, and photographs of the species). The training will identify the portions of the action area in which the species may occur, as well as their legal status and protection. The program also will cover the restrictions and guidelines that must be followed by all construction personnel to reduce or avoid effects on these species during project implementation. This will include the steps to be taken if a sensitive species is found within the construction area (*i.e.*, notifying the crew foreman, who will call a designated biologist).

- An environmental awareness handout that describes and illustrates sensitive resources to be avoided during project construction and identifies all relevant permit conditions will be provided to each crew member.

- Education programs will be conducted for appropriate new personnel as they are brought on the job during the construction period.

Measure 3: Conduct Periodic Biological Monitoring

- The project proponent will retain a qualified biological monitor for the project, who will visit the site a minimum of once per week to ensure that fencing around environmentally sensitive areas is intact and ensure that activities are being conducted in accordance with the agreed upon project schedule and agency conditions of approval. The monitor will provide the project proponent with a monitoring log for each site visit.

- Certain activities will require the presence of a biological monitor for the duration of the activity or during the initial disturbance of an area to ensure that impacts on special-status

species are avoided. The activities that require specific monitoring are identified in the measures below:

Measure 4: Monitor Turbidity in the Sacramento River

- The project proponent will require their contractor to monitor turbidity levels in the Sacramento River during in-water construction activities (*e.g.*, pile driving, extraction of temporary sheet piles used for cofferdams, and placement of RSP).

- Turbidity will be measured using standard techniques upstream and downstream of the construction area to determine whether changes in ambient turbidity levels exceed the thresholds derived from the Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board Central Valley Region (Central Valley Regional Water Quality Control Board 2018). If it is determined that turbidity levels exceed the Basin Plan thresholds, the project proponent or their contractor will adjust work to ensure that turbidity levels do not exceed the Basin Plan thresholds.

Measure 5: Conduct All In-Water Construction Activities between May 1 and November 30 and Only during Daylight Hours

- The project proponent will conduct all in-water construction work, including pile driving (in-water and shore-based within 250 feet of the Sacramento River), installation of cofferdams, removal of temporary sheet piles, and placement of rock revetment, all between May 1 and November 30 to avoid or minimize causing disturbance and injury to, or mortality of, special-status fish species in the affected reaches of the Sacramento River.

- In-water work will be conducted only during daylight hours to provide fish in the affected reaches of the Sacramento River an extended quiet period during nighttime hours for feeding and unobstructed passage.

Measure 6: Implement Measures to Minimize Exceedance of Interim Threshold Sound Levels during Pile Driving

- The project proponent will require their contractor to implement the following measures to minimize the exposure of listed fish species to potentially harmful underwater sounds:

    - The contractor will vibrate all piles to the maximum depth possible before using an impact hammer.

    - No more than 20 piles will be driven per day.

    - During impact driving, the contractor will limit the number of strikes per day to the minimum necessary to complete the work and will limit the total number of hammer strikes to 32,000 strikes per day (*i.e.,* 1,600 hammer strikes per pile, per day) for piles for the temporary trestles, 20,000 strikes per day (*i.e.,* 1,000 hammer strikes per pile, per day) for the piles for the bridge fender system, 12,800 strikes per day (*i.e.,* 1,600 hammer strikes per pile, per day) for piles for

the fixed span piers, and 6,000 strikes per day (*i.e.*, 1.500 strikes per pile, per day) for the cast-in-steel shell piles for the movable span piers.

- During impact driving, the project proponent will require their contractor to use a bubble curtain or dewatered cofferdam to minimize the extent to which the interim peak and cumulative SEL thresholds are reached.

- No pile-driving activity will occur at night, thereby providing fish with an extended quiet period during nighttime hours on days that pile driving is being conducted for feeding and unobstructed passage.

Measure 7: Develop and Implement a Hydroacoustic Monitoring Plan

- The project proponent or their contractor will develop and implement a hydroacoustic monitoring plan. The monitoring plan will be submitted to NMFS for approval before the start of project activities. The plan will include the following requirements.

    - The project proponent or their contractor will monitor underwater noise levels during all impact pile-driving activities on land and in water to ensure that peak and cumulative SELs do not exceed estimated values. Pile driving on any day will cease when monitored sound levels reach the cumulative injury threshold at the predicted attenuation distances.

    - The monitoring plan will describe the methods and equipment that will be used to document the extent of underwater sounds produced by pile driving, including the number, location, distances, and depths of the hydrophones and associated monitoring equipment.

    - The monitoring plan will include a reporting schedule for daily summaries of the hydroacoustic monitoring results and for more comprehensive reports to be provided to the resource agencies on a monthly basis during the pile-driving season.

    - The daily reports will include the number of piles installed per day; the number of strikes per pile; the interval between strikes; the peak sound pressure level (SPL), SEL, and root mean square (RMS) per strike; and the accumulated SEL per day at each monitoring station.

    - The project proponent or their contractor will ensure that a qualified fish biologist is on site during impact pile driving to document any occurrences of stressed, injured, or dead fish. If stressed, injured, or dead fish are observed during pile driving, the project proponent or their contractor will stop work immediately to provide fish an opportunity to move out of the area. In addition, the project proponent will coordinate with Caltrans to immediately consult with NMFS to determine the cause of the incident and whether any and which type of additional protective measures are necessary. Protective measures that are determined necessary to protect listed fish species will be implemented by the project proponent within 72 hours of the incident.

Measure 8: Implement Cofferdam Restrictions

- The following restrictions will be implemented during installation of the cofferdams and cofferdam dewatering.
    - The extent of cofferdam footprints will be limited to the minimum necessary to support construction activities.
    - Sheet piles used for cofferdams will be installed and removed using a vibratory pile driver.
    - Cofferdams will be installed and removed only during the proposed in-water work window (between May 1 and November 30).
    - Cofferdams will not be left in place over winter where they could be overtopped by winter/spring flows and when juveniles of listed species are most likely to be present in the construction area.
    - All pumps used during dewatering of cofferdams will be screened according to CDFW and NMFS guidelines for pumps.
    - Cofferdam dewatering and fish rescue/relocation from within cofferdams will commence immediately following cofferdam closure to minimize the duration that fish are trapped in the cofferdam.

Measure 9: Prepare and Implement a Fish Relocation Plan

- The project proponent or their contractor will develop and implement a fish rescue and relocation plan to recover any fish trapped in cofferdams. The fish rescue and relocation plan will be submitted to NMFS for approval before initiating activities to install cofferdams. At a minimum, the plan will include the following:
    - A requirement that fish rescue and relocation activities will commence immediately after cofferdam closure and that dewatering has sufficiently lowered water levels inside the cofferdams to make it feasible to rescue fish.
    - A description of the methods and equipment proposed to collect, transfer, and release all fish found trapped within cofferdams. Capture methods may include seining, dip netting, and electrofishing, as approved by NMFS. The precise methods and equipment to be used will be developed cooperatively by NMFS and the project proponent or their contractor in advance of project implementation.
    - A requirement that only NMFS-approved fish biologists will conduct the fish rescue and relocation.
    - A requirement that fish biologists will contact NMFS immediately if any listed species are found dead or injured.

- A requirement that a fish rescue and relocation report be prepared and submitted to NMFS within 5 business days following completion of the fish relocation. Data will be provided in tabular form and at a minimum will include the species and number rescued and relocated, approximate size of each fish (or alternatively, approximate size range if a large number of individuals are encountered), date and time of their capture, and general condition of all live fish (*e.g.*, good–active with no injuries; fair–reduced activity with some superficial injuries; poor–difficulty swimming/orienting with major injuries). For dead fish, additional data will include fork length and description of injuries and/or possible cause of mortality if it can be determined.

Measure 10: Develop and Implement a Barge Operations Plan

- The project proponent or their contractor will develop and implement a barge operations plan. The barge operations plan will be submitted to NMFS for approval at least 60 days before the start of project activities. The plan will address the following:
    - Bottom scour from propeller wash.
    - Bank erosion or loss of submerged or emergent vegetation from propeller wash or excessive wake.
    - Accidental material spill.
    - Sediment and benthic community disturbance from accidental or intentional barge grounding or deployment of barge spuds (extendable shafts for temporarily maintaining barge position) or anchors.
    - Hazardous materials spills (*e.g.*, fuel, oil, and hydraulic fluids).
- The barge operations plan will serve as a guide to barge operations and to a biological monitor who will evaluate barge operations during construction with respect to stated performance measures. This plan, when approved by the resource agencies, will be read by barge operators and kept aboard all vessels operating at the construction site.

Measure 11: Prevent the Spread or Introduction of Aquatic Invasive Species

- The project proponent or their contractor will implement the following actions to prevent the potential spread or introduction of aquatic invasive species (AIS) associated with the operation of barges and other in-water construction activities. Species of concern related to the operation of barges and other equipment in the lower Sacramento River include invasive mussels (*e.g.*, quagga mussels [*Dreissena bugensis*] and zebra mussels [*Dreissena polymorpha*]) and aquatic plants (*e.g.*, Brazilian waterweed [*Egeria densa*] and hydrilla [*Hydrilla verticillata*]) (California Department of Fish and Game 2008).
    - Educate construction supervisors and managers about the importance of controlling and preventing the spread of AIS.

- Train vessel and equipment operators and maintenance personnel in the recognition and proper prevention, treatment, and disposal of AIS.
- Prior to departure of vessels from their place of origin, and before in-water construction equipment is allowed to operate within the waters of the Sacramento River, thoroughly inspect and remove and dispose of all dirt, mud, plant matter, and animals from all surfaces that are submerged or may become submerged, or places where water can be held and transferred to the surrounding water.

Measure 12: Minimize or Avoid Permanent Bridge Lighting from Directly Radiating on Water Surfaces of the Sacramento River

- Nighttime lighting of the bridge structure for aesthetic purposes will be minimized. The minimal amount of light necessary to safely and effectively illuminate vehicular, bicycle, and pedestrian traffic on the bridge will be used.

- Lights will be shielded and focused away from the water surface.

Measure 13: Compensate for Temporary Effects on and Permanent Loss of Riparian Forest (Including SRA Cover)

The project proponent will compensate for the permanent loss of up to 1.273 acres of riparian forest. In addition, any unavoidable temporary loss of riparian forest will be mitigated. The project proponent will implement onsite and, if necessary, offsite compensation measures and/or purchase mitigation bank credits to compensate for losses of cottonwood riparian forest on the waterside slope of the existing levees, including riparian forest supporting Shaded Riparian Aquatic (SRA) cover habitat. Onsite compensation will be used as conditions allow. Compliance with the USACE levee vegetation policy (U.S. Army Corps of Engineers 2014), the ULDC (California Department of Water Resources 2012), or other engineering constraints may limit the ability to achieve full onsite compensation. Therefore, offsite compensation and/or purchase of mitigation bank credits may be needed to achieve no net loss of existing in-kind riparian and SRA cover habitat values. Each of these options is discussed below.

1. Onsite and/or Offsite Restoration and Enhancement along the Sacramento River
   Riparian habitat restoration and/or enhancement onsite or offsite should occur in the same year construction is completed. For onsite or offsite replacement plantings, the project proponent will prepare a mitigation planting plan, including a species list and number of each species, planting locations, and maintenance requirements. Plantings will consist of cuttings taken from local plants or plants grown from local material. Planted species for the mitigation plantings will be similar to those removed from the project area and will include native species, such as Fremont's cottonwood, valley oak, black willow, boxelder, Oregon ash, and black walnut. The final planting plan will be developed based on results of the arborist survey for species to be removed plantings will be fitted with exclusion cages or other suitable protection from herbivory. Plantings will be irrigated for up to 3 years or until established. Plantings will be monitored annually for 3 years or as required in the project permits. If 75% of the plants survive at the end of the monitoring period, the revegetation will be considered successful. If the

survival criterion is not met at the end of the monitoring period, planting and monitoring will be repeated after mortality causes have been identified and corrected.

2. Mitigation Bank Credit Purchase
   If this option is chosen, the project proponent will provide written evidence to the resource agencies that compensation has been established through the purchase of mitigation credits. The amount to be paid will be the fee that is in effect at the time the fee is paid. Mitigation can be in the form of creation and/or preservation credits. If mitigation is in the form of restoration/creation credits, the mitigation will be at a minimum ratio of 1:1 (1 acre of restored or created riparian habitat for each acre of riparian habitat removed). If mitigation is in the form of preservation credits, the mitigation will be at a minimum ratio of 2:1 (2 acres of preserved riparian habitat for each acre of riparian habitat removed). The project proponent will purchase riparian habitat credits from an approved mitigation bank near the project, such as the Liberty Island Conservation Bank, Cosumnes Floodplain Mitigation Bank, Fremont Landing Conservation Bank, or other approved bank with available riparian forest credits at the time of project permitting.

In addition to mitigating the loss of riparian forest habitat, specific measures will be included to satisfy NMFS requirements and compensate for the loss of SRA cover (area and linear feet). The acreage will not be duplicated, such that the acreage of riparian forest habitat restored for SRA cover mitigation will apply toward riparian forest habitat mitigation requirements. SRA cover mitigation will include the following riparian replacement requirements:

- Replace the permanent loss of 302 linear feet and up to 0.368 acre of affected SRA cover vegetation at a 3:1 replacement ratio (*i.e.,* 3 linear feet replaced for every 1 foot affected and 3 acres replaced for every 1 acre affected) by planting native riparian trees in temporary impact areas and along existing onsite or offsite unshaded banks along the Sacramento River.

- Plant native riparian trees onsite to the maximum extent practicable, followed by planting on adjacent reaches of the Sacramento River.

- Plant riparian trees that are intended to provide SRA cover along the water's edge at summer low flows up to the OHWM and at sufficient densities to provide shade along at least 85% of the bank's length when the trees reach maturity. This will ensure that riparian plantings intended for SRA cover mitigation will contribute to instream SRA cover when they are inundated during winter/spring flows and overhead cover (shade) during summer flows when they approach maturity.

- Monitor and evaluate the revegetation success of riparian plantings intended for SRA cover mitigation as described above (3 years of monitoring).

- If mitigation for SRA cover is in the form of offsite mitigation bank credits, credits will need to be purchased from an approved mitigation bank within the approved service area for the project that provides riparian forest floodplain conservation credits as offsite compensation for impacts on state- and federally listed fish species, designated critical habitat, and EFH for Pacific salmon.

Measure 14: Purchase Channel Enhancement Credits for Impacts on Critical Habitat

- Permanent impacts on critical habitat (bank and substrate below the OHWM and water column habitat), totaling 1.87 acres (up to 57,600 square feet [1.32 acre] from bridge shading of aquatic habitat and new bridge piers; 24,126 square feet [0.55 acre] from RSP; and 84 square feet (0.002 acre) from bridge fender system) will be mitigated at a 3:1 ratio, totaling 5.61 acres.

- The project proponent proposes to mitigate the permanent loss of critical habitat for listed fish species through purchase of 5.61 acres of mitigation credits at a NMFS-approved anadromous fish bank.

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.

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 incidental take statement (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. See Table 2 for species and Table 3 for critical habitat information.

Table 2. Description of species, current Endangered Species Act (ESA) listing classifications, and summary of species status.

Species	Listing Classification and Federal Register Notice	Status Summary
Sacramento River winter-run Chinook salmon ESU	Endangered, 70 FR 37160; June 28, 2005	According to the NMFS 5-year species status review (NMFS 2016c), the status of the winter-run Chinook salmon ESU, the extinction risk has increased from moderate risk to high risk of extinction since the 2007 and 2010 assessments. Based on the Lindley *et al.* (2007) criteria, the population is at high extinction risk in 2019. High extinction risk for the population was triggered by the hatchery influence criterion, with a mean of 66 percent hatchery origin spawners from 2016 through 2018. Several listing factors have contributed to the recent decline, including drought, poor ocean conditions, and hatchery influence. Thus, large-scale fish passage and habitat restoration actions are necessary for improving the winter-run Chinook salmon ESU viability.
Central Valley spring-run Chinook salmon ESU	Threatened, 70 FR 37160; June 28, 2005	According to the NMFS 5-year species status review (NMFS 2016b), 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 and 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 2016 drought, uncertain juvenile survival during the drought are likely increasing the ESU's extinction risk. Monitoring data showed sharp declines in adult returns from 2014 through 2018 (CDFW 2018).

Species	Listing Classification and Federal Register Notice	Status Summary
California Central Valley steelhead DPS	Threatened, 71 FR 834; January 5, 2006	According to the NMFS 5-year species status review (NMFS 2016a), the status of CCV steelhead appears to have remained unchanged since the 2011 status review that concluded that the DPS was in danger of becoming endangered. Most natural-origin 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 natural-origin 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 DPS of North American green sturgeon	Threatened, 71 FR 17757; April 7, 2006	According to the NMFS 5-year species status review (NMFS 2015) and the 2018 final recovery plan (NMFS 2018b), some threats to the species have recently been eliminated, such as take from commercial fisheries and removal of some passage barriers. Also, several habitat restoration actions have occurred in the Sacramento River Basin, and spawning was documented on the Feather River. However, the species viability continues to face a moderate risk of extinction because many threats have not been addressed, and the majority of spawning occurs in a single reach of the main stem Sacramento River. Current threats include poaching and habitat degradation. A recent method has been developed to estimate the annual spawning run and population size in the upper Sacramento River so species can be evaluated relative to recovery criteria (Mora *et al.* 2018).

Table 3. Description of critical habitat, listing, and status summary.

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); 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. The designation includes the river water, river bottom and adjacent riparian zones used by fry and juveniles for rearing. 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; 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 SR winter-run 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. PBFs considered essential to the conservation of the species include: Spawning habitat; freshwater rearing habitat; freshwater migration corridors; and estuarine areas. 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.
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, 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. PBFs considered essential to the conservation of the species include: Spawning habitat; freshwater rearing habitat; freshwater migration corridors; and estuarine areas. 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 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. Recovery Plans

In July 2014, NMFS released a final Recovery Plan for Sacramento River (SR) winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead (NMFS 2014, Recovery Plan). The Recovery Plan outlines actions to restore habitat and access, and improve water quality and quantity conditions in the Sacramento River to promote the recovery of listed salmonids. Key recovery actions in the Recovery Plan include conducting landscape-scale restoration throughout the Delta, incorporating ecosystem restoration into Central Valley flood control plans that includes breaching and setting back levees, and restoring flows throughout the Sacramento and San Joaquin River basins and the Delta. In August 2018, NMFS released a final Recovery Plan for the sDPS green sturgeon (NMFS 2018), which focuses on fish screening and passage projects, floodplain and river restoration, and riparian habitat protection in the

Sacramento River Basin, the Delta, San Francisco Estuary, and nearshore coastal marine environment as strategies for recovery.

2.2.2. Global Climate Change

One major factor affecting the rangewide status of the threatened and endangered anadromous fish in the Central Valley and aquatic habitat at large is climate change. Warmer temperatures associated with climate change reduce snowpack and alter the seasonality and volume of seasonal hydrograph patterns (Cohen *et al.* 2000). Central California has shown trends toward warmer winters since the 1940s (Dettinger and Cayan 1995). 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).

For winter-run Chinook salmon, the embryonic and larval life stages that are most vulnerable to warmer water temperatures occur during the summer, so this run is particularly at risk from climate warming. Spring-run Chinook salmon adults are vulnerable to climate change because they over-summer in freshwater streams before spawning in autumn (Thompson *et al.* 2011). Spring-run Chinook salmon spawn primarily in the tributaries to the Sacramento River, and those tributaries without cold water refugia (usually input from springs) will be more susceptible to impacts of climate change. Although steelhead will experience similar effects of climate change to Chinook salmon, as they are also blocked from the vast majority of their historic spawning and rearing habitat, the effects may be even greater in some cases, as juvenile steelhead need to rear in the stream for one to two summers prior to emigrating as smolts. In the Central Valley, summer and fall temperatures below the dams in many streams already exceed the recommended temperatures for optimal growth of juvenile steelhead, which range from 14°C to 19°C (57°F to 66°F). The Anderson Cottonwood Irrigation Dam (ACID) is considered the upriver extent of green sturgeon passage in the Sacramento River. The upriver extent of green sturgeon spawning, however, is approximately 30 kilometers downriver of ACID where water temperature is higher than ACID during late spring and summer. Thus, if water temperatures increase with climate change, temperatures adjacent to ACID may remain within tolerable levels for the embryonic and larval life stages of green sturgeon, but temperatures at spawning locations lower in the river may be more affected.

In summary, observed and predicted climate change effects are generally detrimental to the species (McClure 2011, Wade *et al.* 2013), so unless offset by improvements in other factors, the status of the species and critical habitat 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).

In general, the project limits start in West Sacramento, along 15th Street at Jefferson Boulevard, continuing east and over the Sacramento River into the City of Sacramento along Broadway to the 5th Street intersection. The project limits also extend along the following roads: Jefferson Boulevard (approximately 1,300 feet south of the 15th Street intersection to Alameda Boulevard), South River Road (approximately 1,300 feet south and 650 feet north of 15th Street), Marina View Drive (approximately 400 feet south of Broadway), Front Street (approximately 350 feet north and south of Broadway), 3rd Street (approximately 350 feet north of Broadway to X Street), and 5th Street (approximately 200 feet north and south of Broadway). The project limits include proposed improvements to the northbound Interstate 5 (I-5) off-ramp to Broadway. Within these limits, the action area includes portions of the Sacramento River within the OHWM that are used by SR winter run Chinook salmon, CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon where these fish could potentially be exposed to construction-related effects, including changes in water turbidity, sedimentation, near-shore impacts to riparian habitat, the acoustic sounds of pile driving within the water column and the area of potential fish relocation actions.

The action area includes areas both upstream and downstream from pile-driving activity in which pile-driving noise may have a physical or behavioral effect on listed species. Based on an analysis of sound expected to be generated the cumulative sound exposure level (SEL) interim criteria of 183 decibels (dB) could be exceeded for a distance of up to 7,067 feet (2,154 meters) upstream and downstream from the source pile. Although noise levels could exceed background levels beyond that point, a distance to any lesser threshold (*i.e.*, 150 dB root mean square, which is used as a behavioral threshold) cannot be realistically predicted because of the physical geography of the river. The Sacramento River has river channel bends, and the straight-line distance of open water is 6,000 feet upstream and 1,900 feet downstream of the proposed bridge crossing. Therefore, to account for the diffraction and attenuation of sound levels beyond the major river bends upstream and downstream from the proposed bridge crossing, the action area for this project is defined as the entire width of the Sacramento River channel and extending 2,000 feet beyond the straight-line, open-water distances (*i.e.*, a buffer) upstream and downstream of the proposed bridge, or 8,000 feet upstream and 3,900 feet downstream from the proposed bridge crossing (*i.e.*, from approximately river mile [RM] 57 to approximately RM 59.5).

Since the proposed action includes the purchase of mitigation credits from a conservation bank, the action area also includes the areas affected by mitigation banks that have service areas relevant to the Project areas. These include the Fremont Landing Conservation Bank, which is a 100-acre site along the Sacramento River; Bullock Bend Mitigation Bank, which is a 116.15-acre site along the Sacramento River; Liberty Island Conservation Bank, which is a 186-acre site located at the southern end of the Yolo Bypass on Liberty Island in the Delta; and the North Delta Fish Conservation Bank, which is an 811-acre site located in Yolo County in the Delta.

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).

The action area consists of the Sacramento River and riparian forest along the Sacramento River. The Sacramento River within the action area has a relatively high level of historical and ongoing disturbance. Despite the historical and ongoing disturbance, the action area supports numerous listed species, including SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, sDPS green sturgeon. The action area is within designated critical habitat for all of the above listed species. Due to the life history timing of these species, it is possible for one or more of the following life stages to be present within the action area throughout the year: adult migrants, rearing juveniles, or emigrating juveniles.

2.4.1. Hydrology

The Sacramento River has undergone many changes from its historical condition. The magnitude and duration of peak flows during the winter and spring, which affect listed salmonids and sturgeon in the action area, are reduced by water impoundment in upstream reservoirs. Instream flows during the summer and early fall months have increased over historic levels for deliveries of municipal and agricultural water supplies. Overall, water management now reduces natural variability by creating more uniform flows year-round. Current flood control practices require peak flood discharges to be held back and released over a period of weeks to avoid overwhelming the flood control structures downstream of the reservoirs (*i.e.*, levees) and low lying terraces under cultivation (*i.e.*, orchards and row crops) in the natural floodplain along the basins' tributaries. Consequently, managed flows in the main stem of the rivers often truncate the peak of the flood hydrograph and extend the reservoir releases over a protracted period. These actions reduce or eliminate the scouring flows necessary to mobilize sediments and create natural riverine morphological features. Furthermore, the unimpeded river flow is severely reduced by the combined storage capacity of the different reservoirs located throughout the watershed. Very little of the natural hydrologic input is allowed to flow through the reservoirs to the valley floor sections of the tributaries leading to the Delta. Most is either stored or diverted for anthropogenic uses.

2.4.2. Water Quality

The main sources of water in the Sacramento River below Keswick Dam are rain and snowmelt that collect in upstream reservoirs and are released in response to water needs or flood control. The quality of surface water in the Sacramento River within the action area is also influenced by other human activities along the downstream of the dam, including historical mining, agricultural, and municipal and industrial activities.

The quality of water in the Sacramento River is relatively good; only during conditions of stormwater-driven runoff are water quality objectives typically not met (Domagalski *et al.* 2000). Water quality issues within the Sacramento River include the presence of mercury, pesticides

such as organochlorine, trace metals, turbidity, and toxicity from unknown origin (CALFED 2000). Point sources and non-point sources of pollution resulting from agricultural discharge and urban and industrial development occur upstream of the action area. Environmental stresses resulting from low water quality can lower reproductive success and may account for low productivity rates in fish. Organic contaminants from agricultural drain water, urban and agricultural runoff from storm events, and high trace element (*i.e.*, heavy metals) concentrations may deleteriously affect early life-stage survival of fish in the Central Valley watersheds (USFWS 2015).

2.4.3. Predation

Sacramento pikeminnow and striped bass congregate in RSP and overwater structure along the Sacramento River and prey on juvenile salmon. The Sacramento pikeminnow is a species native to the Sacramento River basin and has co-evolved with the anadromous salmonids in this system. However, rearing conditions in the Sacramento River today (*e.g.*, warm water, low-irregular flow, standing water, and water diversions) compared to its natural state and function decades ago in the pre-dam era, are more conducive to warm water species, such as Sacramento pikeminnow and striped bass than to native salmonids. Tucker *et al.* (1998) reported that predation during the summer months by Sacramento pikeminnow on juvenile salmonids increased to 66 percent of the total weight of stomach contents in the predatory pikeminnow.

2.4.4. Fisheries and Aquatic Habitat

The mainstem Sacramento River is an important migration corridor for adult and juvenile SR winter-run Chinook salmon, CV spring-run Chinook salmon and CCV steelhead. Green sturgeon utilize the upper Sacramento River as a migratory corridor, as well as for spawning and juvenile rearing. Shasta and Keswick Dams have presented impassable barriers to anadromous fish since 1944 (Billington *et al.* 2005). ACID Dam and RBDD presented partial barriers to salmonid migration until improvements were made in 2001 and 2012 (NMFS 2009, 2014a), respectively, although ACID Dam continues to present an impassable barrier to green sturgeon (NMFS 2009).

2.4.4.1. SR winter-run Chinook salmon

The distribution of SR winter-run Chinook salmon spawning and rearing is currently limited to the upper Sacramento River, with managed flows out of Shasta Dam. Approximately 299 miles of tributary spawning habitat in the upper Sacramento River above the dams is now inaccessible to SR winter-run Chinook salmon (NMFS 2014). The proportion of the SR winter-run Chinook salmon spawning above ACID has increased since the ladder improvements in 2001 (CDFW 2014 unpublished aerial redd counts). Data on the temporal distribution of SR winter-run Chinook salmon upstream migration suggest that in wet years about 50 percent of the run has passed the RBDD by March, and in dry years, migration is typically earlier, with about 72 percent of the run having passed the RBDD by March (Poytress *et al.* 2014). The upper Sacramento River contains the only remaining habitat that is currently used by spawning SR winter-run Chinook salmon. As reported by NMFS (2014a), historical SR winter-run Chinook salmon population estimates were as high as over 230,000 adults in 1969, but declined to under 200 fish in the 1990s (Good *et al.* 2005). A rapid decline occurred from 1969 to 1979 after completion of the RBDD. Over the next 20 years, the population eventually reached a low point

of only 186 adults in 1994. At that point, SR winter-run Chinook salmon were at a high risk of extinction, as defined by Lindley *et al.* (2007). However, several conservation actions, including a very successful conservation hatchery and captive broodstock program at Livingston Stone National Fish Hatchery (LSNFH), construction of a temperature control device (TCD) on Shasta Dam, maintaining the RBDD gates up, and restrictions in ocean harvest, have likely prevented the extinction of natural-origin SR winter-run Chinook salmon. LSNFH, which is located at the base of Keswick Dam, annually supplements the in-river production by releasing on average 180,000 SR winter-run Chinook salmon smolts into the upper Sacramento River. The LSNFH operates under strict guidelines for propagation that include genetic testing of each pair of adults and spawning no more than 10 percent of the hatchery returns. This program and the captive broodstock program were instrumental in stabilizing the SR winter-run Chinook salmon population following very low returns in the 1990s.

Since carcass surveys began in 2001, the highest adult escapement occurred in 2005 and 2006 with 15,839 and 17,296, respectively. Since 2007 SR winter-run Chinook salmon have declined in abundance with a low of 827 spawning adults in 2011 (NMFS 2016c). As reported in the most recent 5-year status review (NMFS 2016c), the 10-year trend in run size is -0.15, which suggests an annual 15% population decline. This declining trend is likely due to a combination of factors, such as poor ocean productivity (Lindley *et al.* 2009), drought conditions from 2007 to 2009 and 2012 to 2015, and low in-river survival (NMFS 2016c).

The 2012 to 2015 drought increased water temperatures in the upper Sacramento River. This caused significantly higher mortality (95-97%) in the upper spawning area. Due to the lower-than-average survival in the drought, hatchery production from the LSNFH conservation program was increased to offset the impact on the naturally spawning fish. Adult SR winter-run Chinook salmon returns in 2016 to 2018 were low, as expected, due to poor in-river conditions for juveniles from brood years 2013-2015 during drought years. The 2018 adult SR winter-run Chinook salmon escapement estimate (2,458) improved from 2017 (1,155), though was similarly dominated by hatchery-origin fish. An estimated 85 percent of the adult SR winter-run Chinook salmon spawners in 2017 were hatchery-origin fish from LSNFH (K. Offill, USFWS, Red Bluff, CA, unpublished data), evidence that the emergency measures enacted at LSNFH were successful at avoiding a complete year-class failure and substantially benefited the abundance of spawners in 2017.

2.4.4.2. CV spring-run Chinook salmon

The mainstem of the Sacramento River serves as a primary upstream and downstream migratory corridor for CV spring-run Chinook salmon populations in Butte, Clear, Battle, and Cottonwood Creeks. Within the mainstem Sacramento River, the CV spring-run Chinook salmon population appears to have declined from a high of 25,000 in the 1970s to an average low of less than 800 counted at RBDD beginning in 1991. Significant hybridization with fall-run has made identification of a CV spring-run Chinook salmon population in the mainstem very difficult to determine, and there is speculation as to whether a true CV spring-run Chinook salmon population still exists below Keswick Dam within the mainstem of the Sacramento River.

This shift may have been an artifact of the manner in which CV spring-run Chinook salmon were identified at RBDD. More recently, fewer CV spring-run Chinook salmon were counted at

temporary trestles and work platforms, the sixteen 16-inch spud piles for the barges, the twenty to forty (depending on bridge type) 16- inch steel pipe piles in water for the two in-water piers, the forty 16-inch steel pipe piles on land for the two in-levee abutments, the six to eighteen (depending on bridge type) 60-inch cast-in-steel shell (CISS) piles for the two in-water piers for the movable span, and the sixty 14-inch square concrete or 16-inch steel pipe piles for the bridge fender system. Additional sources of underwater noise associated with the project would occur during installation and removal of temporary sheet piles with a vibratory hammer for the temporary cofferdams used to isolate the in-water construction areas for bridge piers. Only driving of piles with an impact hammer is expected to produce sound levels that could result in injury to fish. A summary of pile driving activities (location, timing and duration) with potential to affect fish can be found in Table 4.

Table 4. Pile Driving Activities with potential to affect listed fish species.

Activity	Location	Approximate Timing	Approximate Duration (days)
Vibratory and impact driving of 16-inch steel pipe or H piles for construction trestle	On land and in water	Season 1, May 3–May 21	20
Vibratory and impact driving of 16-inch steel pipe piles for temporary barges	In water	Seasons 1 and 2, May 1–October 27	10
Vibratory driving of sheet piles for cofferdams	In water	Season 1, May 24–June 4	12
Vibratory and impact driving of 16-inch steel pipe piles for fixed span (piers 4 and 5)	In water	Season 1, June 7–June 11	5
Vibratory and impact driving of 16-inch steel pipe piles for abutments 1 and 6	On land	Season 1, June 8–June 14	5
Removal of sheet piles with vibratory driver	In water	Season 1, July 12–July 23	12
Vibratory and impact driving of 60-inch cast in steel shell piles for movable span (piers 2 and 3)	In water	Season 1, May 24–August 13	10
Vibratory and impact driving of 14-inch concrete or 16-inch steel pipe piles for bridge fender system	In water	Season 2, September 25–October 6	6

Activity	Location	Approximate Timing	Approximate Duration (days)
Removal of 16-inch steel pipe or H piles for construction trestle with vibratory driver	In water	Season 2, September 25–October 17	20

Noise levels for unattenuated impact pile driving are as follows. Attenuated noise levels are summarized in Table 5:

Temporary Trestle Piles

Two temporary construction trestles would be installed to support work platforms during construction, one extending from the Sacramento bank and the other extending from the West Sacramento bank of the river. Each trestle would require piles to be driven on land and in the water. Two pile types may be used: 16-inch diameter steel pipe piles and 16-inch steel H-piles. This assessment assumes that 10 to 20 piles would be installed per day and that each pile would require approximately 800 blows to install. Installation of the trestle piles would occur during the first in-water construction season (May 1 to November 30) and would require an estimated 3 weeks to complete. For the piles driven on land, peak SPLs exceeding the injury threshold are predicted to occur within less than 10m for the 16-inch-diameter steel pipe piles and the 16-inch-diameter steel H-piles. Cumulative SELs exceeding the 183-dB and 187-dB injury thresholds are predicted to occur within a radius of 251m from the 16-inch steel pipe piles and 100m from the 16-inch steel H-piles, assuming an unimpeded propagation path. These potential impacts would occur over a period of approximately 2 days.

For the piles in water, peak SPLs exceeding the injury threshold are predicted to occur within 14m for the 16-inch-diameter steel pipe piles and within less than 10m for the 16-inch diameter steel H-piles. The use of an attenuation device is expected to reduce these distances to 10m or less. Cumulative SELs exceeding the 183-dB and 187-dB injury thresholds are predicted to occur within a radius of 541m from the 16-inch steel pipe piles and 215m from the 16-inch steel H-piles, assuming an unimpeded propagation path. The use of an attenuation device is expected to reduce these distances for the respective piles by slightly more than 50 percent. These potential impacts could occur over a period of approximately 24 days.

Noise levels exceeding the behavioral threshold of 150 dB RMS would theoretically extend thousands of feet from pile-driving activities, assuming an unimpeded propagation path. However, river bends located approximately 1,900 feet downstream (579m) and approximately 6,000 feet (1,828m) upstream of the pile driving activity likely would limit the extent of these noise levels. These potential impacts could occur over a period of 4 days.

Temporary Barge Piles

Four temporary construction barges would be used to facilitate bridge construction. Each barge would require four spud piles to be driven in the water to anchor the barge. Temporary barge

piles will be 16-inch diameter steel pipe piles. A total of 4 to 16 piles would be installed on a single day and that each pile would require approximately 800 blows to install. Installation of the spud piles would occur during the first and second in-water construction seasons (May 1 to November 30) and would require approximately 1 week to complete. For spud piles in water, peak SPLs exceeding the injury threshold are predicted to occur within 14m. The use of an attenuation device is expected to reduce this distance to 10m or less. Cumulative SELs exceeding the 183-dB and 187-dB injury thresholds are predicted to occur within a radius of 401 and 1541m, respectively, from the pile, on the days one barge (four piles) is anchored, assuming an unimpeded propagation path. The use of an attenuation device is expected to reduce these distances by slightly more than 50 percent. If two or more barges (8 to 16 piles) are anchored in a single day, then cumulative SELs exceeding the 183-dB and 187-dB injury thresholds are predicted to occur within a radius of 540m from the pile, assuming an unimpeded propagation path. The use of an attenuation device is expected to reduce these distances by slightly more than 50 percent. These potential impacts could occur on 1 or more days throughout each construction season as the barges are periodically repositioned to support construction activities.

Noise levels exceeding the behavioral threshold of 150 dB RMS theoretically would extend thousands of feet from pile-driving activities, assuming an unimpeded propagation path, regardless of whether one or more barges are anchored on the same day. However, river bends located approximately 1,900 feet (579m) downstream and approximately 6,000 feet (1,829m) upstream of the pile-driving activity likely would limit the extent of these noise levels. These potential impacts could occur on 1 or more days throughout each construction season as the barges are periodically repositioned to support construction activities.

Permanent Bridge Piles

Two types of piles will be used for permanent bridge piles. 60-inch-diameter CISS piles for the movable span and 16-inch diameter steel pipe piles for the in-water piers and the two in-levee abutments. The number of piles that would be installed will be dependent on the bridge type design. This assessment assumes that the bascule bridge would require twelve 60-inch CISS piles, the vertical lift bridge would require six to eight 60-inch CISS piles, and the swing bridge would require eighteen 60-inch CISS piles. It also was assumed that from two to four piles would be driven per day and that each pile would require approximately 1,500 blows to install. For the 16-inch steel pipe piles, 20 piles would be required for the in-water piers for the swing bridge, and 40 piles would be required for the in-water piers for both the bascule and vertical lift bridges. All three bridge types would require 40 16-inch steel pipe piles for the in-levee abutments.

60-inch CISS Piles

For the 60-inch CISS piles, peak SPLs exceeding the injury threshold are predicted to occur within 18m. The use of an attenuation device is expected to reduce this distance to 10m or less. Cumulative SELs exceeding the 183-dB and 187-dB injury thresholds are predicted to occur within a radius of 2154m, assuming an unimpeded propagation path. The use of an attenuation device is expected to reduce this distance by more than 50 percent. Noise levels exceeding the behavioral threshold of 150 dB RMS would theoretically extend 10,000m from pile driving activities, assuming an unimpeded propagation path. The use of an attenuation device is expected

to reduce this distance by approximately 50 percent. River bends located approximately 1,900 feet (579m) downstream and approximately 6,000 feet (1,829m) upstream of the proposed location of pile driving activity would likely limit the extent of these noise levels.

Although the distances to injury and behavioral thresholds would be the same for the movable span for all three bridge types, potential impacts on fish associated with piers 2 and 3 would vary by bridge type because of the different number of piles required to construct the fixed spans of each of these three bridge types. For example, potential impacts on fish during construction of the fixed spans would occur over a period of approximately 6 days for the bascule bridge, approximately 4 days for the vertical lift bridge, and approximately 9 days for the swing bridge.

16-inch Steel Pipe Piles

For the 16-inch steel pipe piles on land, peak SPLs exceeding the injury threshold are predicted to occur within a radius of less than 10m from pile-driving activities. Cumulative SELs exceeding the 183-dB and 187-dB injury thresholds are predicted to occur within a radius of 251m, assuming an unimpeded propagation path. Noise levels exceeding the behavioral threshold of 150 dB RMS would extend 1,585m from pile-driving activities, assuming an unimpeded propagation path. River bends located approximately 1,900 feet (579m) downstream and approximately 6,000 feet (1829m) upstream of the proposed location of pile-driving activity likely would limit the extent of these noise levels. The distances to injury and behavioral thresholds associated with abutments 1 and 6 would be the same for all three bridge types because the same number of piles would be required to construct all of the three bridge types. Potential impacts could occur over a period of 10 days for all three bridge types.

Bridge Fender Piles

The bridge fender system will use either/both 14-inch-square concrete piles and 16-inch-diameter steel pipe piles. The only difference between the two approaches is the size and type of pile material; the same number of piles would be installed regardless of the type of pile used.

For the 14-inch-square concrete piles in water, peak SPLs exceeding the injury threshold are predicted to occur within a radius of 14m from pile-driving activities. The use of an attenuation device is expected to reduce this distance to 10m or less. Cumulative SELs exceeding the 183-dB and 187-dB injury thresholds are predicted to occur within a radius of 36m, assuming an unimpeded propagation path. The use of an attenuation device is expected to reduce this distance by approximately 50 percent. These potential impacts could occur over a period of 6 days.

Noise levels exceeding the behavioral threshold of 150 dB RMS would extend 541m from pile-driving activities, assuming an unimpeded propagation path. The use of an attenuation device is expected to reduce this distance by slightly more than 50 percent.

For the 16-inch steel pipe piles in water, peak SPLs exceeding the injury threshold are predicted to occur within a radius of 14m from pile-driving activities. The use of an attenuation device is expected to reduce this distance to 10m or less. Cumulative SELs exceeding the 183-dB and 187-dB injury thresholds are predicted to occur within a radius of 541m, assuming an unimpeded propagation path. The use of an attenuation device is expected to reduce this distance by slightly more than 50 percent. These potential impacts could occur over a period of 6 days.

Noise levels exceeding the behavioral threshold of 150 dB RMS would extend 2,929m from pile-driving activities. The use of an attenuation device is expected to reduce this distance by slightly more than 50 percent. River bends located approximately 1,900 feet (579m) downstream and approximately 6,000 feet (1829m) upstream of the proposed location of pile-driving activity likely would limit the extent of these noise levels.

Sheet Piles for Temporary Cofferdams

Two cofferdams will be installed to construct piers 4 and 5. The sheet piles for the cofferdams would be installed and removed with a vibratory pile driver; this method of installation and removal would not generate high underwater noise levels that result in injury to fish. Vibratory pile driving is a preferred method for minimizing the exposure of fish to potentially harmful pile-driving sounds (NMFS 2009). The sheet piles for the two cofferdams would be installed over a 2-week period in late May and early June of the first construction season.

Table 5. Distances to Injury and Behavioral Thresholds for Impact Pile Driving

Pile Type	Driver Type	Number of Strikes Per Pile	Strikes Per Day	Reference Distance (m)	Attenuation (dB)	Distance (m) to Threshold			
						Onset of Physical Injury			Behavior
						Peak dB	Cumulative SEL dB		RMS dB
							Fish >2 g	Fish < 2 g	
						206 dB	187 dB	183 dB	150 dB
16" steel pipe pile in water (trestle, barge spuds, bridge, and fenders)	impact hammer	800	32,000	10	5	10	251	251	1359
16" steel H-pile in water (trestle)	impact hammer	800	32,000	10	5	10	100	100	464
60" cast-in-steel-shell pile in water (bridge)	impact hammer	1500	6,000	10	5	10	914	914	4642
14" square concrete pile in water	impact hammer	1000	20,000	10	5	10	54	54	251

The underwater sound conditions described above would be expected to occur on days when in-water pile driving occurs. Impact pile driving is expected to injure or kill fishes within certain distance thresholds, depending on the number of strikes used in a day, and whether attenuation measures are being employed. Using the greatest numbers of strikes estimated, it is expected that fish would be killed within up to 10 meters (attenuated) to 18 meters (unattenuated) of the driven pile due to in-water impact pile driving. Fish would be injured within up to 914 (attenuated) to 2,154 meters (unattenuated). Behavioral effects would occur up to 4,642 meters (attenuated) to 10,058 meters (unattenuated). However, the likelihood for exposure to these effects to occur will be minimized, since pile driving will occur during the day, and most fish passage is expected to occur at night. Small numbers of juvenile CCV steelhead, CV spring-run, SR winter-run Chinook salmon and sDPS green sturgeon are expected to be affected. Additionally, river bends located approximately 1,900 feet downstream and approximately 6,000 feet upstream of the pile-driving activity likely would limit the extent of these noise levels.

Acoustic Effects of Barge Traffic

Barge and tugboat traffic will create additional sources of noise in the aquatic environment. This could result in negative impacts to listed species present. Ships under power produce a substantial amount of mechanical- and flow-induced noise from motor, propeller, and hull

turbulence. Measurements of sound intensity from commercial shipping have shown sound levels up to approximately 180 dB (ref. 1 µPa) at the point source (1 meter from ship) (Kipple and Gabriele 2007). This level of noise will drop off by 40 dB at 100 yards away and approximately 53 dB lower at one-quarter mile (Kipple and Gabriele 2007). Elevated noise levels generated by the passage of vessels, such as tugboats, would subject fish within the confines of the action area to anthropogenic-produced noise conditions. The relatively rapid passage of the barge and tugboat past a given point will somewhat attenuate these effects by decreasing the duration of the elevated sound levels, but some temporary effects can be anticipated to occur, depending on the proximity of the exposed fish to the sound source.

The presence of underwater noise may adversely affect a fish's ability to detect predators, locate prey, or sense their surrounding acoustic environment (Slabbekoorn *et al*. 2010, Radford *et al.* 2014). Other species of fish have been shown to respond to recorded ambient shipping noise by either reacting more slowly to predators, thus increasing their susceptibility to predation (Simpson *et al.* 2015, Simpson *et al.* 2016), or becoming hyper-alert and reacting more quickly to a visual predator stimulus, causing them to cease feeding and hide (Voellmy *et al*. 2014b). Voellmy *et al.* (2014a) state that elevated sound levels could affect foraging behavior in three main ways: 1) noise acts as a stressor, decreasing feeding behavior directly through reduced appetite, or indirectly through a reduction in activity, locomotion, and alterations to the cognitive processes involved in food detection, classification, and decision making; 2) noise acts as a distracting stimulus, diverting an individual's limited amount of attention from their primary task to the noise stimuli that have been added to the environment; and 3) noise masks crucial acoustic cues, such as those made by both prey and predators.

Fish also may exhibit noise-induced avoidance behavior that causes them to move into less suitable habitat for foraging or will wait to feed when the noise has abated. Voellmy *et al.* (2014a) surmised that sustained decreases in food consumption could have long-term energetic impacts that result in reductions in growth, survival, and breeding success. Moreover, compensatory feeding activities could increase predation risks by increasing time exposed to predators or by forcing animals to feed in less favorable conditions, such as in times or areas of higher predation pressure.

Increased noise, produced by barge and tugboat traffic may result in listed fish fleeing the area of those noises and moving into shallow margins or adjacent habitat. The channel margins of the Sacramento River have submerged and emergent vegetation and rock riprapped levees where predatory species are likely to occur in greater numbers than in the open waters of the channel. This scenario, therefore, could increase the predation risk of salmonids, particularly smolts. Likewise, elevated noise exposure can reduce the ability of fish to detect piscine predators, by either reducing the sensitivity of the auditory response in the exposed fish or masking the noise of an approaching predator. Such would be the case if open water predators, such as striped bass (*Morone saxatilis*), encounter the juvenile fish in the open channel, while a barge and tugboat are present. The estimated total of eight barge-trips per season (four in May as the barges are brought to the work site and four in November as the barges are removed from the work site at the end of the construction season) and periodic repositioning of the barges during the in-water construction season suggest that disturbances to listed fish would be expected to be small.

Water Quality

Sediment and Turbidity

Site clearing, earthwork, driving of permanent piles, driving and removal of piles for the temporary trestles and barges, vibrating and removal of sheet piles for cofferdams, and installation of RSP would result in disturbance of soil and riverbed sediments—potentially resulting in temporary increases in turbidity and suspended sediments in the Sacramento River. In addition, dewatering and soil removal from the inside of the cofferdams could result in temporary increases in turbidity and suspended sediments in the river, if water (and associated spoils) from within the cofferdams is not properly disposed of or contained and treated before being discharged back to the river. Any construction-related erosion or disturbance of sediments and soils would increase turbidity and sedimentation downstream of the Project area. The distance soils would be transported is dependent on river flows. A prolonged increase in sedimentation and turbidity affects the growth, survival, and reproductive success of aquatic species. High levels of suspended sediment reduces the ability of listed fish to feed and respire, resulting in increased stress levels and reduced growth rates, and a reduced tolerance to fish diseases and toxicants (Waters 1995).

NMFS anticipates that some local increases in turbidity and suspended sediment above baseline levels will result from in-water construction activities. Effects resulting from the proposed project may include potential water quality impacts following construction until graded areas have re-vegetated. NMFS expects these water quality impacts to be minor, short-term increases in turbidity and sedimentation and only lasting the duration of the project. Water quality impacts are unlikely to affect migrating adults to the extent of injuring them, but may injure some juvenile fish, which are smaller and less mobile, and are actively feeding and growing, by temporarily disrupting normal behaviors that are essential to growth and survival. Increased sedimentation and turbidity resulting from project construction will be temporary and limited to a small portion of the river during construction activities. The BMPs incorporated into the project plans will further minimize turbidity effects to listed fish in the project construction area.

Responses of salmonids to elevated levels of suspended sediments often fall into three major categories: physiological effects, behavioral effects, and habitat effects (Bash *et al*. 2001). The severity of the effect is a function of concentration and duration (Newcombe and MacDonald 1991, Newcombe and Jensen 1996) so that low concentrations and long exposure periods are frequently as deleterious as short exposures to high concentrations of suspended sediments.

A review by Lloyd (1987) indicated that several behavioral characteristics of salmonids can be altered by even relatively small changes in turbidity (10 to 50 Nephelometric Turbidity Units [NTUs]). Salmonids exposed to slight to moderate increases in turbidity exhibited avoidance, loss of station in the stream, reduced feeding rates and reduced use of overhead cover. Short-term increases in turbidity and suspended sediment may disrupt feeding activities of fish or result in temporary displacement from preferred habitats. Numerous studies show that suspended sediment and turbidity levels moderately elevated above natural background values can result in non-lethal detrimental effects to salmonids.

Suspended sediment affects salmonids by decreasing reproductive success, reducing feeding success and growth, causing avoidance of rearing habitats, and disrupting migration cues (Bash *et al*. 2001). Sigler *et al.* (1984 in Bjornn and Reiser 1991) found that prolonged turbidity between 25 and 50 NTUs reduced growth of juvenile coho salmon and steelhead. MacDonald *et al.* (1991) found that the ability of salmon to find and capture food is impaired at turbidities from 25 to 70 NTUs. Reaction distances of *O. mykiss* to prey were reduced with increases of turbidity of only 15 NTUs over an ambient level of 4 to 6 NTUs in experimental stream channels (Barrett *et al.* 1992). Bisson and Bilby (1982) reported that juvenile coho salmon avoid turbidities exceeding 70 NTUs. Increased turbidity, used as an indicator of increased suspended sediments, also is correlated with a decline in primary productivity, a decline in the abundance of periphyton, and reductions in the abundance and diversity of invertebrate fauna in the affected area (Lloyd 1987; Newcombe and MacDonald 1991). Increased sediment delivery can also fill interstitial substrate spaces and reduce cover for juvenile fish (Platts *et. al.* 1979) and abundance and availability of aquatic invertebrates for food (Bjornn and Reiser 1991).

Although less is known about the timing of rearing and migration of sDPS green sturgeon, both adult and juvenile life stages are known to utilize the Sacramento River as a migration corridor and may exhibit rearing behavior there as well. Less is known about the specific detrimental physical and physiological effects of sedimentation and turbidity to sturgeon. However, it is thought that high levels of turbidity can generally result in gill fouling, reduced temperature tolerance, reduced swimming capacity and reduced forage capacity in lotic fishes (Wood and Armitage 1997).

Increases in turbidity associated with work are likely to be brief and occur only in the vicinity of the site, attenuating downstream as suspended sediment settles out of the water column. Also, avoidance and minimization techniques will be implemented in this project as well as BMPs pertaining to the prevention or minimization of sedimentation and increased turbidity. These actions will minimize the extent and severity of effects associated with the proposed action outside of the construction footprint. Due to their use of the nearshore habitat in the action area, juvenile listed fish in the action area during construction would be subject to mobilized sediment and short-term increases in turbidity resulting in an increase in predation and reduced feeding and survival.

Contaminants

Construction activities that occur in or near the Sacramento River channel can result in the discharge of contaminants that are potentially lethal to fish. The operation of heavy equipment, cranes, pile drivers, drilling rigs, barges, and other construction equipment during vegetation removal, excavation, and bridge construction could result in spills and leakage of fuel, lubricants, hydraulic fluids, and coolants. Other sources of potential contamination include asphalt, wet concrete, and other materials that may come into direct contact with surface water during construction activities. For example, concrete that is being poured for the bridge decking could be discharged accidentally to the river, thereby contaminating the river with uncured concrete (which can raise pH) and related compounds.

High concentrations of contaminants can cause short-term and long-term effects to fish. The severity of these effects depends on the contaminant, the concentration, duration of exposure,

and sensitivity of the affected life stage. Sublethal effects include increased susceptibility to disease that reduces the overall health and survival of the exposed fish. A long-term effect of contamination is reduced prey availability (Kidd *et al.* 2014). Invertebrate prey species survival can be reduced, therefore, less food is available for fish. In addition, fish consuming prey affected by contamination can absorb toxins directly. However, implementation of avoidance and minimization measures and BMPs, would minimize any risk, and therefore, avoid potential for exposure to hazardous chemicals.

Green sturgeon may be more susceptible to aquatic contaminants, since they are benthic foragers. Studies on white sturgeon found that bioaccumulation of pesticides and other contaminants adversely affect growth and reproductive development (Feist *et al.* 2005). However, with the implementation of the water quality conservation measures (as described in the Project description) and in-water work window, exposure to contaminants is expected to be avoided.

Dewatering and Fish Relocation

The proposed timing of cofferdam installation (late May to early June) would overlap the end of the adult and juvenile peak migration season for spring-run Chinook salmon, the end of the adult migration season for steelhead, and the end of the peak rearing season for green sturgeon in the Sacramento River. Consequently, the potential would exist for listed fish to become entrained in the cofferdams, although juveniles would be expected to be at a greater risk because they are likely to be more abundant in the action area than adults at this time of year. Juvenile CCV spring-run Chinook salmon, CCV steelhead, or sDPS green sturgeon present in the action area and unable to avoid cofferdams would be subject to dewatering and fish capture. Fish capture and relocation may be necessary during dewatering activities, if listed fish are present and found in the enclosed area of the cofferdam. Each step during the capture/relocation process could induce physiological stress leading to injury or death, even when a skilled fish biologist performs the relocation. The potential capture and relocation listed fish species associated with the dewatering of the cofferdam are expected to adversely affect a small number of fish if present in the action area. Although upstream-migrating adult CV spring-run Chinook salmon and CCV steelhead, may occur in the Project area during in-water work, the large size and probable avoidance of the enclosed area makes it unlikely that they would be trapped in the cofferdams.

2.5.2. Effects to Critical Habitat

Construction is expected to have short- and long-term effects on habitat quantity and quality, including effects on the PBFs of designated critical habitat of listed species. The PBFs that occur within the action area for SR winter-run Chinook salmon are (1) migratory corridors for both upstream and downstream migration, (2) habitat and prey items that are free of contaminants, and (3) riparian habitat for juvenile rearing. The PBFs within the action area for sDPS green sturgeon are (1) food resources, (2) adequate flow regime for all life stages, (3) water quality, (4) migratory corridors, (5) adequate water depth for all life stages, and (6) adequate sediment quality. The PBFs within the action area for CV spring-run Chinook salmon and CCV steelhead are (1) freshwater rearing sites, and (2) freshwater migration corridors. The Project will temporarily reduce rearing habitat and food resource availability for salmonids. The migratory corridor for juvenile and adult listed salmonids and green sturgeon will be temporarily affected.

Impacts to the migration corridor are only expected to be short-term (during construction), and unimpeded passage will be open throughout construction.

Shaded Riverine Aquatic Habitat (SRA) Loss

Clearing of the existing cottonwood riparian forest vegetation within the proposed project footprint would result in permanent loss of up to 1.273 acres and temporary disturbance to up to 0.625 acre of cottonwood riparian forest within the action area, of which approximately 0.368 acre is below the OHWM and contributes to overhead (shade) and instream SRA cover. The permanent loss of existing cottonwood forest would result from activities related to construction of the two fixed-span bridge approach structures and the bikeways that would pass under the east end of the bridge structure in the City of Sacramento and the west end of the bridge structure in the City of West Sacramento. The temporary disturbance to cottonwood riparian forest would occur from trimming riparian vegetation and removing additional trees and understory vegetation to provide equipment access. Portions of this affected riparian forest also provide SRA cover habitat that is an important component of anadromous fish habitat. Clearing of the existing cottonwood riparian forest that contributes to SRA cover would result in temporary disturbance to up to 330 linear feet and permanent loss of up to 302 linear feet of overhead SRA cover (shade) along the summer (low-flow) shoreline of the Sacramento River.

Riparian vegetation plays a key role in the conservation value of rearing habitat for many salmonid life stages. It provides shading to reduce stream temperatures, increases the recruitment of large woody material into the river that increases habitat complexity, provides shelter from predators, and enhances the productivity of aquatic macroinvertebrates (Anderson and Sedell 1979, Pusey and Arthington 2003). It has also been shown to directly influence channel morphology and may be directly correlated with improved water quality in riverine systems through biogeochemical cycling, soil and channel chemistry, water movement, and erosion (Schlosser and Karr 1981, Dosskey *et al*. 2010). The proposed action will result in the permanent loss of 1.273 acres of riparian habitat due to disturbance from Project activities. This loss of riparian habitat will result in the degradation of migratory corridors and rearing habitat PBFs for listed fish species. With implementation of a riparian restoration plan and/or mitigation bank credit purchase (as described in Section 1.3.1, Measure 13), long-term impacts to critical habitat due to riparian habitat removal are expected to be minimal.

Freshwater Migratory Corridor Loss

Safe and unobstructed migratory pathways are necessary for adult salmonids and sturgeon to migrate to and from spawning habitats, and for larval and juveniles to migrate downstream from spawning/rearing habitats within freshwater rivers to rearing habitats within the estuaries. The main migratory corridor in the Sacramento River will not be blocked at any time during project implementation so SR winter-run Chinook salmon, CCV steelhead, CV spring-run Chinook salmon and green sturgeon using the area to migrate upstream and downstream in the project action area in this reach of the Sacramento River to feed or rest, should not be affected and the effects of the project on the PBFs of migratory corridors for all listed species is minimal. Fish that use the action area as a migratory corridor will be able to continue using the channel during and after construction of the proposed action. The new bridge will shade the Sacramento River, which may increase predation risk to juveniles. Overwater structures can alter underwater light

conditions and provide potential holding conditions for juvenile and adult fish, including species that prey on juvenile listed fishes. The increase in riverine shading may result in associated riparian vegetation receiving less sunlight for photosynthesis, as well as in-water vegetation receiving less light for photosynthesis. This can result in decreased fish habitat quality and decreased insect productivity (Pincetich 2019). Salmonids may benefit from the overwater shade as a cooling measure for water temperatures. Blocking light can also prevent stream eutrophication (an overabundance of nutrients in a water body), such as algal blooms. Eutrophication may reduce oxygen levels for fish and other species (Pincetich 2019). However, because there is suitable habitat for salmon and sturgeon both upstream and downstream of the Action Area, the effects of the structure are expected to be minor.

Freshwater Rearing Habitat Loss

Freshwater rearing habitat provides water quantity, quality, and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility. Rearing habitat condition is strongly affected by habitat complexity, food supply, and presence of predators of juvenile salmonids and green sturgeon. Freshwater rearing habitats have a high intrinsic value to salmonids, as the juvenile life stages are dependent on the function of this habitat for successful survival and recruitment.

The proposed action would not result in a permanent loss of CV spring-run, CCV steelhead and green sturgeon rearing habitat, but would temporarily make small areas unavailable for rearing during construction. These short-term, temporary instream disturbances (physical equipment, turbidity, etc.) would likely result in the displacement of fish from their habitat to downstream areas. However, there is suitable rearing habitat for salmonids and sturgeon downstream of the action area.

Overwater Shading

Barge shading would occur only during the in-water construction season (May 1 to November 30), as the temporary barges would be removed at the end of the first construction season before the onset of winter. Four barges, each approximately 60 feet wide and 150 feet long (9,000 square feet [0.21 acre]), would be present during construction and would provide a total of 36,000 square feet (0.83 acre) of temporary over-water structure. Because the barges would be present only during construction and moved periodically as construction of the bridge progresses, effects of barge shading would be temporary and localized.

Shading by the temporary work platforms would occur only during the in-water construction season (May 1 to November 30), as the temporary work platforms would be removed at the end of the first construction season before the onset of winter (the temporary trestle piles could remain in place). Two trestles, approximately 22 feet wide and varying in length and configuration, would be present during construction and would provide a total of approximately 33,500 square feet (0.77 acre) of temporary over-water structure. Because the trestles and work platforms would be present only during construction, effects of temporary work platform shading would be temporary and localized. Together, the barges and temporary work platforms would create up to 69,500 square feet (1.60 acres) of temporary overwater structure (*i.e.*, artificial shade).

The new bridge would create approximately 56,000 square feet (1.29 acres) of permanent overwater structure where no over-water structure currently exists. The increased shading created by the new bridge could affect the migration of adult and juvenile Chinook salmon and steelhead, and other species. In the Sammamish River in Washington State, migrating adult salmon hold in shaded areas beneath bridges (Carrasquero 2001). Juvenile salmonids also prefer shaded areas created by bridges, which may make them more vulnerable to predatory fish (*e.g.*, striped bass, Sacramento pikeminnow, and largemouth bass) that also prefer structural and overhead cover (*e.g.*, artificial shade) for ambushing prey. Because of the height of the new bridge over the water, ambient light levels generally would be expected to penetrate into the water, thereby minimizing the effect of bridge shading on aquatic habitats in the Sacramento River.

Sedimentation

Effects of increased turbidity and sedimentation in critical habitat are similar to those described for species. Effects on critical habitat can also reduce fisheries habitat quality by mobilizing sedimentation and increasing turbidity. Sedimentation can decrease or reduce rearing habitat. Increased turbidity, especially caused by fine inorganic particles, increase drift of macroinvertebrates. Aquatic invertebrate communities may change as a result of sedimentation or turbidity, which in turn could affect prey items. In addition, suspended materials in slow moving waters can increase absorption of solar energy near the surface causing the heated upper layers to stratify reducing the dispersion of dissolved oxygen and nutrients to lower depths. Due to the base flows in the Sacramento River, it is anticipated that the effects of suspended sediment that may lead to sedimentation in the project action area are expected to be minimal, because most, if not all, of the suspended sediment will dissipate quickly or be diluted substantially by the high base flows in the Sacramento River and move downstream.

Lighting

The design of the new bridge includes the permanent installation of night lighting. Night lighting has the potential to result in permanent adverse effects to critical habitat PBFs. Night lights can shine onto waters during nighttime hours and may facilitate increased predation on juvenile listed fish by predatory fish, birds, and mammals (Kahler *et al.* 2000). BMPs, including placement of permanent lighting away from water surfaces, will be implemented to incorporate night lighting designs, which limit the amount of light shining on water surfaces. The lights will be shielded and focused on the bridge away from water surfaces. This action will minimize the extent of any negative effects associated with night lighting.

Mitigation / Restoration

The project proponent will implement onsite restoration and offsite compensation measures and/or purchase mitigation bank credits to compensate for losses of SRA cover habitat and in-water aquatic habitat. Revegetation onsite will occur at a 3:1 ratio (3 acres restored for every 1 acre lost). Should offsite restoration be required through the use of compensatory mitigation credits, restoration credits will be purchased at a 1:1 ratio and/or preservation credits will be purchased at a 2:1 ratio. Additionally, to address permanent loss of aquatic habitat, the proposed action includes purchase of mitigation bank credits at a 3:1 ratio. Caltrans will purchase 5.61-

acre credits of salmonid or riparian SRA habitat credits for the permanent loss of 1.87 acres of aquatic habitat below the OHWM.

The purchase of compensatory mitigation credits will restore and preserve, in perpetuity, SRA habitat or similar types of riverine habitat that will be beneficial to salmonids. The mitigation banks that serve the action area offer floodplain or other habitat that can support migrating juvenile and adult SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead and sDPS green sturgeon in the same way that river margin habitat otherwise would have, had the project not occurred. SRA habitat types of conservation credits can benefit both adult and juvenile salmonids and sturgeon, even if such banks are located far from the action area and individuals affected by the project would be unlikely to benefit from the compensation purchase.

Both the riparian and aquatic habitat impacts affect designated critical habitat, as well as listed fish species, described above in this opinion. The purchase of mitigation credits will address the loss of ecosystem functions due to the modification of the riverbank. These credit purchases are ecologically relevant to the PBFs of critical habitat and the species affected by the proposed action, because both banks include SRA, riparian forest and floodplain credits with habitat values that are already established and meeting performance standards. Also, the banks are located in areas that will benefit the ESUs and DPSs affected. The purchase of mitigation credits at one of these banks is expected to benefit the PBFs of freshwater rearing habitat and migration corridors for juvenile SR winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead by providing suitable floodplain and riparian habitat. The floodplains and riparian forest in the bank benefit the growth and survival of rearing salmonids by providing habitat with abundant food in the form of aquatic invertebrates, structural diversity, such as instream woody material (IWM) and cooler stream temperatures.

The purchase of credits provides a high level of certainty that the benefits of a credit purchase will be realized, because all of the NMFS-approved banks considered in this opinion have mechanisms in place to ensure credit values are met over time. Such mechanisms include legally binding conservation easements, long-term management plans, detailed performance standards, credit release schedules that are based on meeting performance standards, monitoring plans and annual monitoring reporting to NMFS, non-wasting endowment funds that are used to manage and maintain the bank and habitat values in perpetuity, performance security requirements, a remedial action plan, and site inspections by NMFS. In addition, each bank has a detailed credit schedule, and each tracks their credit transactions and availability on the Regulatory In-lieu fee and Bank Information Tracking System (RIBITS). RIBITS was developed by the U.S. Army Corps of Engineers with support from the Environmental Protection Agency, the U.S. Fish and Wildlife Service, the FHWA, and NMFS to provide better information on mitigation and conservation banking and in-lieu fee programs across the country. RIBITS allows users to access information on the types and numbers of mitigation and conservation bank and in-lieu fee program sites, associated documents, mitigation credit availability, service areas, as well information on national and local policies and procedures that affect mitigation and conservation bank and in-lieu fee program development and operation.

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).

2.6.1. Water Diversions

Water diversions for municipal and industrial use are found near the action area. Depending on the size, location, and season of operation, these unscreened diversions entrain and kill many life stages of aquatic species, including juvenile listed anadromous species.

2.6.2. 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 water bodies, 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 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. Increases in boating activity also increases likelihood of boat strikes which may injure or kill adult green sturgeon.

2.6.3. 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 within the Sacramento River watershed. The effects of such actions result in continued degradation, simplification, and fragmentation of riparian and freshwater habitat.

2.6.4. Aquaculture and Fish Hatcheries

More than 32 million fall-run Chinook salmon, 2 million CV spring-run Chinook salmon, 1 million late fall-run Chinook salmon, 0.25 million SR winter-run Chinook salmon, and 2 million steelhead are released annually from six hatcheries producing anadromous salmonids in the Central Valley. All of these facilities are currently operated to mitigate for natural habitats that have already been permanently lost as a result of dam construction. The loss of historical habitat and spawning grounds upstream of dams results in dramatic reductions in natural population abundance, which is partially 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 Central Valley 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, predation of hatchery fish on wild fish, and increased fishing pressure on wild stocks as a result of hatchery production.

Impacts of hatchery fish 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 *et al.* 1996).

2.6.5. Recreational Fishing

While hatchery CCV steelhead and Chinook salmon are targeted, incidental catch of protected species, such as naturally produced CV spring-run Chinook salmon and CCV steelhead, does occur. Since 1998, all hatchery CCV steelhead have been marked with an adipose fin clip, allowing anglers to tell the difference between hatchery and wild CCV steelhead. Current regulations restrict anglers from keeping unmarked CCV steelhead in Central Valley streams, except in the upper Sacramento River.

Current sport fishing regulations do not prevent wild CCV steelhead from being caught and released many times over while on the spawning grounds, where they are more vulnerable to fishing pressure. Recent studies on hooking mortality based on spring-run Chinook salmon have found a 12 percent mortality rate for the Oregon in-river sport fishery (Lindsay *et al*. 2004). Applying a 30 percent contact rate for Central Valley rivers (*i.e.*, the average of estimated Central Valley harvest rates), approximately 3.6 percent of adult steelhead die before spawning from being caught and released in the recreational fishery.

In addition, survival of CCV steelhead eggs is reduced by anglers walking on redds in spawning areas while targeting hatchery CCV steelhead or salmon. Roberts and White (1992) identified up to 43 percent mortality from a single wading over developing trout eggs, and up to 96 percent mortality from twice daily wading over developing trout eggs. Salmon and trout eggs are sensitive to mechanical shock at all times during development (Leitritz and Lewis 1980). Typically, CCV steelhead and salmon eggs are larger than trout eggs, and are likely more sensitive to disturbance than trout eggs. While state angling regulations have moved towards restrictions on selected sport fishing to protect listed fish species, hook and release mortality of steelhead and trampling of redds by wading anglers may continue to cause a threat.

2.6.6. Habitat Restoration

Voluntary state or private sponsored habitat restoration projects may have short-term negative effects associated with in-water construction work, but these effects typically are temporary, localized, and the overall outcome is expected to benefit listed species and habitats.

2.6.7. Agricultural Practices

Non-Federal actions that may affect the action area include ongoing agricultural activities in the Sacramento River watershed. Farming and ranching activities within or adjacent to or upstream of the action area may have negative effects on water quality due to runoff laden with agricultural chemicals. Stormwater and irrigation discharges related to agricultural activities contain numerous pesticides and herbicides that may adversely affect salmonid reproductive success and survival rates (King *et al.* 2014). 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.

Agricultural practices in the Sacramento River may adversely affect riparian and wetland habitats through upland modifications of the watershed that lead to increased siltation or reductions in water flow.

2.6.8. Mining Activities

Increased water turbidity levels for prolonged periods of time may result from adjacent mining activities, and increased urbanization and/or development of riparian habitat, and could adversely affect the ability of young salmonids to feed effectively, resulting in reduced growth and survival. Turbidity may cause harm, injury, or mortality to juvenile anadromous fish in the vicinity and downstream of the project area. High turbidity levels can reduce the ability of listed fish to feed and respire, resulting in increased stress levels and reduced growth rates, and reduce tolerance to fish diseases and toxicants. Mining activities may adversely affect water quality, riparian function, and stream productivity.

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.

SR winter-run Chinook salmon ESU, CV spring-run Chinook salmon ESU, CCV steelhead DPS, and sDPS green sturgeon have experienced significant declines in abundance and available habitat in the California Central Valley relative to historical conditions. The status of the species (Section 2.2) details the current range-wide status of these ESUs and DPSs and their critical habitat. The environmental baseline (Section 2.4) describes the current baseline conditions found in the Sacramento River, where the proposed action is to occur. Section 2.4.7 discusses the vulnerability of listed species and critical habitat to climate change projections in the California Central Valley and specifically in the Sacramento River. Reduced summer flows and increased water temperatures will likely be exacerbated by increasing surface temperatures in the Sacramento River. The Sacramento River is a highly manipulated system with flow and temperature regimes that differ drastically from their historical condition. Cumulative effects (Section 2.6) are likely to include decreased water flow, increased river traffic, and increased stormwater runoff from increased urbanization and from concurrent state and local projects in the action area.

2.7.1. Summary of the Project Effects to Listed Species

The proposed action has the potential to affect adult and juvenile SR winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead; and adult, juvenile, and subadult sDPS green sturgeon. The project is expected to result in a reduction of SRA habitat, harassment, injury or death, and predation-related mortality of individuals from pile driving, and injury or mortality of individuals resulting from dewatering.

The expected effects to listed salmonids and sturgeon resulting from the proposed action are harassment of juvenile SR winter-run and CV spring-run Chinook salmon, CCV steelhead, and green sturgeon resulting from the noise of pile driving; the entrainment, capture, and relocation of juveniles from construction activities; and turbidity and sedimentation. Pile driving would result in injury or death to outmigrating juveniles that pass within the 914m zone of impact. Pile driving is also expected to result in temporary disruptions in the feeding, sheltering, and migratory behavior of adult and juvenile salmon and steelhead and green sturgeon for fish passing outside of the 914m zone of impact. This disruption would result in reduced growth and increased susceptibility to predation. Adults are not expected to be injured or killed, however, they would experience temporary migration delays that are not expected to prevent successful spawning. Pile driving is also not expected to prevent salmonids and sturgeon from passing upstream or downstream, because pile driving will not be continuous through the entire day, and will not occur at night, when the majority of fish migrate. Death as a result of dewatering is expected to be minimized by salvaging and relocating fish away from the project site, if necessary. Fish would be handled by a biologist, and a low mortality rate of juveniles is expected to result from fish salvage.

2.7.2. Summary of Project Effects to Critical Habitat

Critical habitat has been designated for SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead and sDPS green sturgeon within the Action Area. Relevant PBFs of the designated critical habitats are listed above in section 2.5.2. Based on the effects of the proposed Project described previously in this opinion, the impacts are expected to permanently degrade a small portion of designated critical habitat for all species.

The quality of the current conditions of PBFs in the action area are poor compared to historical conditions (pre-levees). In particular, levees, riprapping, and removal of riparian vegetation have greatly diminished the value of the aquatic habitat in the action area by decreasing rearing area, food resources via food-web degradation, and complexity and diversity of habitat forms necessary for holding and rearing (channel diversity). Creation of overwater structure and in-water structure with the bridge construction would contribute to the degradation of designated critical habitat. The temporary construction impacts to designated critical habitat would negatively affect the ability of listed species to use the action area as rearing habitat and as migratory corridors during the overlap of migration periods and construction, as discussed in the Effects to Species section.

The project will cause a permanent loss of 0.368 acres of riparian vegetation, adversely affecting migration and rearing habitat PBFs of critical habitat through a small reduction of near-shore cover and food production. As mitigation for these impacts, the applicant will replant at a 3:1 ratio on site, or purchase SRA/salmonid credits from a NMFS-approved conservation bank at a 3:1 ratio for SRA lost. Additionally, there will be a permanent loss of approximately 1.87 ac of riverine habitat below the OHWM from placement of the bridge abutments, piers, and RSP. As mitigation for these impacts, the applicant will purchase salmonid credits from a NMFS-approved conservation bank at a 3:1 ratio (5.61 acres total).

Riparian restoration on-site or at a NMFS-approved conservation bank is expected to benefit the PBFs of freshwater rearing habitat and migration corridors for listed species by providing suitable floodplain and riparian habitat. The floodplains and riparian forest on this site will benefit the growth and survival of rearing salmonids by providing habitat with abundant food in the form of aquatic invertebrates, structural diversity, such as IWM, and cooler stream temperatures.

2.7.3. Effects of the Proposed Action at the Population Level

Based on the geographical location of the Action Area, it is expected that all Sacramento River Basin populations of SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon have the potential to be exposed and adversely affected by project actions. With the nature and potential duration of the effects, we expect the proposed action to temporarily reduce the productivity of a portion of each species exposed to the project site during construction and for the first 5 years as re-vegetation occurs. The presence of the structure and loss of both in-water and riparian habitats will continue into the foreseeable future, thus creating a minor perpetual source of predation and water quality impacts (both beneficial and adverse, see Section 2.5.2) to the action area, and a permanent adverse effect to rearing

PBFs. However, these permanent effects are expected to be offset by replanting onsite and/or the purchase of credits at a NMFS-approved conservation bank.

2.7.4. Summary of Risk to Diversity Groups for each Species

The Recovery Plan identifies four Central Valley salmon and steelhead diversity groups for SR winter-run Chinook, CV spring-run Chinook, and CCV steelhead. Project effects will affect three of the four diversity groups (Basalt and Porous Lava Group, Northern Sierra Nevada Group and Northwestern California Group) as these groups all use the mainstem Sacramento River as their primary migration and rearing corridor. Key threats to salmonids within these diversity groups include inaccessibility of historic habitat, large and small passage impediments, altered flows and water temperatures, loss of riparian and floodplain habitat, predation, and hatchery impacts.

Recovery criteria for SR winter-run Chinook includes maintenance/establishment of three viable populations for the ESU, all located within the Basalt and Porous Lava Diversity Group. Currently the populations of SR winter-run Chinook below Keswick Dam is the only population considered viable within the ESU. The Sacramento River within the Action Area provides important rearing PBFs for SR winter-run Chinook. Although the proposed Project is expected to adversely affect a small portion of this population, the work window will avoid peak migration timing.

For CV spring-run Chinook salmon, recovery criteria includes maintenance/establishment of two viable populations within the Basalt and Porous Lava Diversity Group, one viable population within the Northwestern California Diversity Group, and four viable populations within the Northern Sierra Diversity Group, and a total of and nine viable populations for the ESU. Currently only one population is considered viable. The Sacramento River within the Action Area provides important rearing PBFs for CV spring-run Chinook. Although the proposed Project is expected to adversely affect a small proportion of the ESU for these species, most of the range-wide habitat supporting the species is outside of the Action Area.

Recovery criteria for CCV steelhead include maintenance and establishment of nine viable populations for the ESU. Of those, two viable populations are to be within the Basalt and Porous Lava Diversity Group, one within the Northwestern California Diversity Group, and four within the Northern Sierra Diversity Group. The proposed Project impacts represent a small loss, which is not expected to reach the designation scale for the CCV steelhead DPS as a whole. Permanent project impacts represent a small loss in the scope of available critical habitat at the designation scale for CVV steelhead though the intrinsic value of the action area for conservation of the species remains high.

The sDPS of green sturgeon includes only one spawning population in the Upper Sacramento River. The Recovery Plan for sDPS green sturgeon identifies a no-net loss of sDPS green sturgeon diversity from current levels as a recovery criteria. Diversity refers to individual and population variability in genetic, life history, behavioral, and physiological traits. Maintaining diversity is critical to retaining the species' ability to adapt to a diverse and variable environment. There are currently no methods to directly measure diversity or compare present and historical levels. However, the loss of spawning habitat can be used as a proxy and it is likely that some loss has occurred (NMFS 2018). Because diversity is closely tied with

abundance, distribution, and productivity, the recovery criteria of no-net loss of diversity may be met by improving and/or increasing spawning and rearing habitat to a level which increases spawning and/or rearing distribution or success. Although the proposed Project is expected to adversely affect a small proportion of the DPS for these species, no spawning habitat occurs within the Action Area and most of the range-wide rearing habitat supporting the species is outside of the Action Area. Permanent project impacts represent a small loss in the scope of available critical habitat at the designation scale for sDPS green sturgeon though the intrinsic value of the action area for conservation of the species remains high.

2.7.5. Summary of Risk to the ESU/DPS for each Species and Critical Habitat at the Designation Level

The Sacramento River contains spawning populations of SR winter-run and CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon, making it an important river in terms of range-wide recovery for these species. Further, the Sacramento River is the only spawning location for SR winter-run Chinook salmon and the only known spawning location for sDPS green sturgeon.

Although construction is expected to cause adverse effects to small numbers of listed salmonids, the impacts will be relatively short in duration and will avoid higher river and peak migration time periods, so that abundance would be low within the project footprint. Additionally, most of the effects are not lethal. Construction-related harassment will be temporary and will not impede adult fish from reaching upstream spawning and holding habitat, or juvenile fish from migrating downstream. Long-term impacts of the bridge structure and riparian loss are expected to result in some brief minor behavioral modifications of migrating or rearing juvenile fish, as they move past the structure.

To mitigate the adverse effects of the project, Caltrans proposes to replant on-site and purchase 5.61 acres of mitigation credits at a NMFS-approved conservation bank. On-site restoration and conservation bank credit purchase will offset impacts by increasing floodplain and shaded aquatic and riverine habitat for the SR winter-run Chinook and CV spring run Chinook ESUs, the CCV steelhead DPS and sDPS green sturgeon. This addresses the priority recovery action of restoration and maintenance of riparian and floodplain ecosystems which provide diverse habitat along the Sacramento River.

Combining the minimal, adverse, and beneficial effects associated with the proposed action described above, including the environmental baseline, cumulative effects, status of the species, and critical habitat, the Project is not expected to reduce appreciably the likelihood of both the survival and recovery of the listed species in the wild by reducing their numbers, reproduction, or distribution; or appreciably diminish the value of designated critical habitat for the conservation of the species.

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 salmon, CV spring-run Chinook salmon, CCV steelhead, or sDPS green sturgeon or destroy or adversely modify its designated critical habitat.

2.9. Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1. Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

NMFS anticipates incidental take of SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and North American green sturgeon from impacts directly on designated critical habitat PBFs, or related to pile driving and impairment of essential behavior patterns as a result of these activities, and injury or death related dewatering and relocation. The incidental take is expected to be in the form of harm, harassment, injury or mortality of SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and North American green sturgeon resulting from the installation and removal of temporary and permanent piles during bridge construction. Incidental take is expected to occur for during the in-water work window (May 1 to November) when juvenile SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and North American green sturgeon individuals are migrating past the site.

It is not practical to quantify or track the amount or number of individuals that are expected to be incidentally taken as a result of the proposed action, due to the variability associated with the response of listed fish to the effects of the proposed action, annual variations in the timing of spawning and migration, individual habitat use within the action area, and difficulty in observing injured or dead fish.

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 threshold for incidental take are ecological surrogates of temporary habitat disturbance expected to occur during in-water construction and

pile driving activities and permanent habitat disturbance expected to occur due to riparian removal and bridge structure presence in critical habitat.

Pile driving, dewatering, capture, and handling result in fish behavioral modifications, harm, injury or death. Riparian removal and bridge structure shade reduces primary productivity, decreases prey availability and increase the presence of predatory fish, leading to harm or death. NMFS anticipates incidental take will be limited to the following forms:

1) Take in the form of harm, injury and death to listed fish, due to handling during dewatering of 0.15 acres of river habitat. This habitat disruption will affect the behavior of listed fish resulting in displacement and increased predation, decreased feeding, and increased competition, which will result in decreased survival, reduced growth and reduced fitness, respectively. Fewer than 10 percent captured are expected to die in the process of dewatering.

2) Take in the form of harm, injury and death to listed fish, due to pile driving. Expected impact thresholds for attenuated 60" piles are as follows: The 150dB RMS behavioral threshold is expected to be 4642 meters from the pile resulting in stress to fish, interruptions in migration, increased predation and decreased feeding within this range. The 187dB and 183 dB cumulative thresholds for injury to fish is expected to be 914 meters from the pile. The peak 206dB threshold for injury is expected to be 10 meters from the pile. Impacts to fish within this range includes injury or death. Expected impact thresholds for attenuated 14-16" piles are as follows: The 150dB RMS behavioral threshold is expected to be 1359 meters from the pile resulting in stress to fish, interruptions in migration, increased predation and decreased feeding within this range. The 187dB and 183 dB cumulative thresholds for injury to fish is expected to be 251 meters from the pile. The peak 206dB threshold for injury is expected to be 10 meters from the pile. Impacts to fish within this range includes injury or death. Due to the timing of the activity, actual numbers for each species is expected to be low.

3) Take in the form of harm to listed fish from loss and degradation of riparian and aquatic habitat leading to injury and death by creating habitat conditions that decrease productivity and prey availability and increase predation associated with the riparian removal and new bridge components. Permanent impacts on critical habitat total 1.87 acres (up to 57,600 square feet [1.32 acre] from bridge shading of aquatic habitat and new bridge piers; 24,126 square feet [0.55 acre] from RSP; and 84 square feet (0.002 acre) from bridge fender system).

   If the total acreage of temporary or permanent habitat impacts, including dewatering, as described above is exceeded by more than 10 percent for any impact, then anticipated take levels described are also exceeded, triggering the need to reinitiate consultation. The exceedances allow for flexibility in on-the-ground project changes that might be necessary. For example, the project is expected to dewater 0.15 acres. However, it is possible that the substrate within the originally proposed area could be too dense to facilitate placement of the cofferdams and minor adjustments will be necessary, such as shifting the boundaries of the cofferdam a few feet. Such exceedances within 10 percent are expected to result in minor additional impacts, which

remain consistent with the effects analyzed in this opinion. If monitoring indicates that sound levels greater than 206 dB peak, 187 dB or 183 dB cumulative SEL, or 150 dB RMS extend beyond the above described expected distances for pile size and attenuation type, work should stop and NMFS should be contacted within 24 hours, to determine if incidental take has been exceeded, or if sound levels can be reduced.

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. Dewatering and fish relocation operations shall be conducted according to the specifications provided to NMFS, and the NMFS-approved supervising biologist(s) shall oversee all aspects of dewatering and fish handling operations.

2. Measures shall be taken to minimize the number of piles used and duration of pile driving and its potential impacts on listed salmonids and sturgeon, and to monitor the range and distance of high underwater sound levels generated by pile driving operations;

3. Measures shall be taken to minimize the effect of temporary and permanent habitat loss of riverine and riparian habitat;

4. Caltrans shall monitor and report on the amount or extent of incidental take.

2.9.4. Terms and Conditions

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

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

    a. All aspects of fish relocation operations shall be supervised by at least one NMFS-approved biologist who shall be on site throughout each phase of the capture/relocation operation.

    b. A written plan for a fish relocation operation specific to this project shall be provided to NMFS for approval 60 days prior to implementation of the project.

The plan shall be thoroughly understood by all individuals that are to be involved and operations shall be conducted in strict accordance with the written plan.

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

    a. Attenuation measures shall be used during impact pile driving to control and dampen underwater pressure wave propagation. Effective attenuation measures include:

        i. Use of a bubble curtain around the pile.

        ii. Use of a dual-casing isolation system.

        iii. Use of a cushion block between the hammer and the pile.

    b. Real-time monitoring shall be conducted to ensure that underwater sound levels analyzed in this BO do not exceed the established distances described for pile driving construction. Monitoring shall follow NMFS standard practices of 1-2 hydrophones used, the first being placed at 10 m from the pile, mid-depth in the water column, and the second being placed further away near the isopleth estimated for the cumulative SEL distance;

    c. Caltrans shall submit to NMFS a monitoring and reporting plan that will incorporate provisions to provide daily, monthly, and seasonal summaries of all hydroacoustic monitoring results during the pile driving season for approval at least 60 days prior to the start of construction activities (FHWG 2013). In regards to the daily reports, Caltrans shall submit to NMFS a monitoring report (by close of business of the day following the pile-driving activities) that provides real-time data regarding the distance (actual or estimated using propagation models) to the thresholds (187 dB accumulated SEL and 150 dB RMS) stated in this BO to determine adverse effects to listed species.

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

    a. To control invasive species, all landscaping and revegetation shall consist of plants or seed mixes from native, locally adapted species.

    b. Caltrans shall limit the amount of RSP used for instream protection to the minimum amount needed for erosion and scour protection. Engineering plans shall be provided to the contractors that clearly show the amount of RSP to be placed.

    c. Caltrans shall submit to NMFS a Restoration and Mitigation Plan outlining the maintenance of all on-site and off-site mitigation. The plan shall include performance goals, monitoring plans, replanting plans, and an adaptive management plan for how mitigation will be addressed if the mitigation site fails.

d. Caltrans shall provide NMFS a post-construction field review and yearly field reviews for five years of the proposed project site, to assure conservation measures were adequately implemented and whether additional plantings are needed to establish adequate riparian vegetation. Caltrans should successfully re-vegetate at a rate of at least 80 percent at the project site. The first review should occur the year following construction completion. The field review shall include the following elements:

   i. Seasonal surveys to determine adequate cover and plant survival throughout the year is being met;

   ii. A survival ratio to ensure planting of new vegetation is implemented during the first five years when necessary; and

   iii. Photo point monitoring shots at the established repair site to be used as a tool to determine success and survival rates. The photos shall be taken annually on the same date, as much as practicable.

4. The following terms and conditions implement reasonable and prudent measure 4:

   a. Caltrans shall provide a report of Project activities to NMFS by December 31 of each construction year.

   b. The report shall include Project schedules, Project completions, and details regarding Project implementation for each given year.

   c. This report shall include a summary description of in-water constraint activities, avoidance and minimization measures taken, and any observed take incidents.

Updates and reports required by these terms and conditions shall be submitted to:

Assistant Regional Administrator
National Marine Fisheries Service
California Central Valley Office
650 Capitol Mall, Suite 5-100
Sacramento California 95814-4607
By email: ccvo.consultationrequests@noaa.gov

2.10. Reinitiation of Consultation

This concludes formal consultation for the City of West Sacramento Broadway Bridge Construction Project.

As 50 CFR 402.16 states, reinitiation of consultation is required and shall 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 Caltrans 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 geographic extent of salmon freshwater EFH is described as all water bodies currently or historically occupied by PFMC managed salmon within the USGS 4th field hydrologic units identified by the fishery management plan (PFMC 2014). This designation includes the Sacramento River for all runs of Chinook salmon that historically and currently use these watersheds (winter-run, spring-run, fall-run, and late fall-run). The Pacific Coast salmon fishery management plan also identifies Habitat Areas of Particular Concern (HAPCs): complex channel and floodplain habitat, spawning habitat, thermal refugia, estuaries, and submerged aquatic vegetation, of which the HAPC for complex channel and floodplain habitat are expected to be either directly or indirectly adversely affected by the proposed action.

3.2. Adverse Effects on Essential Fish Habitat

Effects to Pacific Coast salmon HAPCs for complex channel and floodplain habitat are discussed in the context of effects to critical habitat PBFs as designated under the ESA and described in section 2.5.2. A list of adverse effects to EFH HAPCs is included in this EFH consultation. The effects are expected to be similar to the impacts affecting critical habitat and include the following: in-channel disturbance from pile driving and dewatering, and permanent habitat loss/modification.

In-channel disturbance from pile driving

- Degraded water quality
- Reduction/change in aquatic macroinvertebrate production

In-channel disturbance from dewatering

- Degraded water quality
- Reduction/change in aquatic macroinvertebrate production

Permanent habitat loss/modification

- Reduced shelter from predators
- Reduction/change in aquatic macroinvertebrate production
- Reduced habitat complexity

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) Bank erosion control should use vegetation methods or "soft" approaches (such as vegetative plantings and placement of woody material) to shoreline modifications whenever feasible. Hard bank protection should be a last resort and the following options should be explored (tree revetments, stream flow deflectors, and vegetative riprap).

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, for [*choose all applicable FMPs:* Pacific Coast salmon, Pacific Coast groundfish, coastal pelagic species, and U.S. West Coast highly migratory species].

3.4. Statutory Response Requirements

As required by section 305(b)(4)(B) of the MSA, Caltrans 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

Caltrans 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 Caltrans and the City of West Sacramento. Other interested users could the U.S. Fish and Wildlife Service or California Department of Fish and Wildlife. Individual copies of this opinion were provided to Caltrans. 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, if applicable*] 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, if applicable*], and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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