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

March 31, 2022 **Refer to NMFS No:** WCRO-2021-02830

David K. White
California Supervisor, Pacific Region
NOAA Restoration Center
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404-6515

James Mazza
Acting Chief, Regulatory Division
U.S. Department of the Army
San Francisco District, Corps of Engineers
450 Golden Gate Avenue, 4th Floor, Suite 0134
San Francisco, California 94102-3406

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the NOAA Restoration Center and U.S. Army Corps of Engineers' Restoration Program for Northern California

Dear Mr. White and Mr. Mazza:

Thank you for your letter of October 26, 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 NOAA Restoration Center's (Northern California Office) (NOAA RC) and the U.S. Army Corps of Engineers' (San Francisco District) (Corps) Restoration Program for Northern California (Program). Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson–Stevens Fishery Conservation and Management Act (MSA) [16 U.S.C. 1855(b)].

The enclosed biological opinion describes NMFS' analysis of potential effects of the Project on threatened Northern California (NC) steelhead (*Oncorhynchus mykiss*); threatened Southern Oregon/Northern California Coast (SONCC) coho salmon (*O. kisutch*); threatened Coastal California (CC) Chinook salmon (*O. tshawytscha*); and designated critical habitat for these species in accordance with Section 7 of the ESA. In the biological opinion, NMFS concludes the Program is not likely to jeopardize the continued existence of these ESA-listed species, nor is it likely to adversely modify designated critical habitat for these salmonids. NMFS anticipates take of these species will occur as a result of the Program, and has included an incidental take statement with the enclosed biological opinion.

In addition, NMFS concurs with the NOAA RC and Corps' determination that the proposed action is not likely to adversely affect the southern Distinct Population Segment (DPS) of North American green sturgeon (*Acipenser medirostris*), the southern DPS of Pacific eulachon (*Thaleichthys pacificus*), or their designated critical habitats.

NMFS also reviewed the likely effects of the proposed action on EFH, pursuant to section 305(b) of the MSA (16 U.S.C. 1855(b)). Based on our review, the Program will operate within an area identified as EFH for fish species managed under the following Fishery Management Plans: Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species. The Program includes design, staging, monitoring, and adaptive management strategies recommended by NMFS to avoid or minimize potential adverse effects to EFH, and elements that promote species recovery. Thus, no EFH conservation recommendations are provided.

Please contact Julie Weeder at (707) 825-5168 or Julie.Weeder@noaa.gov, if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Enclosure

cc: Jeffrey Jahn, NMFS, Arcata, CA, Jeffrey.Jahn@noaa.gov
Bob Pagliuco, NMFS, Arcata, CA, Bob.Pagliuco@noaa.gov
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Copy to E-File: FRN 151422WCR2021AR00219

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

NOAA Restoration Center and U.S. Army Corps of Engineers' Restoration Program for Northern California

NMFS Consultation Number: WCRO-2021-02830
Action Agencies: NOAA Restoration Center and U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Southern Oregon/Northern California Coast Coho Salmon (*Oncorhynchus kisutch*)	Threatened	Yes	No	Yes	No
California Coastal Chinook Salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Northern California Steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Southern Green Sturgeon (*Acipenser medirostris*)	Threatened	No	N/A	No	N/A
Southern Eulachon (*Thaleichthys pacificus*)	Threatened	No	N/A	No	N/A

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	No
Coastal Pelagic Species	Yes	No
Pacific Coast Groundfish	Yes	No

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

Issued By:

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Date: March 31, 2022

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

NOAA's 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 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson–Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR part 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 2 weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at California Coastal NMFS office.

1.2. Consultation History

In late December 2020, the Northern California Office of the NOAA Restoration Center (NOAA RC) and the U.S. Army Corps of Engineers, San Francisco District Regulatory Division (Corps) began coordination with NMFS West Coast Region California Coastal Office (WCR CCO) to revise their restoration program (Program). NOAA RC would be the lead federal agency for regulatory consultation on, and implementation of, this Program. The need for consultation was triggered by potential effects to threatened Southern Oregon/Northern California Coast (SONCC) coho salmon, California Coastal (CC) Chinook salmon, and Northern California (NC) steelhead, their designated critical habitats, and Essential Fish Habitat for several fisheries regulated under the Magnuson Stevens Fishery Conservation and Management Act (MSA). A restoration project would be eligible for inclusion in the Program if it received NOAA RC funding, required Corps regulatory authorization, or both. The previous biological opinion for the program expired on March 21, 2022.

Throughout 2021, and during the first few months of 2022, staff from NOAA RC, the Corps, and NMFS WCR CCO met regularly to:

- Add tidal areas to the Action Area and add restoration methods to the Proposed Action;
- Develop a revised administrative process that describes procedures for coordination between NOAA RC, the Corps, and NMFS when potential restoration projects are submitted to the Program for possible inclusion; and

- Discuss NMFS comments on draft versions of the Programmatic Biological Assessment (PBA).

On October 26, 2021, NMFS received a letter from NOAA RC and the Corps requesting initiation of Endangered Species Act (ESA) and MSA consultation on the Program, along with a PBA. The same day, NMFS consultation on ESA and MSA was initiated. NMFS noted inconsistencies in the PBA's effects determinations. On February 8, 2022, NOAA RC confirmed via email that their determination for effects to eulachon species was Not Likely to Adversely Affect. On February 18, 2022, NOAA RC provided a revised, final PBA (NOAA 2022) via email that reflected this changed determination.

On March 3, 2022, NMFS sent an email notification to the Action Agency leads providing an update on the timeline for issuance of the Programmatic Biological Opinion (PBO). Due in part to inconsistencies in the PBA, NMFS needed more time to complete the draft consultation and accommodate the QA/QC review process, and expected to issue the PBO by March 31, 2022. The same day, NOAA RC confirmed receipt of the notification.

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 (see 50 CFR 402.02). Under the MSA, "Federal action" means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal agency (see 50 CFR 600.910).]

The Northern California Office of the NOAA RC and the San Francisco District of the Corps are proposing their restoration program in Northern California (Program). The NOAA RC will be the lead federal agency for regulatory consultation on, and implementation of, this Program. The Program consists of 1. the NOAA RC funding of eligible projects through a variety of ways including but not limited to, the Community Based Restoration Program, Office of Habitat Conservation Strategic Investments, and funding through other restoration programs that might develop during the term of this consultation and 2. the Corps authorizing qualifying projects under their regulatory authorities [Section 404 of the federal Water Pollution Control Act, as amended Clean Water Act (CWA); Section 10 of the Rivers and Harbors Act of 1899; and Section 14 of the Rivers and Harbors Act of 1899, 33 U.S.C. 408 ("Section 408")]. A restoration project may be accepted into the Program if it receives NOAA RC funding, requires Corps regulatory authorization, or both.

The NOAA RC will fund and/or the Corps will authorize specific types of restoration projects within the jurisdiction of the NOAA RC's Northern California Office (Humboldt, Del Norte, Trinity, Siskiyou, and part of Mendocino Counties in California and Klamath, Jackson and Lake Counties in Oregon). NOAA RC staff will administer and oversee the program to facilitate implementation of the restoration projects occurring within the NOAA RC's Northern California Office jurisdictional area.

All restoration projects included in the Program will be subject to the administration process described in the Oversight and Administration section below. Restoration projects may be submitted to the Program by either the Corps or the NOAA RC. The NOAA RC will take the lead for the Program, participate in the screening of individual projects under consideration for inclusion in the Program, and track implementation of individual projects. Such tracking will include documentation and reporting to the NMFS WCR CCO of any adverse effects that result from individual projects under this Program.

For a restoration project to be included under the Program, it must meet the applicable guidelines and best management practices, as determined through a review of each Program Application Form (Application) by the NOAA RC. Multiple sideboards are included in the administrative process and the Program itself to avoid and/or minimize adverse effects to listed species and their critical habitat. NOAA RC and the Corps expect some loss of individuals of a listed species may occur during the construction of some Program projects. However, their overall expectation is that the restoration projects implemented under this Program will help to recover threatened and endangered species and their critical habitat via long-term beneficial effects from habitat restoration, habitat enhancement, and increased ecosystem services.

1.3.1. Eligible Project Types

Improvements to stream crossings and fish passage - Projects to address upstream and downstream movement by fish and other species and improve connectivity of habitats.

Removal of small dams, tide gates, levees, bank revetments, and other legacy structures - Projects to improve fish and wildlife habitat, migration, tidal and freshwater circulation, flow, and water quality.

Riparian restoration and protection – Projects that stabilize banks while reducing fine sediment input, enhancing aquatic and riparian habitat, and improving water quality.

Restoration and enhancement of off-channel and side-channel habitat - Projects to reconnect and/or improve aquatic and riparian habitat for fish and wildlife.

Restoration and enhancement of tidal, subtidal, and freshwater wetlands - Projects to improve ecological functions.

Floodplain restoration - Projects including breaching and removal of levees, berms and/or dikes, resulting in hydrologic reconnection and revegetation, to improve ecosystem function through hydrological connection between streams and floodplains.

Water conservation projects for enhancement of fish and wildlife habitat - Projects such as off-stream storage tanks and ponds, including necessary off-channel infrastructure, to reduce low-flow stream withdrawals.

Removal of pilings and other in-water structures - Projects to improve water quality and aquatic habitat for fish and wildlife.

Removal of non-native terrestrial and aquatic invasive species and revegetation with native plants - Projects to improve aquatic and riparian habitat for fish and wildlife and improve other watershed functions.

Instream restoration - Projects to restore functions of streams and riparian areas.

Upslope watershed restoration - Projects that enhance geomorphic processes and reduce anthropogenic sediment pulses.

1.3.2. Program Administration

The NOAA RC will serve as the Lead Federal Action Agency responsible for Program coordination for this Program under applicable Federal and State laws. Oversight and administration of the Proposed Program will be coordinated between NOAA RC, the Corps and WCR CCO to ensure that aquatic habitat restoration project applications are submitted and evaluated for Program eligibility.

1.3.3. Initial Project Screening and Technical Assistance

This PBA (NOAA 2022) describes the Program requirements, developed collaboratively by NOAA RC, the Corps, and the WCR CCO which are designed to limit adverse effects while optimizing long-term benefits. These Program requirements are enacted through the administration of the Program, so that all restoration projects considered and included in the Program will be subject to the administration process, assessment, and review described in this section.

There are three pathways through which restoration projects included under this program will be identified, and this section describes the proposed procedures for each pathway.

The project Application or request for technical assistance comes to the NOAA RC first. The NOAA RC will be the first level of review in screening potential NOAA RC-funded projects, and projects for which applicants request NOAA RC technical assistance for authorization under the Program. Once the NOAA RC receives a request for technical assistance or an Application (see Submittal Requirements below), they will screen the project to determine eligibility and if it will require agency engineering review (see Engineering Review section below). If NOAA RC determines that the project is eligible for the program, they will notify the Corps that the review of the project has begun and provide the technical assistance request or application documents to the Corps.

The project Application or request for technical assistance comes to the Corps first. The Corps will be the first level of review in screening potential projects for authorization under the Program if they are the entity that receives a request for technical assistance or an Application for potential inclusion under the program (see Submittal Requirements below). The Corps will screen the project to determine eligibility and ask the RC for confirmation. If the RC concurs on eligibility, and if engineering review is required, the NOAA RC will coordinate this review with the appropriate agency engineer.

The request for technical assistance comes to WCR CCO first as an individual consultation request. If WCR CCO receives a request for technical assistance or individual ESA S7 consultation that WCR CCO believes could be included under the Program, then WCR CCO will forward the available information to the NOAA RC for consideration and project consideration will proceed as though NOAA RC had received the Application first (see above).

1.3.4. Agency Technical Review

The project types needing agency technical review (which includes review by specialists in, e.g., fish passage, hydrologic, or fluvial geomorphology) include fish passage improvement, small dam removal, installation of fish screens, stage zero projects, pile driving and projects that include the use of explosives (blasting). Many restoration projects that apply to this Program will have already undergone agency technical review through the planning, design or funding phases of the project. If NOAA RC determines that the latest technical specifications for a project as described in the Application have been adequately addressed by prior agency technical review, NOAA RC will document the name of the reviewer and the date of review. If NOAA RC determines that the project still requires technical input, either because there has been no prior agency technical review or because that review was on different technical specifications, then NOAA RC will ensure that the appropriate agency technical review is completed. Due to limited agency technical resources at NMFS, the RC will also rely on restoration partner agency engineers and technical specialists to conduct these reviews. Agency technical reviews could be conducted by NMFS, California Department of Fish and Wildlife (CDFW), or U.S. Fish and Wildlife Service (USFWS) engineers and technical specialists to ensure that the projects meet current guidelines and criteria as described in the PBA (NOAA 2022). NOAA RC will document the name and affiliation of the engineers and technical specialists that previously reviewed the project. The branch chief whose area includes the location of the project will be provided with a summary of the technical review already provided which they will either confirm or seek further evaluation for concurrence.

1.3.5. Confirmation of Project Inclusion

If the NOAA RC determines that a proposed project is eligible for the Program, the NOAA RC will notify the appropriate WCR CCO Branch supervisor of their findings and seek confirmation that the project is eligible to be included under the Program. The WCR CCO Branch Supervisor will be asked to respond within two weeks, notifying the RC of their confirmation or lack thereof. The NOAA RC will assume confirmation of eligibility if no response from the WCR CCO Branch Supervisor has been received within two weeks. If the WCR CCO Branch Supervisor responds within two weeks that s/he does not agree that the project is eligible, the applicant and the Corps will be referred back to the WCR CCO to work through whether or not the project will require individual Section 7 consultation.

Once all necessary notices, approvals and confirmations are obtained through the process described above, the NOAA RC will email the project applicant, the Corps, the WCR CCO Branch supervisor that the project has been accepted into the Program and that programmatic ESA coverage has been issued. Within two weeks of this email, the NOAA RC will complete a Google spreadsheet with headings consistent with the current NMFS ECO spreadsheet so that the WCR CCO can meet their ECO responsibilities. NOAA RC will maintain copies of all correspondence in the Project File. Program applicants will be responsible for obtaining any other necessary permits or authorizations from appropriate agencies before the start of the project including, but not limited, to a State Water Quality 401 Certification, Lake and Streambed

Alteration Agreement, California Endangered Species Act (CESA) take authorization, and local County permits. All applicants for projects included under this Program will ensure that NMFS and CDFW have access to these restoration project sites for 10 years post implementation to ensure that they are operating as described in the Programmatic Application Form.

1.3.6. Pre- and Post-Project Submittal Requirements

The new Program Application has been included as part of the final PBA (NOAA 2022: Appendix I). This Application is not intended to describe every Best Management Practice (BMP), sideboard or minimization measure described in the PBO, but will include information regarding the major sideboards of the program including dewatering limits, fish removal and relocation, and in-water work windows. In addition, the Application will include information related to the pre-project Submittal Requirements below. Any projects that lack sufficient information to determine their appropriateness for inclusion in the Program will be returned to the project proponent for further clarification/development followed by revision and resubmission of the Application. Project Applications can be submitted throughout the year.

1.3.6.1 Pre-Project Submittal Requirements

The following information will be included in the Application for inclusion in the Program:

- Pre-project photo monitoring data;
- Project description;
- Has the project gone through an agency technical review? If yes, who reviewed it?
- Project problem statement;
- Project goals and objectives, etc.;
- Description of the type of project and restoration techniques utilized (culvert replacement, instream habitat improvements, etc.);
- Description of construction activities anticipated and materials to be used (types of equipment, timing, staging areas or access roads required);
- If pile driving is part of the project, submit a pile driving plan and hydroacoustic analysis to confirm that underwater expected sound pressure levels are below thresholds for peak pressure and accumulated sound exposure levels. A hydroacoustic analysis is not required for vibratory sheet piles.
- If dewatering of the work site will be necessary, description of temporary dewatering methods including qualified individuals who will be onsite to relocate protected salmonids, and a relocation plan.
- Construction duration and start- and end-dates;
- Description of applicable minimization and avoidance measures incorporated into the individual project;
- Signed Project Application Form, verifying that they are agreeing to adhere to all conditions of the PBO during project design and implementation (Example in Appendix I).

1.3.6.2 Post Construction Reporting Requirements

By April 1 of the year following completion of construction of a project, each applicant will submit a completion report to the NOAA RC and the Corps that includes project as-built plans describing conditions immediately following completion of construction on the project and photo documentation of pre-project conditions and the site immediately after the project construction. For projects including fish relocation, the report will also include all fisheries data collected by a qualified fisheries biologist, including the number of listed salmonids killed or injured during the proposed action, the number and age class of listed salmonids captured and removed, and any effects of the proposed action on listed salmonids not previously considered.

1.3.7. Annual Report

In order to document the effects of Program-authorized projects on ESA-listed species and their critical habitat over the life of the Program, including tracking adverse effects to these species, by September 1 of each year, the RC will submit to WCR CCO a report of the previous year's restoration activities (defined as September 1 of the previous year to August 31 of the current year) that summarizes Program activities that occurred during the most recent construction season, and conditions following completion of construction on projects. The annual report shall include a summary of the specific type and location of each project. The report shall include the following project-specific information, unless other information or presentation is mutually agreed upon between CCO and the RC prior to submission of report:

- A map indicating the location of each project.
- A description of the activities that occurred during implementation including the problems addressed by the project, timing, restoration techniques, unforeseen issues, restoration metrics (acres/miles restored), and anything else that will describe the work that has been completed during the implementation season.
- A summary of project objectives met.
- A summary across all projects, and by diversity stratum, of the number and species of fish relocated and killed, which refers to Table 1 in this document and shows the number taken in relation to the take authorized (Appendix II of PBA (NOAA 2022) - PBO Reporting Table).
- A summary of any requested variances and their resolution.

1.3.8. Late-Arriving Federal Action Agencies

It is anticipated that other federal action agencies may participate in projects (via funding, authorizations, or helping with implementation) that have already been included in the Program. Examples of potential Late-arriving Federal Action Agencies (L-AFAA) are the Bureau of Land Management (BLM), the Bureau of Reclamation (BOR), the Natural Resource Conservation Service (NRCS), the U.S. Forest Service, and USFWS. WCR CCO is responsible for consideration of requests from L-AFAAs. If the late arriving action agency contacts the NOAA RC or the Corps first, then the NOAA RC or the Corps will respond with the following template language:

> "*The NOAA Restoration Center (RC) has reviewed the (Project Proponent/applicant's) Application to the NOAA RC's Restoration Program for Northern California and has determined that the (Project) fits within the scope of this program. NOAA RC and the United States Army Corps of Engineers' (USACE) have completed programmatic consultation with NMFS under section 7(a)(2) of the ESA for the NOAA RC's Restoration Program for Northern California. Please contact NMFS' Arcata Office to determine the ESA consultation requirements that may remain for your agency's project.*"

NOAA RC will also send a copy of this response to WCR CCO each time this response occurs.

1.3.9. Variance Process

Requests for variance from those limitations previously described in the proposed action will be considered. An example of a variance request would be allowing more than 1,000 contiguous feet of stream to be dewatered if the water quality conditions were demonstrated to be poor (temperatures above 25° C) throughout the reach and no cold water refugia areas were identified in the area to be dewatered. Another example is a request to forego relocating fish prior to dewatering a stream reach with water temperatures greater than 25° C.

The following process will be used to determine whether the proposed variance would result in effects of a nature or magnitude that were not analyzed during consultation. If so, the variance will not be granted. Variance requests may be submitted by project applicants at any time. Variance requests will be evaluated by NOAA RC and the Corps in coordination with WCR CCO. NOAA RC will receive and forward variance requests to WCR CCO. WCR CCO will assist NOAA RC and the Corps in determining whether or not they will grant the variance. NOAA RC will then notify the project applicants of whether or not the variance has been approved under the Program, and document the resolution of each variance request in their annual report for the Program. This documentation will include the following information:

- A description of the project and the design feature within the project that needs a variance
- The reason why the design feature requires a variance.
- The specific design variance requested.
- The rationale for why the requested variance will not result in effects that go beyond those analyzed during the ESA consultation on the Program, either in type, frequency, or magnitude. In the temperature example, this rationale may include describing known temperature tolerances for species that may be present and any evidence that no salmonids have been detected in areas like this (e.g., the mainstem Eel River) above 25° C, to argue that no fish would be harmed by the requested variance.
- Whether the design variance was granted or denied, and the rationale for any denials.

1.3.10. Eligible Project Types and Design Guidelines

Below are the detailed restoration project types included in the proposed Restoration Program. Each project type has a brief summary of the project purpose, a description of different activities and/or sub-project types, and a summary of typical construction, maintenance, and monitoring activities associated with the project type.

Although the Program does not cover projects whose primary purpose is creation or modification of non-restoration oriented infrastructure (e.g., dams and levees), some restoration projects may require creation, modification, or relocation of infrastructure so that travel, recreation, water supply or other types of infrastructure and operations can continue in the context of the restored habitat (e.g., relocation of a bridge or water control structure to allow for habitat restoration).

1.3.10.1 Improvements to stream crossings and fish passage

Improvements to stream crossings and fish passage, including fish screens, provide a number of ecological benefits. For example, they provide safe passage for migratory and non-migratory species, enhance beneficial transport of sediment and debris, and improve hydrology and hydraulics. Stream crossing and fish passage improvements must be consistent with NMFS' fish passage guidelines (NMFS 2001).

1.3.10.1.1 Stream Crossings, Culverts and Bridge Projects

Stream crossing, culvert, and bridge projects generally involve removing, replacing, modifying, retrofitting, installing or resetting existing culverts, fords, bridges and other stream crossings and water control structures of any size. This includes projects that are developed to upgrade undersized, deteriorated, or misaligned culverts.

Constructing or installing a stream crossing, culvert, or bridge may include site excavation, creation of rock ramps or roughened channels, weirs, adding fine and coarse grained streambed materials, formation and pouring of a concrete foundation and walls/abutments, and installation of the crossing structure, as well as placement of rock slope protection (RSP) to protect abutments, piers and walls.

Any crossing, culvert, or bridge that is part of the Program and intersects potential habitat for listed salmonid species must meet NMFS fish passage criteria. Only projects that meet stream simulation or active channel design metrics are included; projects that are considered hydraulic passage solutions (fishways, exposed concrete bottom, etc.) are not covered.

Design guidelines for this project type include:

- All stream crossing projects should consider storm-proofing guidelines presented in Flosi et al. (2010).
- Projects must follow the most recent NMFS guidelines for salmonid passage at stream crossings when implemented in currently occupied or potential anadromous habitat.
- Bridges and culverts will be designed to adequately convey flow and materials (e.g., the 100-year flood) in addition to allowing fish passage. If a bridge or culvert is designed to convey less than the 100-year design flow, the Project Applicant will demonstrate how the undersized culvert or bridge avoids excessive erosion/sedimentation, headcutting, or habitat impacts.
- Structures should be designed to provide passage for all life stages of salmonids. If this is not possible, the RC or Corps will work with WCR CCO engineers through the

variance process established through the CCO Environmental Services Branch for approval.

- Placement of RSP within the bankfull width of the stream will be avoided except for the minimum necessary for protection of bridge abutments and pilings, culverts, and other stream crossing infrastructure. The amount and placement of any RSP will not constrict the bankfull flow nor induce additional erosion in neighboring stream segments. The toe of RSP used for streambank stabilization will be placed sufficiently below the streambed scour depth to ensure stability
- Include minimal use of hard structures (e.g., wingwalls, footers) needed to maintain function of the passage facility. Structures that harden the channel should be placed outside the bankfull channel and/or buried to a depth below the lowest anticipated Vertical Adjustment Profile.

1.3.10.1.2 Fish Screens

This category includes the installation of fish screens on existing water intakes. Constructing/ installing a fish screen usually includes site excavation, forming and pouring a concrete foundation and walls, and installation of the fish screen structure. Pile driving may be needed for certain types of screens. Typically, if the fish screen is placed within or near flood prone areas, rock or other armoring is installed to protect the screen. Fish screen types include: self-cleaning screens (including flat plate and other designs, including rotary drum screens and cone screens with a variety of cleaning mechanisms), and non-self-cleaning screens (including tubular, box, and other designs).

Design guidelines for this project type include:

- NMFS agency review is required for all fish screening projects.
- All fish screens must be consistent with the most recent NMFS fish screen design guidelines.
- All fish screening projects will also provide a fish screen operations and maintenance plan along with their programmatic application form.

1.3.10.1.3 Removal of small dams, tide gates, and legacy structures

These projects are designed to reconnect stream corridors, floodplains and estuaries, establish wetlands, improve aquatic organism passage, restore more natural channel and flow conditions, restore fisheries access to historic habitat for spawning and rearing, and improve long-term aquatic habitat quality and stream geomorphology. All projects will be designed with seasonal construction considerations described in the instream work window section below, to minimize the potential adverse effects to water quality and/or aquatic species.

This project type involves removing small dams, tide gates, flood gates, and legacy structures to improve fish and wildlife migration, tidal and freshwater circulation and flow, and water quality. This project type may also include separation of streams from artificial impoundments (e.g., ponds or lakes) by realigning and/or rerouting channels around these artificial water bodies and/or through the use of vertical concrete or sheet-pile walls.

1.3.10.1.3.1 Removal of Small Dams

Small dams are removed to restore fish access to historic habitat for spawning and rearing and to improve long-term habitat quality and natural stream geomorphology. Types of eligible small dams include permanent, flashboard, debris basin, earthen, and seasonal-type dams that have the characteristics listed below.

Small dams included in the Program are defined by the California Division of Dam Safety (CDDS) as dams of non-jurisdictional size. Non-jurisdictional dams are defined by the by California Code 2010 as: Any artificial barrier which is (a) less than 25 feet in height from the natural bed of the stream or watercourse at the downstream toe of the barrier, or from the lowest elevation of the outside limit of the barrier to the maximum possible water storage elevation and (b) was designed to have an impounding capacity of less than 2000 acre-feet.

Implementing small dam removal projects may require the use of heavy equipment (e.g., self-propelled logging yarders, mechanical excavators, backhoes, jackhammers, etc.) or explosives. Any use of explosives for small dam removal must be justified by site-specific conditions including equipment access difficulties and supported by analyses showing that potential harm is not greater than if heavy machinery were used. The analysis required is defined in the In-water Pile Driving Protection Measures section below.

Proposed Restoration Projects meeting any of the following conditions are ineligible for the Restoration Program:

- Projects involving dams under CDDS jurisdiction (e.g., greater than 25 feet high and impound more than 2,000-acre feet of water);
- Projects in which sediments stored behind the dam have a reasonable potential to release accumulated harmful environmental contaminants [e.g., dioxins, chlorinated pesticides, polychlorinated biphenyls, or mercury] beyond the freshwater probable effect levels summarized in the NOAA Screening Quick Reference Table guidelines (NOAA 2008); or
- Projects that require a more detailed analysis, based on the risk of significant loss or degradation of downstream spawning or rearing areas by sediment deposition.

Sites shall be considered to have a reasonable potential to contain contaminants of concern if they are adjacent to historical contamination sources such as lumber or paper mills, industrial sites, mining sites, or intensive agricultural production going back several decades (i.e., since chlorinated pesticides were legal to purchase and use). For sites that are found to have a reasonable potential for contaminants (e.g., a cone burner or mill sites), project proponents should also assess the habitat downstream as well as within the reservoir sediments to determine if releasing contaminants will exceed background levels. Therefore, preliminary sediment sampling is advisable in these areas to determine if a project would be eligible for the Restoration Program.

Small dams that do not have historical contamination sources in the upstream watershed are considered to have low potential to contain contaminants and, therefore, would be considered low risk with reduced sediment sampling and evaluation.

This Program will only include dam removal that will result in formation of a channel at natural grade and shape upstream from the dam, naturally or with excavation, to optimize connectivity upstream and improve or minimize negative effects on downstream habitat. Dam removal projects accepted into the program where the downstream habitat is in excellent condition and will not benefit from sediment input will: (1) have a small volume of dam-trapped sediment available for release relative to the transport capacity of the stream channel, that when released by storm flows, will have minimal effects on downstream habitat as verified by a qualified engineer and are reviewed by NMFS engineers, or (2) be designed to remove sediment trapped by the dam down to the elevation of the target thalweg including design channel and floodplain dimensions.

Design guidelines for this project type include:
Use of one of the following two methods to restore the channel in a small dam removal project: Natural channel evolution or "stream simulation" design. The conditions under which each of these methods would be used are as follows:

Natural channel evolution: The natural channel evolution approach to restoring a channel bed would consist of removing all hardened portions (by hand efforts, heavy equipment, or explosives) of a dam and allowing the stream's flows to naturally shape the channel through the project reach over time. This method shall only be used in the following situations: (1) there are benefits of introducing sediment downstream and risks are minimal (or risks can be mitigated) to any of the downstream habitats and the aquatic organisms inhabiting them (based upon the amount and size gradation of the material being stored above the dam) if all of the sediment upstream of the dam is released during a single large storm event; (2) the project reach has sufficient space and can be allowed to naturally adjust based upon any land constraints with minimal risk to riparian habitat; (3) when possible, project implementation should follow procedures that have been documented as having been successfully performed elsewhere under similar circumstances; (4) notching the dam in increments after periodic storm events in order to reduce the amount of sediment being released during any individual storm event should have sufficient project funding in place to allow the dam to be completely removed within the Proposed Project timeframe.

Stream simulation: Stream simulation design relies upon trying to duplicate the morphological conditions observed within a natural reference reach throughout the project reach. Stream simulation designs should be used in extreme situations where excessive sediment releases pose a threat to downstream habitat and organisms. Specifically, the sediment upstream of the dam would be physically removed, and the channel through the excavated reach would be designed using stream simulation. Stream simulation designs would be conducted in accordance with known stream restoration guidance documents. This specifically includes: (1) the identification of a suitable reference reach; (2) quantification of the average cross-sectional shape, bank full width, channel slope, bed and bank sediment grain size distributions, and the geomorphic features of the channel (e.g., pool-riffle sequences, meander lengths, step pools, etc.); and (3) reproducing the geomorphic features found within the reference reach in the project reach.

Data Requirements and Analysis:

- Use of a longitudinal profile of the stream channel thalweg for at least a distance equal to 20 bankfull channel widths upstream and downstream of the project and long enough to establish the natural channel grade (as described in the CDFW Manual (Flosi et al. 2010).
- Determine the quantity and quality (grain size distribution and stratigraphy) of sediment stored in the reservoir, methods chosen on a case-by-case basis, with technical input from NMFS technical advisors.
- Depending on the quantity and caliber of sediment stored behind the dam, additional information may be needed to characterize the stored sediment relative to average annual sediment supply and transport capacity near the dam. Methods for estimating these rates should be selected in coordination with NMFS technical advisors.
- Use a habitat typing survey (CDFW Manual Part III, Habitat Inventory Methods) that maps and quantifies all downstream habitat units, including spawning areas that may be affected by sediment released by removal of the water control structure.
- For those projects that are intended to benefit from coarse sediment release to downstream reaches, assess whether additional channel structure is needed to help retain sediment (e.g., LWD and/or boulders) and estimate potential increases in spawning area.

1.3.10.1.3.2 Removal or Upgrade of Tide Gates and Flood Gates

Removal of, or upgrades to, existing tide and flood gates, that involve modifying gate components and mechanisms in tidal stream systems where full tidal exchange is incompatible with current land use (e.g., where backwater effects are of concern). Tide/flood gate replacement or retrofitting include such activities as installation of temporary cofferdams and dewatering pumps, excavation of existing channels, adjacent floodplains, flood channels, and wetlands, and may include structural elements such as streambank restoration and improving hydraulic roughness.

Placement of new gates where they did not previously exist are not eligible for the Restoration Program, with the following exceptions. Often during floodplain and estuarine restoration projects, new tide gates are required within the setback levees in order to protect critical infrastructure, and these types of structures are allowed in this Program. Replacing tide gates are eligible only if the Project can demonstrate that such replacement would significantly increase or enhance fish passage and meaningfully contribute to increases in tidal prism over the baseline condition. New tide gates that do not achieve or allow for full tidal restoration should provide offsetting conservation measures (for example, the installation of a large wood structure), as these new structures will result in long-term and often permanent effects. Excavators, cranes, boats, barges, pumps, dump trucks, and similar equipment are typically used to implement the projects in this category.

Design guidelines for this project type include:

- For projects that constrain tidal exchange, the Project Applicant will ensure that the project increases fish passage opportunities and conditions for target species in areas of constrained tidal exchange. This Program will not support projects that further constrain tidal exchange as compared to current conditions.
- If a culvert and bridge will be constructed at the location of a removed tide gate, consider designing the structure to allow for full tidal exchange whenever possible.

1.3.10.1.3.3 Removal of Legacy Habitat Structures

This activity includes the removal of nonfunctioning in-channel and floodplain legacy habitat structures (e.g., grade control structures, boulder weirs, J-hooks, etc.) to improve water quality and channel geomorphology. Excavators, cranes, boats, barges, pumps, dump trucks, vibratory pile drivers, and similar equipment are typically used to implement the projects in this category.

Design guidelines for this project type include:

- If the structure being removed contains material (i.e., boulders, LWD, etc.) not expected to be naturally present due to channel and valley topography/geology and natural vegetation types at that site, consider burying the material to raise the channel invert, if that is a goal of the project, or disposing of removed material at an approved landfill or disposal site.
- If the structure being removed contains material (i.e., large wood, boulders, etc.) that is typically found within the stream or floodplain at that site, the material can be reused to implement habitat improvements described under other restoration project types in the Restoration Program.
- If the structure being removed is keyed into the bank, consider filling in “key” holes with native materials to restore contours of the stream bank and floodplain. Fill material should be adequately compacted to prevent washing out of the soil during overbank flooding. Material from the stream channel should not be mined to fill in “key” holes.

1.3.10.2 Riparian restoration and protection

These projects are intended to improve salmonid habitat through increased stream shading intended to lower stream temperatures, increase future recruitment of LWD to streams, and increase bank stability and invertebrate production. Riparian habitat restoration projects will aid in the restoration of riparian habitat by increasing the number of plants and plant groupings, and will include the following types of projects: natural regeneration, livestock exclusion fencing and crossings, off channel stock watering, bioengineering, non-native invasive vegetation removal, and revegetation. Part XI of the CDFG Manual, Riparian Habitat Restoration, contains examples of these techniques.

Revegetation with native plants should mimic the area’s naturally occurring wetland, riparian, or aquatic habitats and use seed or plant stock from the local watershed. Activities may include:

- Planting and seeding native trees, shrubs, and herbaceous plants,
- Placing sedges, rushes, grasses, succulents, forbs, and other native vegetation,
- Gathering and installing willow cuttings, stakes, bundles, mats, and fences,
- Temporary irrigation.

Reduction of instream sediment will improve fish habitat and fish survival by increasing fish embryo and alevin survival in spawning gravels, reducing injury to juvenile salmonids from high concentrations of suspended sediment, and minimizing the loss of, or reduction in size of, pools from excess sediment deposition.

Certain bioengineering techniques will be included under this Program including the planting of native plant materials, willow walls, willow siltation baffles, brush mattresses, and brush bundles. These techniques are intended to improve riparian and stream habitat by increasing stream shade to lower stream temperatures, increase the production of invertebrates, provide future recruitment of large woody material to streams, and trap and bind fine sediment to reestablish riparian areas. Projects in this category may require the use of heavy equipment (e.g., self-propelled logging yarders, excavators, backhoes, dump trucks, etc.).

Bioengineering techniques use a minimal amount of hard materials (e.g., rock), but are not intended to include traditional hard engineering techniques. This Program does not include bioengineering techniques that use large amounts of rip rap or other hard materials that are intended to harden banks or prevent geomorphic processes from occurring to prevent erosion on private properties that are within the floodplain/river channel. The use of boulders should be limited in scope and quantity to the minimum necessary to secure the toe of willow baffle trenches and will be buried below the active channel grade. This Program is not meant to cover projects that are merely protecting private property bank erosion issues.

Design guidelines for riparian restoration and willow restoration include:

- A site-appropriate revegetation plan will be developed as part of the project description at the project level.
- Design species palette for revegetation based on the species that naturally or historically occur in the project area, have the best chance of survival considering current site conditions, and can provide required habitat elements for fish.
- Revegetation that is not dependent on irrigation systems is generally preferred, however, there can be instances where irrigation is desirable. If using an irrigation system is necessary for plant establishment, the system must be installed and operational prior to planting, or prior to any periods where the weather forecast may jeopardize successful establishment of plants.
- Acquire native seed or plant sources as close to the project site as possible.
- For installation of pole cuttings, source cuttings from healthy plants, limiting collection to no more than 30% of individual plants or populations. Pole cuttings should be taken from live wood at least one-year-old or older.
- Plant cuttings when dormant and within 48 hours of collection.
- Enclose plantings with temporary fencing, cages, tubes or other protective measure, as appropriate, in areas where plantings are subject to browse by animals, such as deer, elk,

beavers, livestock, gophers, or moles. Remove any non-biodegradable fencing material after plantings are adequately established.

Design guidelines for plant enclosures to protect, restore, or establish aquatic or riparian resources include:

- Fence placement should be designed to allow for lateral movement of a stream, migration or dispersal of wildlife through the area, and establishment of riparian plant species. To the extent possible, fences should be placed outside the channel migration zone, the area along a river within which the channel(s) can be reasonably predicted to migrate over time as a result of natural and normally occurring hydrological and related processes. Install cross-stream fencing at fords, with breakaway wire, swinging floodgates, hanging electrified chain, or other devices to allow the passage of floodwater and large woody material during high flows.
- Avoid and minimize vegetation removal when constructing fence lines to the extent feasible. Large, established riparian vegetation should not be removed.

Design guidelines for livestock stream crossings and watering lanes to protect, restore, or establish aquatic or riparian habitat include:

- Design and construct essential livestock stream crossings to handle reasonably foreseeable flood risks, including associated bedload and debris, and to prevent the diversion of streamflow out of the channel and down the livestock trail that uses the crossing, if the crossing fails. Livestock crossings will not create barriers to upstream and downstream passage of adult and juvenile fish.
- Use existing access roads and stream crossings whenever possible, unless new construction would result in less habitat disturbance and the old trail or crossing is retired. Locate new livestock stream crossings or water lanes where streambanks are naturally low. Avoid placement of stream crossings in or near sensitive aquatic habitats.
- Minimize the number of stream crossings for livestock within a single reach and across a watershed for livestock to limit vegetation disturbance and erosion.
- When locating livestock crossing and watering lanes, ensure the existing fences, pasture access, grazing patterns, shoreline slope and water depth is appropriate. The ramp should be wide enough to accommodate the expected usage but not less than 12 feet and not steeper than 3:1.
- Extending the ramp in the waterway far enough to achieve the desired depth and ensure the approach surface runoff is diverted away from the ramp. If side slopes will be the result of improving the lanes, make sure the cut or fills are not steeper than 2 horizontal to 1 vertical.
- The surface material should be an angular drainage rock and the use of fencing or other barriers is required to delineate the boundaries of the ramp to keep cattle out of the surrounding riparian areas and limit entrance into the active channel.
- Keep the ramps away from shaded river areas and follow the general avoidance and minimization measures included at the end of this document. Design guidelines for off-channel livestock watering to protect, restore, or establish aquatic or riparian habitat

- Withdrawals for livestock watering must not dewater habitats, cause streamflow conditions that adversely affect Covered Species, or significantly reduce habitat value.
- Each livestock water development should have a float valve or similar device, a return flow system, a fenced overflow area, or similar means to minimize water withdrawal and potential runoff and erosion.
- If water intakes are placed in native fish-bearing streams, screen surface water intakes to meet current NMFS and CDFW fish screening guidelines. Screens should be self-cleaning, or regularly maintained by removing debris buildup. A responsible party will be designated to conduct regular inspection and as needed maintenance to ensure that pumps and screens are properly functioning.
- Troughs or tanks should be placed far enough from a stream or surrounded with a protective surface to prevent mud and sediment delivery to the stream. Steep slopes and areas where compaction or damage could occur to sensitive soils, slopes, or vegetation due to congregating livestock should be avoided.
- Part X of the CDFW Manual, Upslope Assessment and Restoration Practices, describes methods for identifying and assessing erosion, evaluating appropriate treatments, and implementing erosion control treatments.

1.3.10.3 Restoration and enhancement of off-channel and side-channel habitat

Restoring and enhancing off-channel and side-channel habitat features helps to improve aquatic and riparian habitat for fish and wildlife. This project type has the following benefits:

- Increases habitat diversity and complexity.
- Improves hydrologic and hydraulic diversity or complexity.
- Provides long-term nutrient storage and substrate for aquatic macroinvertebrates.
- Moderates flow disturbances and protects communities.
- Increases retention of leaf litter.
- Provides refuge for fish during high flows.
- Improved hydrologic connection between a main channel and its floodplain.

This project type typically involves reconnecting side-channel, alcove, oxbow, pond, off-channel, floodplain, and other habitats, and potentially removing off-channel fill, berms and plugs. This activity category typically applies to areas where side channels, alcoves, and other backwater habitats have been filled or blocked from the main channel, disconnecting them from most if not all flow events. Work may involve removing or breaching levees, berms, and dikes; excavating channels; constructing wood or rock tailwater control structures; and constructing large wood and boulder habitat features. This project type can involve the use of logs or boulders as stationary water level control structures. With the exception of off stream storage projects to reduce low-flow stream withdrawals, projects involving the permanent installation of a flashboard dam, head gate, or other mechanical structure are not eligible for the Program. The creation of new side-channel, alcove, oxbow, and pond habitats is included. New side-channels and alcoves will be constructed in geomorphic settings that will accommodate such features. Excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

Design guidelines for this project type include:

- Excavated material removed from off- or side-channels will be: 1) reused onsite to enhance riffles and grade controls to increase connectivity if it is the appropriate grain size range or can be screened to appropriate size range, or 2) hauled to an upland site for disposal, or 3) spread across the adjacent floodplain, as long as the soil is considered suitable for application (e.g., free of contaminants and/or pathogens), and is done so in a manner that does not restrict floodplain capacity or otherwise degrade floodplain function.

1.3.10.4 Floodplain restoration

Project types in this category enlarge key salmonid rearing habitat and improve the diversity and complexity of river-wetland corridors that include aquatic, meadow, and riparian habitat, as well as first order ecosystem functions, because they have the following effects:

- Drive primary productivity which is the foundation of the food web.
- Provide expansive areas of food-rich low velocity habitat that supports large numbers of juvenile salmonids.
- Provide resilient habitat during high stress events such as floods and wildfire, and refuge from predators.
- Provide thermal complexity and buffering due to the connectivity of the hyporheic zone, which offers multiple habitat niches within close proximity.
- Deliver food resource benefits on site as well as downstream from floodplain return flows.
- Provide numerous additional ecosystem benefits such as sediment, carbon, debris and water storage, which supports riparian vegetation, bird and mammal use.
- Create the dynamic hydrological connection between streams and floodplains that salmonids evolved with.
- Increase floodway capacity (reducing downstream flood impacts) and the frequency and duration of floodway inundation.
- Reduce or eliminate legacy areas (such as gravel pits) that strand native fish or provide habitat for nonnative predatory fish, or both.
- Reset valley floors to stage zero.

Floodplain restoration projects involve either 1) removing barriers (such as setback, breaching, and removal of levees, berms and dikes, 2) excavation of elevated surfaces to reconnect to the channel, or 3) or channel fill for hydraulic reconnection, and combinations of these approaches to create streams that are fully-connected with their floodplains and typically multi-threaded, or ‘stage zero’ (see Cluer and Thorne 2013).

These projects generally involve reconnecting historical stream and river channels and freshwater deltas with floodplains, and reconnecting historical estuaries to tidal influence, through levee removal, setback and breaching, or construction of floodplain surfaces that connect at base flow. Typically, these projects take place where floodplains and estuaries have been disconnected from adjacent streams and rivers. Levee setback projects include construction of new levees to facilitate removal or breaching of existing levees and creation of aquatic or riparian habitat. These project types may also include filling and/or reshaping of on- and off-channel gravel pits and channels. Levees may be adjusted or a low levee bench may be created to allow for tidal inundation or channel margin habitat.

Meadow and floodplain restoration may involve reconnecting down-cut channels to their floodplains to restore hydrologic processes and meadow health by filling incised, entrenched channels with local material such as undifferentiated sediment from nearby banks or legacy berms, creating new stream channels, re-grading floodplains (which involves skimming earth off higher areas and moving it into lower areas), realigning channels, or installing water surface elevation structures.

These restoration actions may be implemented to completion through construction and earth moving techniques, or through kick-starting physical processes complete work over time to restore a channel network and floodplain that supports forested wetlands or grasslands. It follows that a multi-year multi-step process would be a necessary part of proposals that intend to rely on process-based incremental methods.

Similar to restoration projects that create off-channel/side-channel habitats, proposed floodplain restoration projects will include information regarding consideration of water supply (channel flow, overland flow, and groundwater), water quality, and reliability; and tolerance for an enlarged dynamic river corridor including channel changes.

Heavy equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement these projects when valleys are being reset. Low tech methods such as beaver dam analogs (and similar), constructed riffles, beaver introduction, may be used when incremental process-based methods are used.

Design guidelines for channel reconstruction, valley reset, or relocation projects include:

- Design actions to restore floodplain inundation characteristics by modifying channel capacity through a combination of parameters, including elevation, width, sinuosity gradient, length, and roughness--in a manner that closely mimics or resets those that would naturally occur at that stream and valley type.
- To the extent feasible, native materials (rock, gravel, large wood, sod, willows, topsoil, etc.) should be salvaged and utilized as channel fill. Non-native fill material may be reused if it is of similar quality to native material, or removed from the channel and floodplain to an upland site or appropriate offsite disposal location, potentially including a landfill (for anthropogenic debris).
- Where practicable, construct geomorphically appropriate elevations, stream channels, and floodplains (e.g., enable natural transport processes including the creation of depositional and scour features) within a watershed and reach context to connect channels.
- When necessary, decompact soils once overburden material is removed. Overburden or fill composed of pathogen-free and native materials, which originated from the project area, may be used within the floodplain to support the project goals and objectives.

- Significant areas of restored floodplain should remain hydraulically connected during base flow conditions.

Design guidelines for projects that involve setback or removal of existing berms, dikes and levees include:

- Design actions to restore floodplain activation characteristics in a manner that closely mimics, to the extent possible, those that would naturally occur in that area.
- Where it is not possible to remove or setback all portions of dikes and berms, openings may be created with carefully planned breaches. Timing and spacing of breaches should be planned for maximum positive environmental outcomes.
- Bare surfaces should be treated with LWD placement and/or replanted using native plants.

1.3.10.5 Establishment, restoration, and enhancement of tidal, subtidal, and freshwater wetlands

Establishing, restoring, and enhancing tidal, subtidal, and freshwater wetlands results in increased primary and secondary production and diversification and increased aquatic habitat for a diversity of fish and wildlife species.

This project type generally involves grading (e.g., creating depressions, berms, and drainage features) and/or breaching (e.g., excavating breaks in levees, dykes, and/or berms) to create topography and hydrology that:

- Supports native marsh plants (planted or recruited naturally).
- Provides habitat elements for target species.
- Provides other targeted wetland functions.
- Allows fish and other aquatic species to use channel networks and marsh plains with hydrologic variability (seasonally or tidally).

This project type also creates ecotones (transitional zone between two habitat or community types [aquatic and upland interface]), 'horizontal levees', and/or setback berms) and/or "living shorelines" that use fill and excavation with native vegetation (submerged and/or emergent), alone or in combination with offshore sills (e.g., artificial reefs), to stabilize the shoreline. Creation of ecotones could require extensive beneficial fill and have the potential to affect adjacent existing wetlands. However, these projects are necessary to allow tidal wetlands to respond to sea level rise, provide refuge for native wildlife, and buffer wetlands from adjacent municipal and industrial land uses.

Living shorelines provide a natural alternative to 'hard' shoreline stabilization methods like stone sills or bulkheads, and provide numerous ecological benefits including water quality improvements, fish and invertebrate habitat, and buffering of shoreline from waves and storms. Living shoreline projects use a suite of habitat restoration techniques to reinforce the shoreline, minimize coastal erosion, and maintain coastal processes while protecting, restoring, enhancing, and creating natural habitat for fish and aquatic plants and wildlife.

This project type includes excavation, removal, and/or placement of fill materials to restore or approximate pre-disturbance site conditions; contouring wetlands to establish more natural topography, hydrology, and/or hydraulics; and setting back, modifying, or breaching existing dikes, berms and levees.

This project category also includes the following actions:

- Constructing transitional tidal marsh habitat (i.e., "horizontal levees," setback berms, or ecotones)
- Backfilling artificial channels
- Removing existing drainage structures, such as drain tiles
- Filling, blocking, or reshaping drainage ditches to restore wetland hydrology
- Establishing tidal/fluvial channels and wetlands in tidal waters where those wetlands previously existed, or have migrated or will migrate as a result of sea level rise
- Installing structures or fill necessary to establish wetland or stream hydrology
- Constructing nesting/planting islands
- Constructing open water areas
- Constructing noncommercial, native oyster habitat (e.g., reefs) over an unvegetated bottom in tidal waters
- Conducting noncommercial, native shellfish seeding
- Establishing submerged aquatic vegetation (e.g., eelgrass beds) in areas where those plant communities previously existed.
- Activities needed to establish vegetation, including plowing or disking for preparation of seedbeds and planting appropriate wetland species, and use of seed buoys.
- Project activities that plan for climate change, including sea level rise, will be considered in tidally influenced locations. California's Climate Adaptation Strategy recommends using ecotones and living shorelines as a potential adaptation method to reduce the need for engineered "hard" shoreline protection devices and to provide valuable, functional coastal habitat (CNRA 2018). The California State Coastal Conservancy's Climate Change Policy also supports the use of living shorelines for their ability to improve the resiliency of estuarine habitat to future sea level rise and other related effects of climate change.

Ecotone habitat levees should be used when new exterior levees are required to protect adjacent landowners from the return of tidal inundation. The project side of the levee should be constructed with areas of longer gentle slopes to accommodate upland refugia for sensitive salt marsh and brackish marsh species during future flood king tides. Interior berms should be disconnected from the adjacent uplands to reduce access by predators during high tides. In addition, sidecast material should be used during the excavation of new channels to recontour pond bottoms to achieve the desired hydrology, including creating islands disconnected from uplands to provide future upland refugia and nesting areas in larger marshes.

Excavators, graders, bulldozers, dump trucks, front-end loaders, boats, barges, and similar equipment may be used to implement projects.

Design guidelines for this project type include:

- Implement projects to repair or restore estuary functions, while not putting adjacent landowners at increased flood risk once dikes/levees are breached and the project area is flooded.
- Where possible, recreate historic channel morphology that supports wetland function. Channel designs should be based on aerial photograph interpretation, literature, topographic surveys, and nearby undisturbed channels. Channel dimensions (width and depth) should be based on measurements of similar types of channels and the drainage area.
- Removal of temporary access roads and decompaction of soils as necessary to support desired revegetation.
- Restore wetlands to elevations necessary to support the desired vegetation communities, accounting for anticipated natural sediment accumulation and future sea level rise. Appropriate dredge material or other clean fill material may be imported to raise subsided landscapes, depending on the desired habitat to be restored. Overfill may be necessary to accommodate settling.

If grading of intertidal plane (landform) is needed, implement the following guidelines, to the extent feasible, to avoid and/or minimize adverse effects to water quality, sensitive resources, and/or Covered Species:

- conduct all grading of tidal plane in dry conditions, behind cofferdams, dikes, and/or levees;
- After grading of the tidal plane is complete, implement water management activities to revegetate and stabilize exposed soils on the plane prior to removing cofferdam and/or breaching dikes or levees.

Implement the following pre-breach water management measures:

- Release on-site water gradually; water from the project area should be released gradually to reduce the effect of potentially low dissolved oxygen (DO) and high temperature water on the surrounding water body; this would allow the plume of degraded water to dissipate without harmful effects to aquatic life.
- For projects that include the use of donor vegetation beds for use in restored marsh and/or emergent or submerged vegetation sites, no more than five percent of the below ground biomass of an existing donor bed should be harvested for transplanting purposes. Plants harvested should be taken in a manner that thins an existing bed without leaving any noticeable bare areas. Harvesting of flowering shoots for seed buoy techniques should occur only from widely separated plants and only a certain percent of the donor stock should be used per year. This percent is site dependent and prior to restoration requires intimate knowledge of the genetics and population dynamics of the donor site.
- Shellfish substrate should be placed to encourage oyster larval recruitment. Restoration sites are typically subtidal or intertidal on un-vegetated, soft bottom estuarine areas. Rarely, substrate may be placed on hard substrate that represents former reef habitat, but only if the hard substrate is not currently producing oysters at a sustainable level. Natural

substrate (oyster or clam shells) is preferred due to the oysters' affinity for it, but is not always available. Shells are most often deployed loose or in mesh bags. Artificial substrate should be used when there is not enough shell substrate available to create larger reef areas or when the bottom substrate is unstable and substantial sinking of the reef is likely to occur. Common artificial substrates include limestone rock and baycrete (e.g., Reef Balls, Oyster Castles, etc.). Regardless of type, most substrate is deployed from a boat or barge, but in some shallow water situations, restoration practitioners and community volunteers may carry the substrate to the reef location.

- Restoration efforts could also include releasing live shellfish in the restoration area if the local population is not large enough to produce viable larvae or has been fully extirpated from the area. Oysters may be released as single oysters, or already attached to substrate as oyster spat on shell. Non-reef-forming organisms such as clams and abalone are released as individuals, but may be caged as necessary to (e.g., to reduce predation) and facilitate research efforts. Rearing shellfish prior to release occurs in land-based or near-shore aquaculture facilities. Some shellfish are purchased from commercial facilities, but some funding recipient organizations run their own facilities as well.
- Shell sources – shell or other substance used for substrate enhancement should be procured from clean sources that do not deplete the existing supply of shell bottom. Shells should be left on dry land for a minimum of one month before placement in the aquatic environment. Shells from the local area should be used whenever possible.
- Native species and disease – Shellfish species native to the project area should be used where possible. Any shellfish transported across state lines or grown through an aquaculture facility should be certified disease free.

1.3.10.6 Water conservation projects for enhancement of fish and wildlife habitat

Creation, operation, and maintenance of water conservation projects, including off-stream storage tanks and ponds and associated off-channel infrastructure and rainwater harvest systems, reduce low-flow stream withdrawals and enhance stream flows, particularly base flows for fish and wildlife habitat during the dry season. These projects typically require placing infrastructure (e.g., pumps and piping, fish screens and head gates) in or adjacent to the stream to provide alternative water intake facilities. Other projects in this category include piping ditches to create a more efficient use of water where the water saved will be dedicated to fish and wildlife under State Water Code Section 1707 or forbearance agreements. These projects are designed to improve streamflow and riparian habitat for fish and wildlife.

Tailwater is created in flood irrigation operations as unabsorbed irrigation water flows back into the stream. Restoration projects to address tailwater input will construct tailwater capture systems to intercept tailwater before it enters streams. Water held in capture systems, such as a pool or a pond, can be reused for future irrigation purposes, thereby reducing the need for additional stream withdrawals.

All water conservation projects in the Program will require diverters to agree to forbearance or dedication, and verify compliance with water rights — as conditioned by a small domestic use or livestock stockpond registration, appropriative water right, or a statement of riparian water use registered with the State Water Resources Control Board and reviewed for compliance by the NOAA RC and the Corps.

Design guidelines for this project type include:

- Design storage volumes so that water diverters have sufficient storage capacity to cover intended domestic, irrigation, or livestock needs during the no-pump time periods for drier than average years (e.g., dry season droughts). The no-pump time period should be based on the season, local conditions, forbearance agreement, and existing studies if available. These projects will require a technical review.
- All pump intakes must be screened in accordance with current NMFS fish screen criteria.
- All water conservation projects must ensure that any water saved will remain instream for fish and wildlife benefits either through forbearance agreements or the State Water Board's 1707 process.
- All water conservation projects need to be associated with legal water rights recognized by the State Water Board or a local water master for watersheds that are adjudicated via decree.
- Tailwater collection ponds that do not incorporate return channels to the creek will be located far enough from the edge of the active channel to not likely cause stranding of juvenile salmonids during flood events.
- Tailwater captured and re-used shall be done to reduce stream withdrawals, an in-lieu of use. No new ground shall be put into production due to tailwater re-use.

1.3.10.7 Removal of pilings and other in-water structures

Untreated and chemically treated wood pilings, piers, vessels, boat docks, and derelict fishing gear, and similar structures built using plastic, concrete and other materials may be removed to improve water quality and habitat for fish and wildlife. These projects are designed to remove contaminant sources and hazards from stream, river, and estuary habitats. These projects are intended to cover only the removal of debris or structures and not the replacement of any structures or pilings. The removal of any pilings in estuarine waters under this Program requires compliance with the California Eelgrass Mitigation Policy (CEMP), to ensure that eelgrass resources are not affected by the project.

Equipment such as boats, barges, excavators, dump trucks, front-end loaders, and similar equipment may be used to implement these projects.

Design guidelines for projects that involve removing an intact pile include:

- In areas where eelgrass is found within and around the project site, conduct work at high tides with sufficient depths in order to ensure that any impacts to submerged aquatic vegetation via propeller wash, or vessel groundings are avoided. Projects must demonstrate compliance with the CEMP.
- Install a floating surface boom to capture floating surface debris, as necessary.
- Dislodge the piling with an excavator bucket (through pushing and pulling) or vibratory hammer, whenever feasible. Avoid intentionally breaking a pile by twisting or bending.

- Slowly lift piles from the sediment and through the water column.
- Place chemically treated piles in a containment basin on a barge deck, pier or shoreline without attempting to clean or remove any adhering sediment. A containment basin for the removed piles and any adhering sediment may be constructed of durable plastic sheeting with sidewalls supported by hay bales or another support structure to contain all sediment.
- Fill the holes left by each piling with clean, native sediments located from the project area if available, as needed.
- Dispose of all removed piles, floating surface debris, any sediment spilled on work surfaces, and all containment supplies at a permitted disposal site.
- Pile cutting should be considered a last resort, following multiple attempts to fully extract piling using other methods. If cutting piles, piles should be cut below the mudline to provide more habitat and ensure that as much debris is removed as possible. Areas with low levels of contamination, wave and/or currents conducive to mixing (i.e., high-energy environments), and/or small numbers of piles removed may not need to be cut to prevent remobilization of contaminants.

Design guidelines for projects that involve removing a broken pile include:

- If a pile breaks above the surface of uncontaminated sediment, or less than two feet below the surface, every attempt short of excavation should be made to remove it entirely.
- If a pile breaks above presumed, or known contaminated sediment, saw the stump off at the sediment line; if a pile breaks within contaminated sediment, make no further effort to remove it and cover the hole with a cap of clean substrate appropriate for the site, as applicable.

1.3.10.8 Instream restoration

Instream restoration provides the following benefits:

- Enhanced habitat complexity, diversity, and cover for wildlife species
- Increased spawning and rearing habitat
- Improved pool habitat and pool-to-riffle ratios
- Increased sinuosity
- Improved water quality

These projects may include the following activities:

- Placing large woody material or boulders.
- Constructing engineered logjams.
- Installing small wood structures or beaver dam analogues.
- Beaver restoration.
- Augmenting and placing gravel.
- Stream channel reconstruction.
- Removing revetment and other streambank armoring materials.
- Improving stream morphology and channel dynamics.

- Restoring sediment input and retention balance.
- Improving water quality.
- Excavating, sorting, placing, and contouring existing on-site materials (e.g., historic mine tailings) on perched floodplains and in channels to reconnect those habitats and improve spawning and rearing conditions.

Project types in this category typically occur in areas where channel structure is lacking due to past stream cleaning (large woody material removal), riparian timber harvest, historic grazing and meadow dewatering practices, hydromodification, urbanization, and in areas where natural gravel supplies are low due to anthropogenic disruptions. These projects would occur in stream channels and adjacent floodplains to increase channel complexity, rearing habitat, pool formation, spawning gravel deposition, channel complexity, hiding cover, low velocity areas, and floodplain function. Equipment such as helicopters, excavators, dump trucks, front-end loaders, full-suspension yarders, and similar equipment may be used to implement projects.

Engineered logjams are large wood structures that include an anchoring system, such as rebar pinning, ballast rock, or vertical posts. These structures are designed to redirect flow and change scour and deposition patterns, and are patterned after stable natural log jams. They are anchored in place using rebar, rock, or piles (driven into a dewatered area or the streambank, but not in water). Engineered log jams create a hydraulic shadow, which is a low-velocity zone downstream that allows sediment to settle out. Scour holes develop adjacent to the engineered logjam.

Large woody material may be installed using either anchored and/or unanchored logs, or both, depending on site conditions and wood availability. Wood loading methods may include but are not limited to direct felling, whole tree tipping/placement, or tree placement by helicopters, grip hoisting, or excavator, and other etc.

Creation of beaver habitat and installation of beaver dam analogue structures, including installation of in-stream structures to encourage or simulate beaver dam building and shunting of flows onto floodplain surfaces may be designed in association with stream and riparian habitat projects.

In-channel structures consist of porous channel-spanning structures consisting of biodegradable vertical posts (beaver dam support structures) approximately 0.5 to 1 meter apart and at a height intended to act as the crest elevation of an active beaver dam. Variation of this restoration treatment may include post lines only, post lines with wicker weaves, construction of starter dams, reinforcement of existing active beaver dams, and reinforcement of abandoned beaver dams.

Beaver Habitat Restoration - The long-term goal of this project type is to restore linear, entrenched, simplified channels to their previously sinuous, structurally complex channels that were connected to their floodplains. This will result in a substantial expansion of riparian vegetation and improved instream habitat. Beavers, which were historically prevalent in many watersheds, build dams that, if they remain intact, will substantially alter the hydrology, geomorphology, and sediment transport within the riparian corridor. Beaver dams will entrain substrate, aggrade the bottom, and reconnect the stream to the floodplain; raise water tables; increase the extent of riparian vegetation; increase pool frequency and depth; increase stream sinuosity and sediment sorting; and lower water temperatures.

In addition, infrastructure along streams and in riparian areas may be removed or relocated. The primary purpose of infrastructure removal is to eliminate or reduce impacts on riparian areas and vegetation, reduce erosion, reduce sedimentation into adjacent streams, and provide for native revegetation or natural native plant recruitment. Among the types of infrastructure that could be removed or relocated are boat docks, boat haul out locations, campgrounds, campsites, day-use sites, roads/trails, and off-highway/off-road vehicle routes that impact aquatic resources or riparian habitat.

Design guidelines for this project type include:

- Where appropriate, consult the CDFW Manual and Fluvial Habitat Center at Utah State, Low-Tech Process-Based Restoration Design Manual during the planning and design process (http://lowtechpbr.restoration.usu.edu/).
- For the purposes of large wood placement, trees can may be felled or pulled/pushed over, if tree felling does not significantly degrade the riparian habitat, create excessive stream bank erosion, destabilize stream banks, create temperature increases in water bodies, or concentrate surface runoff, or increase the likelihood of channel avulsion during high flows.
- Where feasible, retain trees killed through fire, insects, disease, blow-down, and other means. Retain snags and trees with broad, deep crowns ("wolf" trees), damaged tops, or other abnormalities that may provide a valuable wildlife habitat component.
- Stabilizing or key pieces of large wood must be intact, hard, with little decay, and if possible have root wads (untrimmed) to provide functional refugia habitat for fish.
- Place large wood and boulders in areas where they would naturally occur and in a manner that closely mimics natural accumulations for that stream type. For example, boulder placement may not be appropriate in low gradient meadow streams. Engineered logjams should be patterned, to the greatest degree possible, after stable natural log jams in the project area, either present or historical.
- Project design should simulate log jams, debris flows, wind throw, tree breakage, and other disturbance events to the greatest degree possible using techniques including, but not limited to, log jams, debris flows, wind throw, and tree breakage.
- If large wood anchoring is required, a variety of methods could be used. These include buttressing the wood between riparian trees, the use of or using manila, sisal, or other biodegradable ropes for lashing connections. If hydraulic conditions warrant the use of structural connections, cable, duckbills, rebar pinning or bolted connections could be used but this approach should be generally avoided unless no other options exist. Clean rock could be used for ballast but is limited to the minimum size or weight needed to anchor the large wood.

Design guidelines for stream channel reconstruction include:

- In situations where excessive sediment releases from the project site or surrounding watershed currently pose a threat to downstream habitat and organisms (i.e., stage zero projects and large (>100 acre) floodplain restoration projects), use stream simulations following USFS Stream Simulation Design to inform the project design. Stream simulation designs should:
    - Identify a suitable reference reach and survey a long profile;
    - Quantify the average cross-sectional shape, bankfull width, bed and bank sediment grain size distributions, and the geomorphic features of the channel (e.g., pool-riffle sequences, meander lengths, step pools, etc.); and
    - Reproduce the geomorphic features found within the reference reach in the project reach.

Design guidelines for gravel augmentation include:

- Only augment gravel in locations where the natural supply has either been eliminated, significantly reduced through anthropogenic disruptions, or where it can be used in conjunction with other projects, such as off-channel habitat or floodplain restoration.
- Size gravel with the proper gradation for the stream, using non-angular rock. When possible use gravel of the same lithology as found in the watershed.
- Gravel should not be mined from the floodplain in a manner that would cause stranding during future flood events. Only use imported gravel that is free of invasive species and non-native seeds.
- Gravel should be placed directly into the stream channel, at tributary junctions, or other areas in a manner that mimics natural gravel deposition.

1.3.10.9 Upslope Watershed Restoration

Sites in upslope and riparian watershed areas may be restored to reduce delivery of sediment to streams, promote natural hydrologic processes, and restore wildlife habitat and improve water quality. This project type also includes road- and trail-related restoration, including decommissioning, upgrading, and storm-proofing. The following are some of the specific techniques that may be used:

- Removing, installing, or upgrading culverts;
- Constructing water bars and dips;
- Deep ripping decommissioned roadbeds;
- Reshaping road prisms;
- Vegetating cut slopes and roadbeds;
- Removing and stabilizing side-cast materials;
- Grading or resurfacing roads and trails that have been improved for aquatic restoration, using gravel, bark chips or other permeable materials;
- Shaping the contours of the road or trail base;
- Replacing road fill with native soils;
- Installing new culverts under trails or roads to reduce ditch length;

- Stabilizing the soil and tilling compacted soils to establish native vegetation.

These actions target priority roads and trails that contribute sediment to streams or disrupt floodplain and riparian functions. Equipment such as excavators, bulldozers, dump trucks, and front-end loaders, may be used to implement these projects.

Design guidelines for road and trail erosion control and decommissioning include:

- Road and trail erosion control and decommissioning shall use the Handbook for Forest, Ranch and Rural Roads: A Guide for Planning, Designing, Constructing, Reconstructing, Upgrading, Maintaining and Closing Wildland Roads (Weaver et. al 2015) and any subsequent editions.
- When demolishing or removing road segments immediately adjacent to a stream, use BMP's including sediment control barriers between the project and stream.
- Where feasible, existing vegetative buffers along access roads or trails should be used to avoid or minimize runoff of sediment and other pollutants to surface waters.
- Minimize disturbance of existing native vegetation in ditches and at stream crossings.
- Space the drainage features used for storm proofing and erosion treatment projects in such a manner as to hydrologically disconnect road surface runoff from stream channels. If grading and resurfacing are required, use clean, permeable materials for resurfacing.
- Dispose of slide and waste material in stable sites out of the flood-prone area. Clean material may be used to restore natural or near-natural contours.
- For projects within riparian areas, recontour the affected area to mimic natural floodplain contours and gradient to the extent possible.
- For permanent decommissioning of roads, complete excavation of stream crossing fills, including 100-year flood channel bottom widths and stable side slopes. Excavate unstable or potential unstable sidecast and fill slope materials that could otherwise fail and deliver sediment to a stream. Perform road surface drainage treatments (e.g., ripping, outsloping, and/or cross draining) to disperse and reduce surface runoff.

Design guidelines for road relocation include:

- When a road is decommissioned in a floodplain and future vehicle access through the area is still required, relocate the road away from the stream, as far as is practical. New road construction should be outside waters of the U.S. or any other aquatic habitat suitable for Covered Species.

1.3.10.10 Restoration Effectiveness Monitoring

The NOAA RC has been providing a beneficial service to the restoration community by advancing restoration science through pre- and post-project effectiveness monitoring on restoration projects throughout northern California. For the past 11 years, these efforts have been authorized through the CDFW's ESA 4(d) program, but based on the suggestion from WCR CCO staff, the Restoration Center has decided to include these monitoring efforts in the Program.

The NOAA RC has limited staff and resources to conduct pre-project assessment and post-project effectiveness monitoring and will not be monitoring every project that we cover under this Program. The NOAA RC anticipates that monitoring will occur on some projects that will either be funded via the NOAA RC or permitted by the Corps, as well as Program projects that are either being planned or implemented through other funding sources (e.g., state, federal, tribal). The NOAA RC anticipates that approximately 10 projects per year would be monitored for pre-implementation and up to 8 projects per year would be monitored for post project effectiveness.

Because this Program is a long-term effort and it is difficult to anticipate where and when the RC will be able to conduct this effectiveness monitoring, the Proposed Action describes the general purpose of monitoring, potential monitoring methods, the potential locations of these activities, and a limit on the amount of fish trapped, netted, or otherwise captured, handled, and released in each population.

Pre-Assessment Project Monitoring: When planning restoration projects, a lack of information regarding species occurrence, distribution and density during different parts of the year often confound project design objectives. Knowing site-specific fish presence/absence information during the summer and winter can help inform design elements and help determine if the feature will be used only for winter rearing, summer rearing, or both.

Post Project Monitoring: In order to determine the effectiveness of the project, the NOAA RC proposes to determine species utilization, timing and duration of use, and in certain cases, growth rates of target species utilizing the project area. PIT tags will be used to determine growth rates, residency times and apparent survival. Tissue samples will be provided to the NMFS Southwest Fisheries Science Center for genetic analysis, when requested and scale samples will be provided to CDFW, when requested.

Many project types including, but not limited to estuary restoration, Beaver Dam Analogs, off channel habitat creation and floodplain reconnection projects will be monitored to estimate the effectiveness of these efforts. Many of these projects will be monitored for both summer and winter habitat utilization. Monitoring efforts may be conducted from the first significant rainfall (Oct-Nov) through spring (April-June) for winter rearing projects and also during summer base flow season (June-Oct) to determine summer rearing. In addition to the biological monitoring, habitat conditions (temp/salinity/DO) may be spot checked during sampling events as well.

1.3.10.10.1.1 Monitoring Methods

<u>**Snorkel Surveys**</u>

Snorkel surveys are conducted to determine an overall presence/absence for a given area. Surveys may be conducted pre- and post-project when conditions allow. Survey crews would consist of 1-2 divers counting salmonids swimming upstream using a 4-pass bounded count methodology for population estimates or single pass surveys for presence/absence surveys in water that has at least 3 feet of visibility.

Procedure Used: Observe Only

Seining
Seining is conducted to capture salmonids in deeper water that does not have significant complexity (e.g., LWD). Two consecutive seine hauls are conducted at a given location using a 30 ft. x 4 ft. knotless mesh nylon seine. Nets consist of 6mm mesh wing sections 9 m in length and a 3 mm mesh 2 m x2 m bag section. The seine is set by 2-3 crew members in a round haul fashion by fixing one end on the bank while the other end is deployed, wading upstream and returning to shore in a half circle. Once the lead line approaches the shore it is withdrawn more than the cork line until fish are corralled in the bag and the lead line is on the bank. Each haul is expected to take approximately 1 - 5 minutes. Fish captured in the bag are kept submerged in water until they are transferred by dip net, separated, and placed in aerated 5-gallon buckets following each haul prior to processing. Sampling will cease if water quality conditions are unfavorable to the health of the fishes or if temperatures exceed 21°C.
Procedures Used: Seine, measure, weigh, anesthetize, PIT tag, capture, handle, release.

Minnow Traps
Minnow trapping is typically used in very complex habitats where seining would likely not be successful due to small/large wood and significant aquatic vegetation. Galvanized 5mm square wire mesh minnow traps will be baited with iodine-soaked roe and set. The minnow traps are 430mm in length with a middle circumference of 760mm and fyke openings of 25mm at both ends. Traps are fished at each site on the bottom of the channel next to habitat structures if possible. Soak time of individual traps ranges from 30 to 180 minutes. Sampling will cease if water quality conditions are unfavorable to the health of the fishes or if temperatures exceed 21° C.
Procedures Used: Trap, measure, weigh, anesthetize, PIT tag, capture, handle, release.

Fyke Nets
Fyke nets will be used in off-channel and slow water habitats when minnow traps and seining are found to not be effective. Fyke Nets (size, 1/4 in mesh) may be set in the afternoon in a pond with the entrance/exit blocked so that no fish may enter or leave. Fyke nets are set overnight and checked the following morning. The same methods will be repeated approximately 1 or 2 days following the first trapping event. Fyke nets have an opening at the mouth up to 15 feet wide and narrow down to a small opening approximately 6 inches wide and up to 20 feet in length. Fyke nets are set in the deepest part of the pond and would not be used in flood flows or when temperatures exceed 21° C.
Procedures Used: Trap, measure, weigh, anesthetize, PIT tag, capture, handle, release.

Electrofishing
Electrofishing will be used in low water conditions when stream habitat is too complex for seining or minnow traps, or those methods are not effective to inform the monitoring question. All electrofishing will be conducted according to NMFS Guidelines for Electrofishing Waters Containing Salmonids listed under the Endangered Species Act (2000). Electrofishing activities will be conducted during periods of the day or when water is coolest. All electrofishing and handling procedures will be consistent with electrofishing methods and guidelines described below which describes fish relocation activities, except fish would not be relocated from the habitat where they were found during effectiveness monitoring. After handling, fish will be

released in the same pool they were captured. Electrofishing will not be used in high flows or when temperatures exceed 18° C.
Procedures Used: Electrofish, capture, net, anesthetize, weigh, measure, PIT tag, fin clip, capture, handle, release.

1.3.10.10.1.2 Handling Methods

Anesthetic
Fish will be closely observed in an anesthetic bath of Alka–Seltzer Gold (aspirin free) brand sodium bicarbonate ($NaHCO_3$) until loss of equilibrium is achieved but operculum movement is still present. Concentrations will range from 1 to 2 tablets per gallon of fresh river water depending on fish size and water temperature. The bicarbonate material will be allowed to completely dissolve before fish are added to the anesthetic bath.

Fry and juveniles will be anesthetized in groups < 10 fish per batch and larger parr and smolts will be anesthetized in groups of 2 fish. Salmonids should be able to be handled after 1-2 minutes in the anesthetic bath and will be processed immediately following loss of equilibrium. Fish will be allowed to recover in 5-gallon buckets of aerated fresh river water until normal behavior is observed. Water temperature in the recovery bucket will be monitored and maintained to be within 2 degrees of the ambient river temperature. Fish will be released to slow water habitat in the location in which they were originally found.

Measure/Weigh
While anesthetized, individuals will be placed onto a wetted Plexiglas measuring board and measured to the nearest mm fork length, then transferred to a wetted container on an electronic scale and weighed to the nearest 0.01g.

PIT Tagging
Anesthetized fish greater than or equal to 70mm FL may be implanted with tags up to 12mm, fish 60mm FL to 69mm FL may be implanted with up to 9mm tags, and fish <60mm would not be tagged. A full duplex PIT tag that is surgically implanted into the body cavity of the fish will be used as described by Prentice et al. (1990). A small incision would be made with a sterile scalpel anterior to the pectoral fin and the tag would be inserted by hand into the body cavity of the fish. Recovery protocols would follow as above to allow for full recovery before release.

Tissue Sampling
Tissue sampling techniques such as fin-clipping are common to many scientific research efforts using listed species. All sampling, handling, and clipping procedures have an inherent potential to stress, injure, or even kill the fish. Fin clipping is the process of removing part of a fish's fin to either mark the fish or to collect genetic material for analysis. Although researchers have used all fins for marking at one time or another, the current preference is to clip the adipose, pelvic, or pectoral fins. Marks can also be made by punching holes or cutting notches in fins, severing individual fin rays (Welch and Mills 1981). Many studies have examined the effects of fin clips on fish growth, survival, and behavior. The results of these studies are somewhat varied; however, it can be said that fin clips do not generally alter fish growth.

1.3.10.10.1.3 Measures to Minimize Effects of Effectiveness Monitoring

Snorkel surveys would be the predominant method of assessing fish presence and absence, whenever feasible. Where there is an interest in collecting growth data or to implant PIT tags to track movement and survival, fyke, seining, and minnow trapping efforts would be considered. If fish handling is desired, data collection crews will be large enough to reduce the impact of handling on salmonids to the greatest extent possible. Captured fish will be placed in buckets of river water with thermometers to verify temperature is consistent with environmental temperatures and a portable aerator to keep DO levels up to acceptable levels. During high flows minnow traps will be set in areas of slow water refugia. All PIT tagged fish will be anesthetized before PIT tag implantation. All fish will be returned to the habitat where they were collected.

1.3.10.10.1.4 Annual Estimates of Fish Captured, Handled, and Tagged During Monitoring, and Related Fish Losses

Table 1 describes the anticipated number of fish that will be handled based on historic monitoring data and existing population data, and the estimated mortality effects. The number of fish potentially encountered for effectiveness monitoring has been broken down into those observed, captured/handled/released/ and pit tagged. These numbers were estimated by considering the RC's prior years' 4(d) numbers, the potential to encounter a specific habitat unit that has a very robust population, and the amount of PIT tags needed to produce a robust estimate for predicting residence time, growth rates and localized population estimates. The estimated numbers were increased for the Upper Klamath Population because over 400 miles of habitat will be opened up after the Klamath dam removal project and we anticipate encountering additional fish as their habitat ranges expand.

Table 1: Annual maximum estimates of juvenile (a) SONCC coho salmon, (b) CC Chinook salmon, and (c) NC steelhead captured and handled during effectiveness monitoring activities, and the anticipated mortality effects of two aspects of monitoring.

a. Annual SONCC coho salmon encounters and associated estimated mortality.

SONCC Coho Salmon Diversity Stratum	**Capture/Handle/Release related to monitoring**	**PIT tagging related to monitoring**	**Anticipated Mortality (3%)**
Central Coastal	2500	600	93
Southern Coastal	3000	800	114
Interior Klamath	4000	1500	165
Interior Trinity	500	100	18
Interior Eel	3000	800	114
Total	**13000**	**3800**	**504**

b. Annual CC Chinook salmon encounters and associated estimated mortality.

CC Chinook Diversity Stratum	Capture/Handle/Release related to monitoring	PIT tagging related to monitoring	Anticipated Mortality (3%)
North Coastal	1500	400	57
North Mountain Interior	1500	400	57
Total	**3000**	**800**	**114**

c. Annual NC steelhead encounters and associated estimated mortality.

NC Steelhead Diversity Stratum	Capture/Handle/Release related to monitoring	PIT tagging related to monitoring	Anticipated Mortality (3%)
Northern Coastal	2500	400	87
Lower Interior	2500	400	87
North Mountain Interior	2500	400	87
Total	**7500**	**1200**	**261**

1.3.11. Protection, Avoidance and Minimization Measures

1.3.11.1 Prohibited Activities

The following activities are not within the scope of the Proposed Restoration Program, are not analyzed in this biological opinion, and will require separate authorization:

- Removal of any dam under Federal Energy Regulatory Commission (FERC) jurisdiction.
- Use of gabion baskets.
- Use of chemically treated timbers used for grade or channel stabilization structures, bulkheads, overwater structures, or other instream structures.
- Construction of new fish ladders.
- With the exception of storage projects to reduce low flow stream withdrawals, off-channel/side-channel habitat projects that require the installation of a flashboard dam, head gate, or other mechanical structure.
- Use of riprap, RSP or any other form of bank protection, other than the minimum amount needed to achieve restoration project goals.
- Projects that include impact pile driving that exceeds the Interim Pile Driving Criteria (June 2008) (or current Pile Driving Criteria when 2008 criteria are updated) are excluded for inclusion in the Program.
- Projects that are likely to cause, for any Covered Species, a permanent net loss of habitat, permanent net loss of habitat function, or permanent net loss of functional value of designated or proposed critical habitat (e.g., the physical and biological features essential for the species' recovery and conservation).
- Projects that would result in any net loss of eelgrass resources.

1.3.11.2 Limits on Area of Disturbance for Stream Dewatering

A maximum of 1,000 contiguous feet of that stream reach may be dewatered at any given time. Other sections of stream within the same project area may be dewatered in up to 1,000-foot increments, as long as listed fish that were handled during the initial dewatering event are not handled during subsequent dewatering events during the same year. To avoid handling the same fish multiple times during sequenced dewatering events, fish must be relocated to suitable habitat conditions outside of the zone that could be dewatered during that season. In addition, for each dewatering and relocation event, sufficient field staff must be available to efficiently move and care for relocated fish. The fish relocation plan submitted prior to the event must describe this sufficiency.

1.3.11.3 General Construction Season

The general construction season will be from June 15 to November 1. Restoration, construction, fish relocation, and dewatering activities within any wetted and/or flowing creek channel shall only occur within this period. Extensions to this work season can be granted if: 1. There is less than a 50% chance of 1.5 inches of rain predicted over any 24-hour period during the granted time extension, and 2. The RC determines, and NMFS confirms, that an extension will not result in effects that go beyond those analyzed during the ESA consultation on the Program, either in type or magnitude.

1.3.11.4 Limits on Project Frequency and Location

The NOAA RC's 2012 Biological Assessment limited the number of sediment-producing projects based on watershed size to reduce the potential cumulative effects of turbidity in each stream. Based on NOAA RC staff's collective experience observing many of these projects after the first rains of the season (pers. comm., Bob Pagliuco, and Leah Tolley, June 2021), the current proposed action does not include such a limit, because the Protective Measures required by the Program are expected to prevent turbidity that will negatively affect listed fish. In addition to the erosion control measures, effects of turbidity will be controlled by limiting the number of floodplain reconnection projects over 100 acres, and small dam removals, to one project, per HUC-12, per year.

1.3.11.5 General Conservation Measures

A number of conservation measures have been incorporated into the proposed action.

The purpose of conservation measures is to incorporate design refinements and best practices into the proposed action to avoid and/or minimize potential effects. The rationale behind including these commitments is that the Program's project applicant(s) will undertake and implement the applicable and necessary measures below as part of any proposed project. Although these best practices are required for restoration projects authorized under the Program, specific measures may be altered, added or removed on an individual project basis with the approval of the NOAA RC and Corps, in coordination with NMFS WCR CCO.

- Work shall not begin until: (a) the Corps and/or NOAA RC has notified the applicant that NMFS has not objected to incorporating the project into the Program (i.e., the requirements of the ESA have been satisfied), and (b) all other necessary permits and authorizations are finalized.
- All materials placed in or over streams, rivers or other waters shall be nontoxic. Any combination of wood, plastic, cured concrete, steel pilings, or other materials used for in-channel structures shall not contain coatings or treatments or consist of substances toxic (e.g., copper, other metals, or pesticides, petroleum-based products, etc.) to aquatic organisms that may leach into the surrounding environment in amounts harmful to aquatic organisms.
- Water containing mud or silt from construction activities shall be treated by filtration or retention in a settling pond to avoid draining sediment-laden water back to the stream channel. Alternatively, an infiltration area may be created and used within the regular project footprint or in upland areas, if the soil composition of the area adequately supports infiltration back into the system.
- Screens shall be installed on all water pump intakes and other water withdrawal structures in compliance with NMFS salmonid-screening specifications.
- Construction supervisors and managers will be educated on weed identification and the importance of controlling and preventing the spread of invasive weeds. Equipment will

be cleaned of any sediment or vegetation at designated wash stations before entering or leaving the project area to avoid spreading pathogens or non-native invasive species. The Project Applicant will follow the guidelines in the CDFW's California Aquatic Invasive Species Management Plan (CDFW 2008) and Aquatic Invasive Species Disinfection/Decontamination Protocols (CDFW 2016).

- Construction equipment such as portable equipment, vehicles, and supplies, including chemicals, shall be stored at designated construction staging areas or on barges, exclusive of any riparian or wetland areas. Any equipment that may leak shall be stored over impermeable surfaces, if available, and drip pans (or any other type of impermeable containment measure) will be placed under parked machinery and checked and replaced when necessary, to prevent drips and leaks from entering the environment.
- Where possible, poured concrete should be excluded from contact with surface or groundwater during initial curing, ideally for a period of 30 days after it is poured. During that time, runoff from the concrete will not be allowed to enter the surface or groundwater. If this is not feasible due to expected flows and site conditions, commercial sealants that are appropriate for use near water may be applied to the poured concrete surface to prevent exposure of uncured concrete to streamflow and subsequent risk to water quality and aquatic life before the sealant comes into contact with flowing water. If sealant is used, water will be excluded from the site until the sealant is dry and fully cured according to the manufacturer's specifications. Concrete is considered to be cured when water poured over the surface of concrete consistently has a pH of less than 8.5.
- Areas for fuel storage, refueling, and servicing of construction equipment must be located in an upland location and following industry BMPs.
- The contractor/applicant to the Program shall inspect, maintain and repair all erosion control materials and devices prior to and after any storm event, at 24-hour intervals during extended storm events, and a minimum of every two weeks until all erosion control measures are no longer needed.
- Immediately after project completion and before the close of the seasonal work window, all exposed soil shall be stabilized with erosion control measures such as mulch, seeding, and/or placement of erosion control blankets. Where straw, mulch, or slash is used on bare mineral soil, the minimum coverage shall be 95 percent with two-inch minimum depth.

1.3.11.6 Dewatering Activities and Fish Relocation Protection Measures

The following protection measures apply to all projects where dewatering and fish relocation activities occur:

- In those specific cases where it is deemed necessary to work in flowing water, the work area shall be isolated and all flowing water shall be temporarily diverted around the work site to maintain downstream flows during construction. The contiguous length of the dewatered stream channel, and the duration of any single dewatering event, shall be minimized to the greatest extent practicable.
- Before beginning project work, a dewatering and fish capture and relocation plan will be submitted to the NOAA RC or the Corps as an additional part of the project description,

so that any activities involving the handling of protected fishes may be reviewed and modified if necessary.

- Fish shall be excluded from the work area by blocking the stream channel above and below the work area with fine-meshed block nets or screens. Mesh openings will be no greater than 1/8 inch. The bottom of a seine must be completely secured to the channel bed. Screens must be checked twice daily, or more frequently as needed, and cleaned of debris to permit free flow of water. Block nets shall be placed and maintained throughout the dewatering period at the upper and lower extent of the areas where fish will be removed. Block net mesh shall be sized to ensure salmonids upstream or downstream do not enter the areas proposed for dewatering. Net placement is temporary and will be removed once dewatering has been accomplished or construction work is complete for the day.
- Prior to dewatering, the best means to bypass flow through the work area shall be determined to minimize disturbance to the channel and avoid direct mortality of fish and other aquatic vertebrates. Project site dewatering shall be coordinated with a qualified biologist, who will perform fish and amphibian relocation activities. The qualified biologist(s) must be familiar with the life history and identification of listed salmonids and listed amphibians within the action area. The qualified biologist shall submit qualifications to the NOAA RC for approval prior to fish relocation activities. Prior to dewatering a construction site, the qualified biologist shall capture and relocate fish and amphibians to avoid direct mortality and minimize adverse effects. Plastic/rubber material shall be placed over sandbags used for construction of cofferdams to minimize water seepage into the work area. Coffer dams and stream diversion systems shall remain in place and fully functional throughout the construction period. When coffer dams with bypass pipes are installed, debris racks will be placed at the bypass pipe inlet. Bypass pipes will be monitored a minimum of two times per day, seven days a week. All accumulated debris shall be removed.
- Bypass pipes will be sized to accommodate, at a minimum, twice the expected baseflow. The work area may need to be periodically pumped dry of seepage. Pumps will be placed in flat areas, well away from the stream channel, and secured by tying off to a tree or stake in place to prevent movement by vibration. Pumps shall be refueled in an area well away from the stream channel and fuel absorbent mats will be placed under the pumps while refueling. Pump intakes shall be covered with mesh per the requirements of NMFS Fish Screening Criteria to prevent potential entrainment of fish or amphibians that could not be removed from the area to be dewatered. The pump intake shall be checked periodically for impingement of fish or amphibians. If pumping is necessary to dewater the work site, procedures for pumped water shall include requiring a temporary siltation basin for treatment of all water prior to entering any waterway and not allowing oil or other greasy substances originating from operations to enter or be placed where they could enter a wetted channel. Screen openings shall not exceed 1/4 inch (6.35 mm) in the diagonal direction and approach velocities should not exceed 1ft/second. Velocities should be minimized by placing screens in slow water conditions either in a pool or in a constructed backwater area.
- When construction is complete, the flow diversion structure shall be removed as soon as possible in a manner that will allow flow to resume with the least disturbance to the substrate. Cofferdams will be removed so surface elevations of water impounded above

the cofferdam will be reduced at a rate that will minimize the probability of fish stranding as the area upstream becomes dewatered.

- All seining, electrofishing, and relocation activities shall be performed by a qualified biologist. All qualified biologists need to be experienced in fish identification, have experience with fish removals and relocations and have an understanding of the water quality needs of fish. The qualified biologist will need to submit their qualifications to the NOAA RC for approval prior to fish relocation activities. The qualified biologist shall capture and relocate listed species prior to construction of the water diversion structures (e.g., cofferdams). The qualified biologist shall note the number of listed species observed in the affected area, the number and species of fish relocated, where they were relocated to, and the date and time of collection and relocation. The qualified biologist will adhere to the following requirements for capture and transport of listed fish species:
    - At some sites with low habitat complexity, herding fish with a single seine pass before the block net is installed can help reduce the number of fish that must be handled.
    - Determine the most efficient means for capturing fish (e.g., seining, dip netting, trapping, and electrofishing). Complex stream habitat generally requires the use of electrofishing equipment, whereas in outlet pools, fish may be concentrated by pumping-down the pool and then seining or dip netting fish.
    - NOAA RC (staff identified as project contact) shall be notified one week prior to capture and relocation of listed fish to provide the NOAA RC an opportunity to monitor the operation.
    - In streams with high water temperature, perform relocation activities during morning periods, when water is coolest.
    - Prior to capturing fish, determine the most appropriate release location(s). Consider the following when selecting release site(s): Similar water temperature as capture location, ample habitat for captured fish, low likelihood of fish reentering work site or becoming impinged on exclusion net or screen.
    - All electrofishing will be conducted according to NMFS Guidelines for Electrofishing Waters Containing Salmonids listed under the Endangered Species Act (2000) and whenever possible electrofishing should be performed in the early morning.
    - Water temperature, dissolved oxygen, and conductivity shall be recorded in an electrofishing log book, along with electrofishing settings.

The following methods shall be used if fish are removed with seines:

- A minimum of three passes with the seine shall be utilized to ensure maximum capture probability of salmonids within the area.
- All captured fish shall be processed and released prior to each subsequent pass with the seine.
- The seine mesh shall be adequately sized to ensure fish are not gilled during capture and relocation activities.

The following methods shall be used during relocation activities associated with either method of capture (electrofishing or seining) for salmonids:

- Salmonids shall not be overcrowded into buckets; allowing no more than 150 0+ fish (approximately six cubic inches per young-of-the-year [0+] individuals approximately) per five-gallon bucket and fewer individuals per bucket for larger fish.
- Every effort shall be made not to mix (0+) salmonids with larger salmonids, or other potential predators. Have at least two containers and segregate (0+) fish from larger age classes. Larger amphibians shall be placed in the container with larger fish.
- Native salmonid predators collected and relocated during electrofishing or seining activities shall be relocated in a dispersive manner so as to not concentrate them in one area. Particular emphasis shall be placed on avoiding relocation of predators into steelhead and salmon relocation pools. To minimize predation on salmonids, these species shall be distributed throughout the wetted portion of the stream so as not to concentrate them in one area.
- All captured listed fish shall be relocated outside of the proposed construction site and placed in suitable habitat. Captured fish shall be placed into a pool, preferably with a depth of greater than two feet with available instream cover.
- All native captured fish will be allowed to recover from electrofishing and anesthesia before being returned to the stream.
- Temporarily hold fish in cool, shaded, aerated water in a container with a lid. Provide aeration with a battery-powered external bubbler. Protect fish from jostling and noise and do not remove fish from this container until time of release.
- Place a thermometer in holding containers and, if necessary, periodically conduct partial water changes to maintain a stable water temperature.

1.3.11.7 In-water Pile Driving Activities and Protection Measures

Most pile driving will be conducted in or adjacent to dry channels. Projects that include impact pile driving that exceeds the Interim Pile Driving Criteria (June 2008) listed below (or current Pile Driving Criteria when 2008 criteria are updated) are excluded for inclusion in the Program. If pile driving cannot occur in a dry channel, if necessary fish will be relocated using the techniques described in section 1.3.11.7. The project application shall include relevant details of the nature of the pile driving-activity, including: the number of piles, type/size of the piles, estimated sound levels caused by the driving, how many piles will be driven each day. Project applicants shall implement the following measures to avoid and minimize potential adverse effects that could otherwise result from in-water pile driving activities:

- Project applicants shall develop a plan for pile driving activities to minimize impacts to fish and will allow sufficient time in the planning and construction schedule for coordination with regulatory agencies. If water depths allow for hydrophones, pile driving will cease before injury levels are exceeded regardless of what kind of attenuation, dewatering, or fish relocation measures are implemented.
- Impact pile driving that exceeds the Interim Pile Driving Criteria (June 2008) listed below (or current Pile Driving Criteria when 2008 criteria are updated) is excluded for inclusion:

Peak pressure = 206 dBpeak
Accumulated sound exposure levels = 183 dB cSEL
Accumulated sound exposure levels for fish over 2g = 187 dB cSEL

The 183 dB cSEL level will be used unless, through the variance process defined below, salmonids under 2 grams are determined to be absent. The number of piles, type/size of the piles, estimated sound levels caused by the driving, how many piles will be driven each day, and any other relevant details on the nature of the pile driving activity must be included in the project application. See Technical Guidance for the Assessment of Hydroacoustic Effects of Pile Driving on Fish (2020) Caltrans Hydroacoustic Manual for more information on assessment techniques https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/hydroacoustic-manual.pdf

- Pile driving shall occur during the established/approved in-water and general work windows (see above).
- Sheet piling shall be driven by vibratory or nonimpact methods (i.e., hydraulic) that result in sound pressures below threshold levels to the extent feasible.
- Pile driving activities shall occur during periods of reduced currents. Pile-driving activities shall be monitored to ensure that the effects of pile driving on protected fish species are minimized. If any stranding, injury, or mortality to fish is observed, NMFS shall be immediately notified and in-water pile driving shall cease. Vibratory hammers, rather than impact hammers, shall be used whenever possible.
- If pile driving is implemented in, or adjacent to, a wetted stream or estuary, monitoring of fish shall occur during pile driving activity to ensure no fish stranding or mortality occurs.
- Sound monitoring will be done, if monitoring is possible due to water depth, to ensure that cSEL injury levels are not exceeded. If levels are met, then pile driving shall cease for a minimum of 12 hours. Attenuation measures include the following:
    - A cushioning block could be used between the hammer and pile
    - A confined or unconfined air bubble curtain shall be used.

1.3.11.8 Vegetation/Habitat Disturbance Protection Measures

The following protection measures apply to all projects where vegetation/habitat disturbance occurs:

- Vegetation disturbance will be avoided and minimized to the extent practicable. Disturbed areas will be revegetated with plant species appropriate to the site.
- Disturbance to existing grades and native vegetation shall be limited to the actual site of the project, necessary access routes, and staging areas. The number of access routes, the size of staging areas, and the total area of the project activity shall be limited to the minimum necessary to achieve the project goal. All roads, staging areas, and other facilities shall be placed to avoid and limit disturbance to streambank or stream channel habitat as much as possible. When possible, existing ingress or egress points shall be used and/or work shall be performed from the top of the creek banks or from barges on the waterside of the project levee. Following completion of the work, the contours of the creek bed and creek flows shall be returned to pre- construction conditions or improved to provide increased biological functions.

- If removal of vegetation is required within project access or staging areas, the disturbed areas shall be replanted with native species, and the area will be maintained and monitored for a period of two years after replanting is complete to ensure the revegetation effort is successful. The standard for success is 60% survival of plantings or 80% ground cover for broadcast planting of seed, after a period of two years. Any non-biodegradable fencing materials shall be removed after plantings are adequately established. If revegetation efforts will be passive (i.e., natural regeneration), success will be defined as total cover of woody and herbaceous material equal to or greater than pre-project conditions.
- Prior to construction, locations and equipment access points will be determined to minimize riparian disturbance. Unstable areas will be avoided. Project designs and access points to be used should minimize riparian disturbance without affecting less stable areas, to avoid increasing the risk of channel instability.
- Soil compaction will be minimized by using equipment with a greater reach or that exerts less pressure per square inch on the ground than other equipment, resulting in less overall area disturbed or less compaction of disturbed areas.

1.3.11.9 Dredging Operation Protection Measures

The Project Applicant will develop and implement a dredging operations and dredging materials management plan to minimize the effects that could occur during dredging operations and material reuse and disposal. The plan will describe a sampling program for conducting physical and chemical analyses of sediments before disturbance. It also will describe BMPs to be implemented during dredging operations. BMPs might include (e.g., using less intrusive dredging procedures, properly containing dredging spoils and water, using silt curtains, using methods to minimize turbidity, and timing dredging activity to coincide with low flows). The plan also will describe methods to evaluate the suitability of dredged material for reuse and disposal.

1.3.11.10 Herbicide Use Protection Measures

The following protection measures apply to all projects where herbicide application is anticipated as a project activity:

- Whenever feasible, reduce vegetation biomass by mowing, cutting, or grubbing it before applying herbicide to reduce the amount of herbicide needed.
- Chemical control of invasive plants and animals will only be used when other methods are determined to be ineffective or infeasible.
- Herbicide use will be evaluated on a project-by-project basis with consideration of (and preference given toward) integrated pest management (IPM) strategies wherever possible. See University of California statewide IPM Program for guidance documents (http://ipm.ucanr.edu/index.html).
- Chemical use is restricted in accordance with approved application methods and BMPs designed to prevent exposure to non-target areas and organisms.
- Any chemical considered for control of invasive species must adhere to all regulations, be approved for use in California, its application must adhere to all regulations per the

California Environmental Protection Agency, and must be applied by a licensed applicator under all necessary state and local permits.

- Use herbicides only in a context where all treatments are considered, and various methods are used individually or in concert to maximize the benefits while reducing undesirable effects and applying the lowest legal effective application rate, unless site-specific analysis determines a lower rate is needed to reduce non-target impacts.
- Treat only the minimum area necessary for effective control. Soil-activated herbicides can be applied as long as directions on the label are followed. NOAA RC will recommend project proponents seek the advice of an Agricultural Pest Control Advisor (PCA) if they are unfamiliar with the best chemical choices and combinations for their project, even if they are only planning to use the choices described here. If the project proponent is experienced with the use of certain chemicals and chemical mixtures, this extra step may not be necessary.
- To limit the opportunity for surface water contamination with herbicide use, all projects will have a minimum buffer for ground-based broadcast application of 100 feet, and the minimum buffer with a backpack sprayer is 15 feet (aerial application is not included in the proposed action).
- The licensed Applicator will follow recommendations for all California restrictions, including wind speed, rainfall, temperature inversion, and ground moisture for each herbicide used. In addition, herbicides will not be applied when rain is forecast to occur within 24 hours, or during a rain event or other adverse weather conditions (e.g., snow, fog).
- Herbicide adjuvants are limited to water or nontoxic or practically nontoxic vegetable oils and agriculturally registered, food grade colorants (e.g., Dynamark U.V. (red or blue), Aquamark blue or Hi-Light blue) to be used to detect drift or other unintended exposure to waterways.
- Any herbicides will be transported to and from the worksite in tightly sealed waterproof carrying containers. The licensed Applicator will carry a spill cleanup kit. Should a spill occur, people will be kept away from affected areas until clean-up is complete.
- Herbicides will be mixed more than 150 feet, as practicable, from any water of the state to minimize the risk of an accidental discharge. Impervious material will be placed beneath mixing areas in such a manner as to contain any spills associated with mixing/refilling.
- The licensed pesticide applicator will keep a record of all plants/areas treated, amounts and types of herbicide used, and dates of application, and pesticide application reports must be completed within 24 hours of application and submitted to applicable agencies for review. Wind and other weather data will be monitored and reported for all pesticide application reports.

Table 2. The risk quotient (RQ) and level of concern for the active ingredient in herbicides proposed for use in riparian areas of restoration projects. A low level of concern is for active ingredients with an RQ greater than 10. A moderate level of concern is for active ingredients with an RQ between 1 and 10. Source: BPA/NMFS 2020.

ACTIVE INGREDIENT	RISK QUOTIENT	LEVEL OF CONCERN
2,4-D (amine)	34.6	Low
Aminopyralid	417	Low
Chlorsulfuron	240	Low
Clethodim	6.43	Moderate
Clopyralid	47.3	Low
Dicamba	3.3	Moderate
Glyphosate1 (aquatic)	214	Low
Glophosate 2	7.9	Moderate
Imazapic	714	Low
Imazapyr	110	Low
Metsulfuron	163	Low
Picloram	3.5	Moderate
Sethoxydim	3.5	Moderate
Sulfometuron	321.7	Low
Triclopyr (TEA)	75.5	Low

2,4-D amine. 2,4-D amine acts as a growth-regulating hormone on broad-leaf plants, being absorbed by leaves, stems and roots, and accumulating in a plant's growing tips. If an applicant uses 2,4 D amine, this action requires a 15-feet buffer when hand applied, and a 50-foot buffer when it is applied using a backpack sprayer.

Aminopyralid. This is a relatively new selective herbicide first registered for use in 2005. It is used to control broadleaf weeds, and is from the same family of herbicides as Clopyralid, Picloram and Triclopyr. Propose to use Aminopyralid for the selective control of broadleaf weeds.

Chlorsulfuron. This herbicide is used to control broadleaf weeds and some annual grasses. Chlorsulfuron is readily absorbed from the soil by plants. Buffer and application methods will adhere to applicable measures identified in section 1.3.11.10 Herbicide Use Protection Measures.

Clethodim. Clethodim is a post emergence herbicide for control of annual and perennial grasses, and is applied as a ground broadcast spray or as a spot or localized spray. This Program does not allow it for broadcast application; it is allowed for hand application and backpack sprayer, both with a 50-foot buffer.

Clopyralid. Clopyralid is a relatively new and very selective herbicide. It is very effective against knapweeds, hawkweeds and Canada thistle. Clopyralid does not bind tightly to soil, and thus would seem to have a high potential for leaching. That potential is functionally reduced by the relatively rapid degradation of Copyralid in soil. It is one of the few herbicides that this Program proposes to allow up to the waterline (for hand application), but requires a 100-foot buffer for broadcast application. This Program only allows for one treatment per year.

Dicamba. This Program proposes to use Dicamba to control broadleaf weeds, brush and vines. The Program does not allow any broadcast application of Dicamba (because of issues associated with drift) for any project. Leaves and roots absorb Dicamba and it moves through the plant. It should be applied during active plant growth periods, with spot and basal bark periodic application during dormancy. It does not bind to soil particles, and microbes appear to be the primary source of chemical breakdown in soil. Buffer and application methods will adhere to applicable measures identified in section 1.3.11.10 Herbicide Use Protection Measures.

Glyphosate 1 (aquatic). Glyphosate is a nonselective herbicide used to control grasses and herbaceous plants; it is the most commonly used herbicide in the world. It is moderately persistent in soil, with an estimated average half-life of 47 days (range 1-174 days). Buffer and application methods will adhere to applicable measures identified in section 1.3.11.10 Herbicide Use Protection Measures.

Imazapic. Imazapic is used to control grasses, broadleaves, vines, and for turf height suppression in non-cropland areas. The Program proposes to use Imazapic in noxious weed control and rights-of-way management. The Program proposes to allow its use up to the waterline with hand injection methods, and 15-foot buffers for backpack sprayer application, and 100-foot buffers for broadcast application.

Imazapyr. Imazapyr is used to control a variety of grasses, broadleaf weeds, vines and brush species. Buffer and application methods will adhere to applicable measures identified in section 1.3.11.10 Herbicide Use Protection Measures.

Metsulfuron methyl. The Escort formulation of this product will be used to control brush, certain woody plants, broadleaf weeds and annual grasses. It is active in soil and is absorbed from the soil by plants. Buffer and application methods will adhere to applicable measures identified in section 1.3.11.10 Herbicide Use Protection Measures.

Picloram. This is a restricted-use pesticide labeled for non-cropland forestry, rangeland, right-of-way, and roadside weed control. It is a growth inhibitor and is used to control a variety of broadleaf weed species. It is absorbed through the leaves and roots, and accumulates in new growth. The use of this herbicide is restricted to hand applications only (no broadcast applications) with a 25+ foot buffer and no use on sandy or riverwash soils. The buffers and application methods greatly minimize the risk of exposure to listed fish and their prey species.

Sethoxydim. This herbicide is a selective post-emergence pesticide for control of annual and perennial grasses. Its mode of action is lipid biosynthesis inhibition. Project design criteria and conservation measures sharply reduce the risk of exposure. The Program imposes a 50-foot no-application buffer for both spot spraying and hand application, and a 100-foot buffer for broadcast application. Other measures for wind speed, weather, etc., also reduce the risk of exposure.

Sulfometuron-methyl. At proposed application rates, sulfometuron methyl is highly effective for killing seedlings of several broadleaves and grasses. The Program expects that no chronic exposure would occur because the herbicide degrades relatively rapidly. Buffer and application methods will adhere to applicable measures identified in section 1.3.11.10 Herbicide Use Protection Measures.

Triclopyr (TEA). The environmental fate of Triclopyr has been studied extensively. This formulation of Triclopyr is not highly mobile, although soil adsorption decreases with decreasing organic matter and increasing pH. Buffer and application methods will adhere to applicable measures identified in section 1.3.11.10 Herbicide Use Protection Measures.

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 to adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS, and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

The NOAA RC and the Corps determined the proposed action is not likely to adversely affect Southern DPS of Green Sturgeon (*Acipenser medirostris*), Southern Eulachon (*Thaleichthys pacificus*), or designated critical habitat for either species. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.10).

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 also relies on the regulatory 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 SONCC coho salmon, CC Chinook salmon, and NC steelhead use the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the 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 ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision 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 critical 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 is likely to 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" for the jeopardy analysis. 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.
This biological opinion analyzes the effects of the proposed action on the following listed species and their designated critical habitats:

Threatened SONCC coho salmon (*Oncorhynchus kisutch*)

- Listing determination (70 FR 37160; June 28, 2005)
- Critical habitat designation (64 FR 24049; May 5, 1999);

Threatened CC Chinook salmon (*O. tshawytscha*)

- Listing determination (70 FR 37160; June 28, 2005)
- Critical habitat designation (70 FR 52488; September 2, 2005);

Threatened NC steelhead (*O. mykiss*)

- Listing determination (71 FR 834; January 5, 2006)
- Critical habitat designation (70 FR 52488; September 2, 2005).

2.2.1. Species Description and Life History

2.2.1.1 Coho Salmon

The life history of coho salmon in California has been well documented by Shapovalov and Taft (1954) and Hassler (1987). In contrast to the life history patterns of other anadromous salmonids, coho salmon in California generally exhibit a relatively simple three-year life cycle. Adult coho salmon typically begin the freshwater migration from the ocean to their natal streams after heavy late fall or winter rains breach the sandbars at the mouths of coastal streams (Sandercock 1991). Delays in river entry of over a month are not unusual (Salo and Bayliff 1958, Eames et al. 1981). Migration continues into March, generally peaking in December and January, with spawning occurring shortly after arrival to the spawning ground (Shapovalov and Taft 1954).

Coho salmon are typically associated with medium to small coastal streams characterized by heavily forested watersheds; perennially-flowing reaches of cool, high-quality water; dense riparian canopy; deep pools with abundant overhead cover; instream cover consisting of large, stable woody debris and undercut banks; and gravel or cobble substrates.

Female coho salmon choose spawning areas usually near the head of a riffle, just below a pool, where water changes from a laminar to a turbulent flow and small to medium gravel substrate are present. The flow characteristics surrounding the redd usually ensure good aeration of eggs and embryos, and flushing of waste products. The water circulation in these areas also facilitates fry emergence from the gravel. Preferred spawning grounds have: nearby overhead and submerged cover for holding adults; water depth of 4 to 21 inches; water velocities of 8 to 30 inches per second; clean, loosely compacted gravel (0.5 to 5-inch diameter) with less than 20 percent fine silt or sand content; cool water ranging from 39 to 50 degrees Fahrenheit (° F) with high dissolved oxygen of 8 mg/L; and inter-gravel flow sufficient to aerate the eggs. Lack of suitable gravel often limits successful spawning.

Each female builds a series of redds, moving upstream as she does so, and deposits a few hundred eggs in each. Fecundity of female coho salmon is directly proportional to size; each adult female coho salmon may deposit from 1,000 to 7,600 eggs (Sandercock 1991). Briggs (1953) noted a dominant male accompanies a female during spawning, but one or more subordinate males may also engage in spawning. Coho salmon may spawn in more than one redd and with more than one partner (Sandercock 1991). Coho salmon are semelparous meaning they die after spawning. The female may guard a redd for up to two weeks (Briggs 1953).

The eggs generally hatch after four to eight weeks, depending on water temperature. Survival and development rates depend on temperature and dissolved oxygen levels within the redd. According to Baker and Reynolds (1986), under optimum conditions, mortality during this period can be as low as 10 percent; under adverse conditions of high scouring flows or heavy siltation, mortality may be close to 100 percent. McMahon (1983) found that egg and fry survival drops sharply when fine sediment makes up 15 percent or more of the substrate. The newly-hatched fry remain in the redd from two to seven weeks before emerging from the gravel (Shapovalov and Taft 1954). Upon emergence, fry seek out shallow water, usually along stream margins. As they grow, juvenile coho salmon often occupy habitat at the heads of pools, which generally provide an optimum mix of high food availability and good cover with low swimming cost (Nielsen 1992). Chapman and Bjornn (1969) determined that larger parr tend to occupy the head of pools, with smaller parr found further down the pools. As the fish continue to grow, they move into deeper water and expand their territories until, by July and August; they reside exclusively in deep pool habitat. Juvenile coho salmon prefer: well shaded pools at least 3.3 feet deep with dense overhead cover, abundant submerged cover (undercut banks, logs, roots, and other woody debris); water temperatures of 54° to 59° F (Brett 1952, Reiser and Bjornn 1979), but not exceeding 73° to 77° F (Brungs and Jones 1977) for extended time periods; dissolved oxygen levels of 4 to 9 mg/L; and water velocities of 3.5 to 9.5 inches per second in pools and 12 to 18 inches per second in riffles. Water temperatures for good survival and growth of juvenile coho salmon range from 50° to 59° F (Bell 1973, McMahon 1983). Growth is slowed considerably at 64° F and ceases at 68° F (Bell 1973).

Preferred rearing habitat has little or no turbidity and high-sustained invertebrate forage production. Juvenile coho salmon feed primarily on drifting terrestrial insects, much of which are produced in the riparian canopy, and on aquatic invertebrates growing within the interstices of the substrate and in leaf litter in pools. As water temperatures decrease in the fall and winter months, fish stop or reduce feeding due to lack of food or in response to the colder water, and growth rates slow. During December through February, winter rains result in increased stream flows. By March, following peak flows, fish resume feeding on insects and crustaceans, and grow rapidly.

In the spring, as yearlings, juvenile coho salmon undergo a physiological process, or smoltification, which prepares them for living in the marine environment. They begin to migrate downstream to the ocean during late March and early April, and out-migration usually peaks in mid-May, if conditions are favorable. Emigration timing is correlated with peak upwelling currents along the coast. Entry into the ocean at this time facilitates more growth and, therefore, greater marine survival (Holtby et al. 1990). At this point, the smolts are about four to five inches in length. After entering the ocean, the immature salmon initially remain in nearshore waters close to their parent stream. They gradually move northward, staying over the continental shelf (Brown et al. 1994). Although they can range widely in the north Pacific, movements of coho salmon from California are poorly understood.

2.2.1.2 Chinook salmon

Chinook salmon return to freshwater to spawn when they are three to eight years old (Healey 1991). Some Chinook salmon return from the ocean to spawn one or more years before they reach full adult size, and are referred to as jacks (males) and jills (females). Chinook salmon runs are designated on the basis of adult migration timing; however, distinct runs also differ in the degree of maturation at the time of river entry, thermal regime and flow characteristics of their spawning site, and actual time of spawning (Myers et al. 1998). Both winter-run and spring-run Chinook salmon tend to enter freshwater as immature fish, migrate far upriver, and delay spawning for weeks or months. For comparison, fall-run Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of rivers, and spawn within a few days or weeks of freshwater entry (Healey 1991).

Fall-run CC Chinook salmon migrate upstream from September through November, with most migration occurring in September and October following early-season rain storms. Spawning largely occurs from early October through December, with a peak in late October. Adequate instream flows and cool water temperatures are more critical for the survival of spring-run Chinook salmon (compared to fall-run or winter-run Chinook salmon) due to over-summering by adults and/or juveniles. Chinook salmon generally spawn in gravel beds that are located at the tails of holding pools (Bjornn and Reiser 1991). Adult female Chinook salmon prepare redds in stream areas with suitable gravel composition, water depth, and velocity. Optimal spawning temperatures range between 42° to 57° F. Redds vary widely in size and location within the river. Preferred spawning substrate is clean, loose gravel, mostly sized between 1 and 10 cm, with no more than 5 percent fine sediment. Gravels are unsuitable when they have been cemented with clay or fine particles or when sediments settle out onto redds, reducing inter-gravel percolation (62 FR 24588). Minimum inter-gravel percolation rate depends on flow rate, water depth, and water quality. The percolation rate must be adequate to maintain oxygen delivery to the eggs and remove metabolic wastes. Chinook salmon require a strong, constant level of subsurface flow, as a result, suitable spawning habitat is more limited in most rivers than superficial observation would suggest. After depositing eggs in redds, most adult Chinook salmon guard the redd from 4 to 25 days before dying.

Chinook salmon eggs incubate for 90 to 150 days, depending on water temperature. Successful incubation depends on several factors including dissolved oxygen levels, temperature, substrate size, amount of fine sediment, and water velocity. Maximum survival of incubating eggs and pre-emergent fry occurs at water temperatures between 42° and 56° F with a preferred temperature of 52° F. CC Chinook salmon fry emerge from redds during December through mid-April (Leidy and Leidy 1984).

After emergence, Chinook salmon fry seek out areas behind fallen trees, back eddies, undercut banks, and other areas of bank cover (Everest and Chapman 1972). As they grow larger, their habitat preferences change. Juveniles move away from stream margins and begin to use deeper water areas with slightly faster water velocities, but continue to use available cover to minimize predation risk and reduce energy expenditure. Fish size appears to be positively correlated with water velocity and depth (Chapman and Bjornn 1969, Everest and Chapman 1972). Optimal temperatures for both Chinook salmon fry and fingerlings range from 54° to 57° F, with maximum growth rates at 55° F (Boles 1988). Chinook salmon feed on small terrestrial and aquatic insects and aquatic crustaceans. Cover, in the form of rocks, submerged aquatic vegetation, logs, riparian vegetation, and undercut banks provide food, shade, and protect juveniles from predation. CC Chinook salmon will rear in freshwater for a few months and out-migrate during April through July (Myers et al. 1998).

2.2.1.3 Steelhead

Steelhead are anadromous forms of *O. mykiss*, spending some time in both freshwater and saltwater. Steelhead young usually rear in freshwater for one to three years before migrating to the ocean as smolts, but rearing periods of up to seven years have been reported. Migration to the ocean usually occurs in the spring. Steelhead may remain in the ocean for one to five years (two to three years is most common) before returning to their natal streams to spawn (Busby et al. 1996). The distribution of steelhead in the ocean is not well known. Coded wire tag recoveries indicate that most steelhead tend to migrate north and south along the continental shelf (Barnhart 1986).

Steelhead can be divided into two reproductive ecotypes, based upon their state of sexual maturity at the time of river entry and the duration of their spawning migration: stream maturing and ocean maturing. Stream maturing steelhead enter fresh water in a sexually immature condition and require several months to mature and spawn, whereas ocean maturing steelhead enter fresh water with well-developed gonads and spawn shortly after river entry. These two reproductive ecotypes are more commonly referred to by their season of freshwater entry (i.e., summer [stream maturing] and winter [ocean maturing] steelhead). The timing of upstream migration of winter steelhead, the ecotype most likely encountered during the proposed action, is typically correlated with higher flow events occurring from late October through May. In central and southern California, significant river outflow is also often required to breach sandbars that block access from the ocean; for this reason, upstream steelhead migration in these areas can be significantly delayed, or precluded entirely during extremely dry periods. Adult summer steelhead migrate upstream from March through September; however, results from past capture/relocation efforts in the action area (CDFW 2014, 2015, 2016, 2017, 2018, 2019) suggest the chance of encountering adult summer steelhead during the Program's "work window" is extremely low and thus unlikely to occur. In contrast to other species of Oncorhynchus, steelhead may spawn more than one season before dying (iteroparity); although one-time spawners represent the majority.

Because rearing juvenile steelhead reside in freshwater all year, adequate flow and temperature are important to the population at all times [California Department of Fish and Game (CDFG 1997)]. Outmigration appears to be more closely associated with size than age. In Waddell Creek, Shapovalov and Taft (1954) found steelhead juveniles migrating downstream at all times of the year, with the largest numbers of young-of-year and age 1+ steelhead moving downstream during spring and summer. Smolts can range from 5.5 to 8 inches in length. Steelhead outmigration timing is similar to coho salmon (NMFS 2016).

Survival to emergence of steelhead embryos is inversely related to the proportion of fine sediment in the spawning gravels. However, steelhead are slightly more tolerant than other salmonids, with significantly reduced survival when fine materials of less than 0.25 inches in diameter comprise 20 to 25 percent of the substrate. Fry typically emerge from the gravel two to three weeks after hatching (Barnhart 1986).

Upon emerging from the gravel, fry rear in edge-water habitats and move gradually into pools and riffles as they grow larger. Older fry establish territories which they defend. Cover is an important habitat component for juvenile steelhead, both as a velocity refuge and as a means of avoiding predation (Meehan and Bjornn 1991). Steelhead, however, tend to use riffles and other habitats not strongly associated with cover during summer rearing more than other salmonids. Young steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles. In winter, juvenile steelhead become less active and hide in available cover, including gravel or woody debris.

Water temperature can influence the metabolic rate, distribution, abundance, and swimming ability of rearing juvenile steelhead (Barnhart 1986, Bjornn and Reiser 1991, Myrick and Cech 2005). Optimal temperatures for steelhead growth range between 50° and 68° F (Hokanson et al. 1977, Wurtsbaugh and Davis 1977, Myrick and Cech 2005). Variability in the diurnal water temperature range is also important for the survivability and growth of salmonids (Busby et al. 1996).

Suspended sediment concentrations, or turbidity, also can influence the distribution and growth of steelhead (Bell 1973, Sigler et al. 1984, Newcombe and Jensen 1996). Bell (1973) found suspended sediment loads of less than 25 milligrams per liter (mg/L) were typically suitable for rearing juvenile steelhead.

2.2.2. Species Status

2.2.2.1 SONCC coho salmon

Although long-term data on coho salmon abundance are scarce, the available evidence indicates that spawner abundance has declined since the last status review for populations in this ESU (Williams et al. 2016). In fact, most of the 30 independent populations in the ESU are at high risk of extinction because they are below or likely below their depensation threshold, which can be thought of as the minimum number of adults needed for survival of a population.
The distribution of SONCC coho salmon within the ESU is reduced and fragmented, as evidenced by an increasing number of previously occupied streams from which SONCC coho salmon are now absent (Good et al. 2005, Williams et al. 2011, and Williams et al. 2016). Extant populations can still be found in all major river basins within the ESU (70 FR 37160). However, extirpations, loss of brood years, and sharp declines in abundance (in some cases to zero) of SONCC coho salmon in several streams throughout the ESU indicate that the species' spatial structure is more fragmented at the population-level than at the ESU scale. The genetic and life history diversity of populations of SONCC coho salmon is likely very low and is inadequate to contribute to a viable ESU, given the significant reductions in abundance and distribution.

2.2.2.2 CC Chinook salmon

The CC Chinook salmon ESU was historically comprised of approximately 32 Chinook salmon populations (Bjorkstedt et al. 2005). Many of these populations (about 14) were independent, or potentially independent, meaning they had a high likelihood of surviving for 100 years absent anthropogenic impacts. The remaining populations were likely more dependent upon immigration from nearby independent populations than dependent populations of other salmonids (Bjorkstedt et al. 2005).

In 1965, CDFG (1965) estimated escapement for this ESU at over 76,000 spawning adults. Most were in the Eel River (55,500), with smaller populations in Redwood Creek (5,000), Mad River (5,000), Mattole River (5,000), Russian River (500) and several smaller streams in Humboldt County (Myers et al. 1998). Currently available data indicate abundance is far lower, suggesting an inability to sustain production adequate to maintain the ESU's populations. The one exception is the Russian River population, where escapement typically averages a few thousand adults (Sonoma Water 2020).

CC Chinook salmon populations within the Action Area remain widely distributed. Populations south of the Action Area suffer poor distribution, specifically the area between the Navarro River and Russian River and the area between the Mattole and Ten Mile River populations (Lost Coast area). Concerns regarding the lack of population-level estimates of abundance, the loss of populations from one diversity stratum[1], as well poor ocean survival contributed to the conclusion that CC Chinook salmon are "likely to become endangered" in the foreseeable future (Good et al. 2005, Williams et al. 2011, Williams et al. 2016). Yet, some encouraging news from the NMFS 2016 CC Chinook status review is the discovery of spawning adults in several smaller, coastal Mendocino County tributaries, which suggests ESU spatial diversity is likely better than previously thought (NMFS 2016).

2.2.2.3 NC Steelhead

With few exceptions, NC steelhead are present wherever streams are accessible to anadromous fish and have sufficient flows. The most recent status review (NMFS 2016) reports that available information for winter-run and summer-run populations of NC steelhead do not suggest an appreciable increase or decrease in extinction risk since publication of the previous status review update in 2011 (NMFS 2011). Williams et al. (2016) found that population abundance was very low relative to historical estimates, and recent trends are downwards in most stocks. NC steelhead remain broadly distributed throughout their range, with the exception of habitat upstream of dams on both the Mad River and Eel River, which has reduced the extent of available habitat. Extant summer-run steelhead populations exist in Redwood Creek and the Mad, Eel (Middle Fork) and Mattole Rivers. The abundance of summer-run steelhead was considered "very low" in 1996 (Good et al. 2005), indicating that an important component of life history diversity in this DPS is at risk. Hatchery practices in this DPS have exposed the wild population to genetic introgression and the potential for deleterious interactions between native stock and introduced steelhead. However, abundance and productivity in this DPS are of most concern, relative to NC steelhead spatial structure and diversity (Williams et al. 2011). The most recent status review for NC steelhead (NMFS 2016) concludes NC steelhead, despite recent conservation efforts, remain impacted by many of the factors that led to the species being listed as threatened. Low streamflow volume, illegal cannabis cultivation, and periods of poor ocean productivity continue to depress NC steelhead population viability.

[1] A diversity stratum is a grouping of populations that share similar genetic features and live in similar ecological conditions

2.2.3. Status of critical habitat

In designating critical habitat, NMFS considers, among other things, the following requirements of the species: 1) space for individual and population growth, and for normal behavior; 2) food, water, air, light, minerals, or other nutritional or physiological requirements; 3) cover or shelter; 4) sites for breeding, reproduction, or rearing offspring; and, generally; and 5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of this species (50 CFR 424.12(b)). In addition to these factors, NMFS also focuses on Physical or Biological Features (PBF) and/or essential habitat types within the designated area that are essential to the conservation of the species and that may require special management considerations or protection (81 FR 7214).

The designations of critical habitat for the species described above previously used the term primary constituent element or essential features. The new critical habitat regulations (81 FR 7214) replace this term with 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 primary constituent elements, physical or biological features, 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.

In designating critical habitat, NMFS considers, among other things, the following requirements of the species: 1) space for individual and population growth, and for normal behavior; 2) food, water, air, light, minerals, or other nutritional or physiological requirements; 3) cover or shelter; 4) sites for breeding, reproduction, or rearing offspring; and, generally; and 5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of this species (50 CFR 424.12(b)). In addition to these factors, NMFS also focuses on PBFs and/or essential habitat types within the designated area that are essential to conserving the species and that may require special management considerations or protection.

For SONCC coho salmon critical habitat, the following essential habitat types were identified: 1) Juvenile summer and winter rearing areas; 2) juvenile migration corridors; 3) areas for growth and development to adulthood; 4) adult migration corridors; and 5) spawning areas. Within these areas, essential features of coho salmon critical habitat include adequate: 1) substrate, 2) water quality, 3) water quantity, 4) water temperature, 5) water velocity, 6) cover/shelter, 7) food, 8) riparian vegetation, 9) space, and 10) safe passage conditions (64 FR 24029).

PBFs for CC Chinook salmon and NC steelhead critical habitat, and their associated essential features within freshwater include:

- freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;
- freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
- water quality and forage supporting juvenile development; and

- natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;
- freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

The condition of designated critical habitat for SONCC coho salmon, CC Chinook salmon, and NC steelhead, and its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. The waterbodies that make up critical habitat for these species often have poor quality summer and rearing habitats due to lack of instream and riparian cover (large wood, deep pools, trees for shade, etc.), low summer stream flows, and high water temperatures. Spawning habitats are often degraded by high levels of fine sediments and lack of cover. Migration habitats often lack cover and resting areas and some spawning habitats are no longer accessible.

2.2.4. Factors responsible for species and critical habitat status

The condition of designated critical habitat for SONCC coho salmon, CC Chinook salmon, and NC steelhead, and its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. NMFS has determined that currently depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat: logging, agriculture, mining, urbanization, stream channelization, dams, wetland loss, and water withdrawals (including unscreened diversions for irrigation). Impacts of concern include altered stream bank and channel morphology, elevated water temperature, lost spawning and rearing habitat, habitat fragmentation, impaired gravel and wood recruitment from upstream sources, degraded water quality, lost riparian vegetation, and increased erosion into streams from upland areas (Weitkamp et al. 1995; Busby et al. 1996; 64 FR 24049; 70 FR 37160; 70 FR 52488). Diversion and storage of river and stream flow has dramatically altered the natural hydrologic cycle in many of the streams within the ESU. Altered flow regimes can delay or preclude migration, dewater aquatic habitat, and strand fish in disconnected pools, while unscreened diversions can entrain juvenile fish. Other factors, such as overfishing and artificial propagation, have also contributed to the current status these listed salmonids and their designated critical habitat. All these human induced factors have exacerbated the adverse effects of natural environmental variability from such factors as drought and poor ocean conditions.

2.2.5. Climate Change

One additional factor affecting the range-wide status of the steelhead, salmon, and their aquatic habitat at large is climate change. Impacts from global climate change are already occurring in California. For example, average annual air temperatures, heat extremes, and sea level have all increased in California over the last century (Kadir et al. 2013). Snow melt from the Sierra Nevada has declined (Kadir et al. 2013). However, total annual precipitation amounts have shown no discernable change (Kadir et al. 2013). Most ESUs and DPSs may have already experienced some detrimental impacts from climate change. NMFS believes the impacts on listed salmonids to date are likely fairly minor because natural, and local climate factors likely still drive most of the climatic conditions steelhead experience, and many of these factors have much less influence on steelhead abundance and distribution than human disturbance across the landscape. In addition, The ESUs and DPSs considered in this opinion, for the most part, are not dependent on snowmelt driven streams and, thus, not as affected by declining snow packs as, for example, California Central Valley species.

The threat to listed salmon and steelhead from global climate change will increase in the future. Modeling of climate change impacts in California suggests that average summer air temperatures are expected to continue to increase (Lindley et al. 2007, Moser et al. 2012). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe et al. 2004, Moser et al. 2012, Kadir et al. 2013). Total precipitation in California may decline; critically dry years may increase (Lindley et al. 2007, Schneider 2007, Moser et al. 2012). Wildfires are expected to increase in frequency and magnitude (Westerling et al. 2011, Moser et al. 2012).

Shifting climate patterns across coastal California may impair salmon and steelhead population productivity in the future. For example, in the San Francisco Bay region, warm temperatures generally occur in July and August, but as climate change takes hold, the occurrences of these events will likely begin in June and could continue to occur in September (Cayan et al. 2012). Climate simulation models project that the San Francisco region will maintain its Mediterranean climate regime, but will also experience a higher degree of variability of annual precipitation during the next 50 years. The greatest reduction in precipitation is projected to occur in March and April, with the core winter months remaining relatively unchanged (Cayan et al. 2012). Estuaries may also experience changes detrimental to salmonids. Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia et al. 2002, Ruggiero et al. 2010). In marine environments, ecosystems and habitats important to juvenile and adult salmonids are likely to experience changes in temperatures, circulation, water chemistry, and food supplies (Brewer and Barry 2008, Feely et al. 2004, Osgood 2008, Turley 2008, Abdul-Aziz et al. 2011, Doney et al. 2012). The projections described above are for the mid to late 21st Century. In shorter time frames, climate conditions not caused by the human addition of carbon dioxide to the atmosphere are more likely to predominate (Cox and Stephenson 2007, Santer et al. 2011).

2.3. Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The action area includes all stream channels, estuarine habitats, riparian areas, wetlands, and hydrologically linked upslope areas affected by the implementation of restoration projects authorized and permitted under the Program. The action area corresponds with the NOAA Restoration Center's Northern California Office area jurisdiction (Figure 1) that encompasses the Eel and Mattole Rivers to the South and the Smith and Klamath Rivers to the North (including areas in Oregon for the Klamath River). The action area is in the following counties: Humboldt, Del Norte, Trinity, Siskiyou, and part of Mendocino County in California and Klamath, Jackson and Lake Counties in Oregon (Figure 1). The area includes the following USGS 4th field HUCs: Upper Klamath, Lower Klamath, Shasta, Scott, Smith, Salmon, Trinity, South Fork Trinity, Mad-Redwood, Lower Eel, South Fork Eel, Middle Fork Eel, and Upper Eel and Mattole.

Most effects resulting from restoration activities will be restricted to the immediate restoration project site, while some activities may result in impacts to habitat or individual fish for a short distance downstream. The specific extent of effects from each project will vary depending on site conditions, project type, and specific project methods. Therefore, the Action Area for this Program is defined as all stream channels, estuarine habitats, riparian areas, wetlands, and hydrologically linked upslope areas within the NOAA RC's Northern California Office area jurisdiction (Figure 1) that encompasses the Eel and Mattole Rivers to the South and the Smith and Klamath Rivers to the North (including areas in Oregon for the Klamath River).

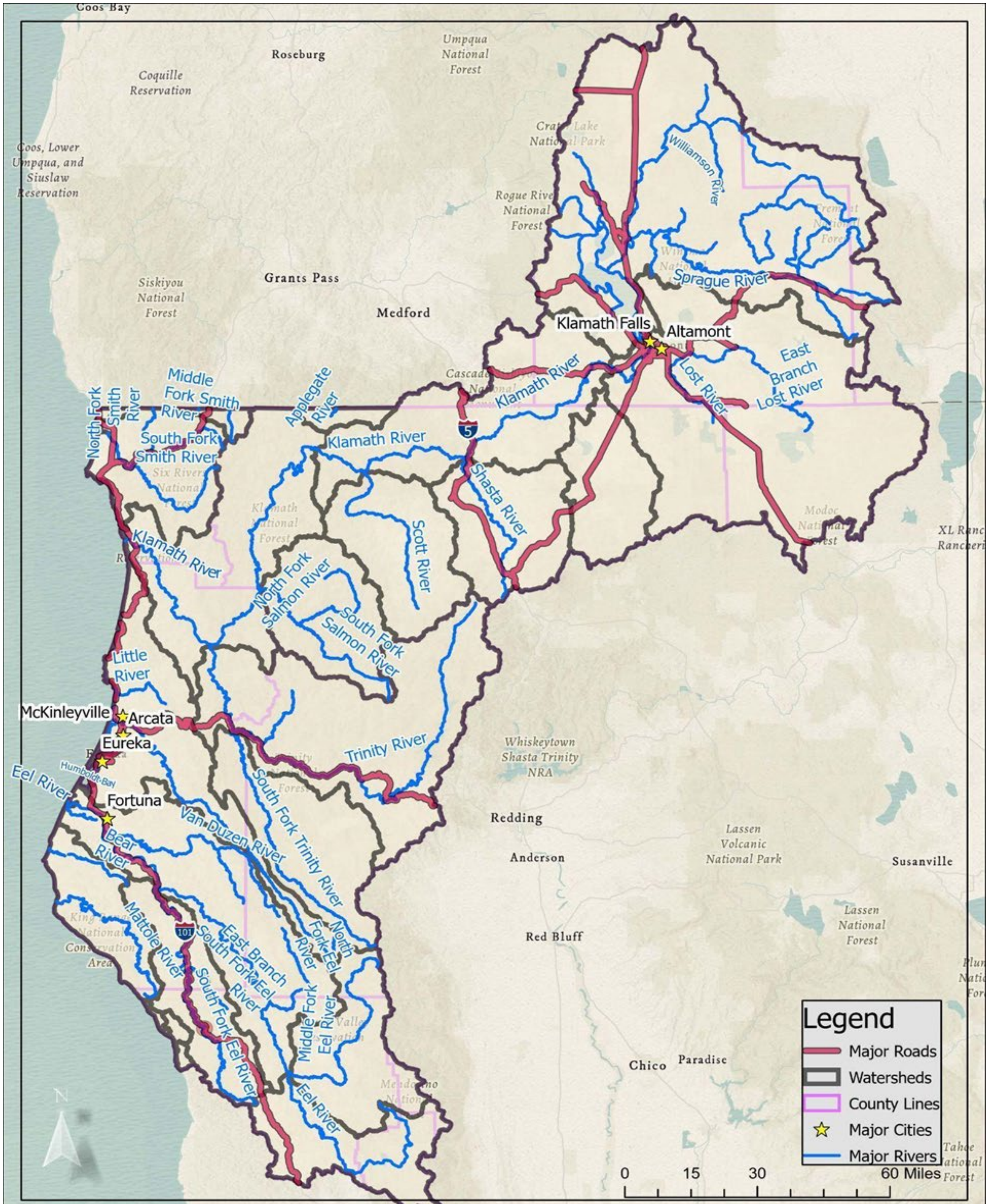

Figure 1: Action Area for the Proposed Action.

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 for this Program is defined as all stream channels, estuarine habitats, riparian areas, wetlands, and hydrologically linked upslope areas within the NOAA RC’s Northern California Office area jurisdiction (Figure 1) that encompasses the Eel and Mattole Rivers to the South and the Smith and Klamath Rivers to the North (including areas in Oregon for the Klamath River) The area includes the following USGS 4th field HUCs: Upper Klamath, Lower Klamath, Shasta, Scott, Smith, Salmon, Trinity, South Fork Trinity, Mad-Redwood, Lower Eel, South Fork Eel, Middle Fork Eel, Upper Eel and Mattole.

Restoration projects that have been accepted into the Program up to this point, including both those with some implementation completed and those for which implementation has not yet begun, have been analyzed under the existing RGP-12 programmatic biological opinion (WCRO-2020-02938) and are, therefore, part of the baseline for the current proposed action.

Native vegetation in the action area varies from old growth redwood (*Sequoia sempervirens*) forest along the coastal drainages to Douglas fir (*Pseudotsuga menziesii*) intermixed with hardwoods in the foothills, to ponderosa pine (*Pinus ponderosa*) and Jeffery pine (*P. jefferyi*) stands common within the upper elevations. Areas of grasslands (e.g., oak woodland habitat) are also found along ridge tops and south facing slopes of some watersheds.

The action area, for the most part, has a Mediterranean climate characterized by cool wet winters with typically high runoff, and dry warm summers characterized by low instream flows. Fog is a dominant climatic feature along the coast, generally occurring daily in the summer and not infrequently throughout the year. Higher elevations and inland areas tend to be relatively fog free. Most precipitation falls during the winter and early spring as rain, with occasional snow at higher elevations, especially in the interior mountainous regions of northern California. Along the coast, average air temperatures range from 46° to 56° F. Further inland and in the southern part of the action area, annual air temperatures are much more varied, ranging from below freezing in winter to over 100° F during the summer months.

High seasonal rainfall on bedrock and other geologic units with relatively low permeability, erodible soils, and steep slopes contribute to the flashy nature (stream flows rise and fall quickly) of the watersheds within the action area. In addition, these high natural runoff rates have been increased by extensive road systems and other land uses. High seasonal rainfall combined with rapid runoff rates on unstable soils delivers large amounts of sediment to river systems. As a result, many river systems within the action area contain a relatively large sediment load, typically deposited throughout the lower gradient reaches of these systems.

2.4.1. Status of, and factors affecting, the species and critical habitat in the Action Area

This section provides a synopsis of the geographic area of consideration, the ESUs and watersheds present, specific recent information on the status of salmon and steelhead, and a summary of the factors affecting the listed species within the action area. The best information presently available demonstrates that a multitude of factors, past and present, have contributed to the decline of west coast salmonids (NMFS 2012, 2013, 2014, 2016). The following is a summary of the factors affecting the species or critical habitat in the action area.

Urban development within the action area is found primarily on the estuaries of the larger streams, though there are some small towns and rural residences throughout the area. Forestry is the dominant land-use with limited agriculture. The action area includes the California portion of the SONCC coho salmon ESU, the northern portion of the CC Chinook salmon ESU, and the northern portion of the NC steelhead DPS, and contains designated critical habitat for all three species.

Generally speaking, excessive fine sediment and poor water quality/quantity are the predominant factors limiting salmonid survival and recovery throughout the action area. Past logging and road building practices caused extensive hillside erosion within the Klamath River, Mad River, Redwood Creek, Eel River and Mattole River watersheds. During the same period, massive floods, such as the 1964 incident, accelerated existing erosion rates, which caused fine sediment deposition and pool aggradation that remains to this day.

Poor water quality and low streamflow volume impacts much of the region, although the cause of these conditions varies based upon location. Agricultural water demand in the upper Klamath River, Shasta River, and Scott River watersheds has depressed SONCC coho salmon abundance and spatial diversity. Mainstem Klamath River reservoirs block fish passage, interrupt natural river hydrology, and support aquatic disease outbreaks by warming and enriching (via eutrophication) stored water prior to its release downstream (NMFS 2014). The lack of bedload-moving winter discharge and warm spring river flows has allowed a native salmon pathogen (C. Shasta) to flourish, significantly depressing smolt coho salmon survival during their downstream migration. Further south within the Eel and Mattole drainage, illegal cannabis cultivation has denuded hillsides, drained summer baseflow from streams, and polluted waterways with chemical pesticides and fertilizers. State regulation of legal cannabis growers and increased enforcement targeting illegal operators will likely minimize cannabis-related impacts in the future, whereas an ambitious plan to remove the Klamath River dams will greatly improve salmonid population abundance, distribution, and productivity in the coming decades.

Salmonid populations are struggling throughout the west coast due to persistent drought. The following language is taken from Williams et al. (2016), which provides a description of the effects of recent drought conditions on listed salmonids in California, but has been updated to include those similar conditions that have occurred since 2016.

California has experienced well below average precipitation over the last decade (2010-2021). Some paleoclimate reconstructions suggest that the current drought is the most extreme in the past 500 or perhaps more than 1,000 years. Anomalously high surface temperatures have amplified the effects of drought on water availability This period 2010-2020 of drought and high air, stream, and upper-ocean temperatures have together likely had negative impacts on the freshwater, estuary, and marine phases for many populations of coho salmon, Chinook salmon, and steelhead.

2.4.2. Climate Change

The threat to SONCC coho salmon, CC Chinook salmon, and NC steelhead from climate change is relatively lower in coastal areas due to the fog zone and benefits of old growth redwood forests, including shady, complex stream and riparian areas, and cool stream temperatures (NMFS 2014, 2016a). In particular, the Redwood Creek watershed should continue to act as a refuge for salmonids and eulachon due to the preponderance of protected parklands, old growth forest, the cool, coastal climate, and continuing restoration efforts.

The effects of climate change will be more pronounced further inland. Average annual Northwest air temperatures have increased by approximately 1.8°F since 1900, or about 50 percent more than the global average warming over the same period (ISAB 2007). The latest climate models project a warming of 0.18°F to 1.08°F per decade over the next century. Recent evidence suggests that climate and weather is expected to become more extreme, with an increased frequency of drought and flooding (IPCC 2019). Water temperatures will reach extremes during the summer months with the combined effect of reduced flow and warmer air temperatures. These long-term effects may include, but are not limited to, depletion of cold water habitat, variation in quality and quantity of tributary rearing habitat, alterations to migration patterns, accelerated embryo development, premature emergence of fry, increased bio-energetic and disease stresses on fish, and increased competition among species.

Climate change effects contributing to warming and reduced snowpack along with timber harvest and fire suppression have led to an increase in the number of large wildfires and the total area burned within the SONCC coho ESU and the Klamath-Trinity Mountains. Large wildfires produce mass-wasting events in high severity burn areas. Elevated levels of sediment introduction from surface erosion and mass-wasting are compounded by forest management actions including road networks, timber harvest activities, and historical fire suppression actions (Barr et al. 2010).

In coastal and estuarine ecosystems, the threats from climate change largely come in the form of sea level rise and the loss of coastal wetlands. Sea levels will likely rise exponentially over the next 100 years, with possibly a 43-84 cm rise by the end of the 21st century (IPCC 2019). This rise in sea level will alter the habitat in estuaries and either provide an increased opportunity for feeding and growth or in some cases will lead to the loss of estuarine habitat and a decreased potential for estuarine rearing.

Marine ecosystems face an entirely unique set of stressors related to global climate change, all of which may have deleterious impacts on salmonid growth and survival while at sea. In general, the effects of changing climate on marine ecosystems are not well understood given the high degree of complexity and the overlapping climatic shifts that are already in place (e.g., El Niño, La Niña, and Pacific Decadal Oscillation). Overall, climate change is believed to represent a growing threat, and will challenge the resilience of salmonids and other species in Northern California.

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

Given the large spatial area where individual restoration projects may occur, many past Section 7 consultations and Section 10 permits have occurred within the action area. The majority of the consultations were concluded through the informal consultation process and thus did not identify adverse effects on listed species. A low number (less than 50) of formal biological opinions are produced each year that identify adverse effects to listed species and/or critical habitat, exempt take of listed anadromous fish, and have terms and conditions that minimize any such take. Jeopardy opinions have been issued within a few watersheds in the action area (i.e., Klamath River and Eel River). For each, modifications were made to dam operations to avoid jeopardizing listed species and adversely modifying critical habitat.

In December 2021, NMFS completed a section 7 consultation (WCRO-2021-01946) with the Federal Energy Regulatory Commission on the proposed removal of four dams on the Klamath River, which is expected to overlap with the proposed action. The current environmental baseline in the mainstem Klamath River is expected to change as a result of dam removal. For example, sediment stored behind the dams will move downstream and potentially affect the riverbed in the action area. Adverse effects to SONCC coho salmon will be short-term and affect different year classes and the project will likely kill a relatively small percentage of the total number of juvenile coho salmon in the Upper Klamath River population in the year of drawdown and is not expected to eliminate any one-year class. We believe these changes to the environmental baseline will not affect our analyses of impacts of the proposed action.

CDFW has funded numerous restoration projects within the action area over the last several decades through a variety of grant programs. Since 1997, restoration projects funded by CDFW's Fisheries Restoration Grants Program have been implemented under the Corps' Regional General Permit 12 (RGP-12) and the associated NMFS programmatic biological opinion (Most recently, WCR-2015-2400). A portion of these projects involved dewatering, during which the vast majority of captured and relocated fish survived. Despite minor, short-term impacts to salmonid habitat resulting from a subset of projects implemented annually, these projects significantly improved on-site habitat conditions, with likely corresponding benefits to individual fish and the populations that they comprise.

2.5. Effects of the Action

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

The life histories of SONCC coho salmon, CC Chinook salmon, and NC steelhead are described in the Status of Species section. Juvenile salmonids are the life stages most likely to be exposed to any effects resulting from construction activities. The Program's construction season (June 15 to November 1) is designed to avoid the migratory adult life stage of salmonids, although some stray adults may be present then. Monitoring activities, which may occur at any time of year, may also encounter juvenile and adult salmonids.

2.5.1. Effects to Species

NMFS expects Program implementation to cause adverse effects to limited numbers of individual SONCC coho salmon, CC Chinook salmon, and NC steelhead. Juveniles and a low number of adults are expected to be present during the construction season, and both juveniles and adults may be present during monitoring activities year-round. However, as adult salmonids are expected to avoid areas of disturbance and capture methods targeting juvenile fish, no adverse effects to adult salmonids are anticipated.

2.5.1.1 Noise, Motion, and Vibration Disturbance

Noise, motion, and vibration disturbance resulting from activity in the channel may cause minor and temporary behavioral effects to listed species. NMFS expects any juvenile or adult salmonids present in the Action Area during the construction season to temporarily move to other available areas to avoid episodic areas of disturbance, resulting in minor, temporary changes in fish behavior (an hour or less). Any fish present during construction activities are expected to detect areas of disturbance, actively avoid those portions of a project footprint where heavy equipment is operated, and move into undisturbed habitat nearby. Juvenile salmonids may be attracted to activity that stirs up sediment as it can disrupt benthic prey, but are expected to move quickly away whenever they detect an immediate threat. Because these avoidance behaviors will likely be limited to short time periods, we don't anticipate any reductions in the fitness of individual salmonids.

2.5.1.2 Disturbance of riparian and aquatic habitat

NMFS expects any disturbance of riparian and aquatic habitat resulting from Program activities (including pile driving) to cause only minor, temporary effects to individual fish, with one exception. The effects to species resulting from mobilization of sediment are discussed in Section 2.5.2.4 of this document and are not included in the following discussion.

Some degree of disturbance to riparian and aquatic habitat is possible during implementation of every habitat restoration project included in the Program [i.e., when access to the habitat is established, and during the implementation of restoration actions (e.g., during actual placement of large wood in a stream)]. The PBA (NOAA 2022) and the Proposed Action (Section 1.3) within this document include a comprehensive list of protection measures that every project must follow. NMFS expects use of these protection measures will minimize the extent and severity of habitat disturbance and provide for rapid recovery of disturbed habitat. Restoration projects implemented under the Program will avoid disturbing riparian vegetation to the extent possible, as described in the Vegetation and Habitat Disturbance Protection Measures detailed in the Proposed Action (Section 1.3) within this document.

2.5.1.3 Exposure to Toxic Chemicals

The following aspects of the Proposed Action have the potential to detrimentally affect water quality: equipment refueling, fluid leakage, and maintenance activities within and near the stream channel; water in contact with wet cement; and herbicide application and drift.

Effects of these activities on species are expected to be minor and temporary, given the extensive protection measures described in the Proposed Action, which should effectively limit or eliminate entry of these chemicals into stream courses. Specifically, the General Conservation Measures will reduce effects from equipment refueling, leakage, and maintenance as well as newly poured concrete, and the Herbicide Use Protection Measures will limit or eliminate any herbicide transfer to stream courses. Any fish that do detect toxic chemicals in their environment during the construction season are expected to avoid them by temporarily relocating either upstream or downstream into suitable habitat adjacent to the worksite. Salmonids are particularly vulnerable to herbicide impacts during the incubation stage. However, because but no salmonid eggs or embryos would be present during the defined construction or herbicide use period, NMFS expects these life stages will not be exposed to toxic chemicals; any such chemicals that enter streams later (from residual amounts remaining after work is done) will be diluted and flushed from salmonid habitat by fall rains prior to when eggs are laid and embryos emerge.

2.5.1.4 Stress, injury, or death from fish capture, handling, tagging, and/or relocation

Stress, injury, or death from fish capture, handling, tagging, and/or relocation may occur when fish are relocated prior to dewatering events at project sites during the construction season. Fish may also be captured, handled, and tagged during effectiveness monitoring activities at any time of year. The following methods may be used to capture fish prior to dewatering, or during effectiveness monitoring: seine, minnow trap, fyke net, and electrofishing with dip nets. Snorkel surveys may also be conducted to observe fish as part of effectiveness monitoring.

All project sites that require dewatering will require relocation of any fish occurring there. A qualified biologist will capture and relocate fish away from the restoration project work site prior to draining a reach to enable in-water work, so they are protected from crushing or desiccation. Fish in the area to be dewatered will be captured using the method most appropriate for particular field conditions, then quickly transferred to buckets of oxygenated water and promptly released in a suitable instream location nearby. Monitoring activities may also result in fish capture and handling, but fish would be released back at the original capture site. The Program requires submission of a dewatering and fish capture and relocation plan for agency review and approval prior to any planned relocation event. This plan will describe the qualifications of staff that will relocate fish, the sufficiency of the field staff that will be available to efficiently move and care for relocated fish, and the suitability of the release location.

Juvenile salmonids are the life stage most likely to be exposed to fish relocation preceding dewatering during the construction season. Few adults are expected to be present during the Program’s construction season, which avoids the migratory timeframes of salmon and steelhead.

Because of their relative mobility, any returning or holding adults present near construction zones are expected to avoid areas prior to dewatering. Any adult salmonids that made their way into construction areas set for dewatering would be clearly visible to field personnel due to their large size and strong movements; these staff would re-establish a means for adult fish to leave the construction area before dewatering efforts began. Both adult and juvenile salmonids may be present during monitoring efforts, which may occur at any time of year. Due to size and mobility, adults are expected to effectively avoid areas where monitoring activities are occurring.

Snorkel surveys may be used to observe listed fish without capturing or handling them. NMFS expects such surveys to have minor, temporary effects on salmonids. Observation without handling is the least disruptive method for determining a species' presence/absence and estimating their relative numbers. Its effects are also generally the shortest-lived and least harmful of the research activities discussed in this section because a cautious observer can effectively obtain data while only slightly disrupting the fishes' behavior. Young fish frightened by the turbulence and sound created by observers are likely to seek temporary refuge in deeper water or behind or under rocks or vegetation. In extreme cases, some individuals may leave a particular pool or habitat type and then return when observers leave the area. No injuries or deaths are expected to occur as a result of snorkel surveys.

Electrofishing may be used to remove fish from areas prior to dewatering activities during the construction season, to monitor salmonids in low water conditions where stream habitat is too complex for seining or minnow traps, or in places where those methods are not effective to inform the monitoring question. During electrofishing, an electrical current is passed through water containing fish (and the fish themselves) in order to stun them, which makes them easy to capture. This method can cause effects of varying severity - from disturbance of fish to immediate mortality. Salmonids can be injured or killed by spinal injuries that sometimes occur due to forced muscle contractions when the current passes through the body. Smaller fish are subjected to a lower voltage gradient than larger fish (Sharber and Carothers 1988), resulting in lower injury rates (e.g., Hollender and Carline 1994, Dalbey et al. 1996, Thompson et al. 1997). The percentage of fish that are injured or killed by electrofishing varies widely depending on the equipment used, the settings on the equipment, the expertise of the technician, and water temperature (Sharber and Carothers 1988, McMichael 1993, Dalbey et al. 1996; Dwyer and White 1997).

All Program projects will follow the Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act (NMFS 2000), which describes the appropriate settings for electrofishing gear and a temperature limit above which no electrofishing should occur. When operated by experienced personnel following these guidelines, as expected under this Program, shocked fish normally revive quickly. Studies on the long-term effects of electrofishing indicate that even with spinal injuries, salmonids can survive long-term, although severely injured fish may have stunted growth (Dalbey et al. 1996, Ainslie et al. 1998).

Seining methods may be used to capture salmonids in deeper water without significant habitat complexity (e.g., LWD). Minnow traps are typically used in very complex habitats where seining would likely not be successful due to small/large wood and significant aquatic vegetation. Fyke nets may be used in off-channel and slow water habitats when minnow traps and seining are found to not be effective. Dip nets are used to collect fish that are stunned by electrofishing. The capture of listed salmonids using these methods is likely to cause temporary stress to these fish during transfer from the seine, trap, or net to oxygenated water containing anesthetic. Injury may occur during transfer, but due to the experience level of field staff NMFS expects such injury to be a rare occurrence.

During effectiveness monitoring, all captured fish will be anesthetized, then weighed and measured. The PBA (NOAA 2022) and the Proposed Action section (Section 1.3) within this document describe precautions that will be taken to reduce the degree of fish stress from these procedures (e.g., temperature limits for sampling, close observation of fish while they recover from anesthesia and from any procedures, and monitoring of temperature and dissolved oxygen in the recovery bucket). NMFS expects these precautions to effectively reduce the likelihood of injury or death from handling activities, including tagging fish and clipping their fins.

Passive Integrated Transponder (PIT) tags may be inserted into the body cavity of some captured fish after anesthesia. A PIT tag is an electronic device that relays signals to a radio receiver; it allows salmonids to be identified whenever they pass a location containing such a receiver (e.g., any of several dams) without the need for researchers to handle the fish again. PIT tags have very little effect on growth, mortality, or behavior. The few reported studies of PIT tags have shown no effect on growth or survival (Prentice et al., 1987; Jenkins and Smith, 1990; Prentice et al., 1990). For example, in a study between the tailraces of Lower Granite and McNary Dams (225 km), Hockersmith et al. (2000) concluded that the performance of yearling Chinook salmon was not adversely affected by PIT-tags. Additional studies have shown that growth rates among PIT-tagged Snake River juvenile fall Chinook salmon in 1992 (Rondorf and Miller, 1994) were similar to growth rates for salmon that were not tagged (Conner et al., 2001). Prentice and Park (1984) also found that PIT-tagging did not substantially affect survival in juvenile salmonids.

After anesthetic is administered, a single fin may be altered or removed on each fish in order to take a non-lethal tissue samples or to allow for later identification of a fish. Many studies have examined the effects of fin clips on fish growth, survival, and behavior. The results of these studies are somewhat varied; however, it can be said that fin clips do not generally alter fish growth. Studies comparing the growth of clipped and unclipped fish generally have shown no differences between them (e.g., Brynildson and Brynildson 1967). Moreover, wounds caused by fin clipping usually heal quickly - especially those caused by partial clips. Mortality among fin-clipped fish is also variable. Some immediate mortality may occur during the marking process, especially if fish have been handled extensively for other purposes. Delayed mortality depends, at least in part, on fish size; small fishes have often been found to be susceptible to it, and Coble (1967) suggested that fish shorter than 90 mm are at particular risk. The degree of mortality among individual fishes also depends on which fin is clipped. Recovery rates are generally recognized as being higher for adipose- and pelvic-fin-clipped fish in comparison to those that are clipped on the pectoral, dorsal, and anal fins (Nicola and Cordone 1973), likely because the adipose and pelvic fins are not as important as the other fins for movement or balance (McNeil and Crossman 1979).

Based on analyses of fish relocation data collected across the north coast, and Program coordination requirements, NMFS expects any injury or death of listed species due to fish collection and handling will be minimal. A CDFW analysis of data from two years of fish relocation activities in Humboldt County showed that mortality rates associated with individual fish relocation sites were less than 3% and the mean mortality rates for all sites was less than 1% (Collins 2004). Further, a NMFS (2012) review of all Fisheries Restoration Grant Program (FRGP) annual monitoring reports of dewatering and relocation activities for 99 projects across 8 years showed less than 1% of relocated steelhead perished. As described in the PBA (NOAA 2022), if fish mortality exceeds 3% of the catch of any listed species during any particular fish relocation event, NMFS will be contacted. Sampling or fish relocation for that project may only resume with the approval of NMFS, after the cause of the mortality event is known and activities are modified as needed to reduce or eliminate its future occurrence.

Due to Program elements, NMFS expects relocated fish will not suffer from lower habitat quality or reduced growth potential after they are moved. Specifically, each fish capture and relocation plan shall describe the extent to which the release site has similar water temperatures as the capture location, contains ample habitat for captured fish, and holds a low likelihood of fish reentering the work site or becoming impinged on any exclusion nets or screens.

Annual estimates of the number of fish anticipated to be encountered, and to be injured or killed, during fish relocation and monitoring activities are described in Tables 3, 4, and 5.

2.5.1.5 Crushing

If in-water work occurs without dewatering a work area, any salmonids present are at risk of being killed by crushing injury from boots or heavy equipment. NMFS expects these salmonids to avoid sources of potential injury or death, but their ability to do so decreases if the amount of water in the work area is small, e.g., at low tide, or if there is a large volume of equipment and people in a small watered area that is not sufficiently connected to other aquatic zones to allow fish to escape. The likelihood of injury or death from crushing may be greater in tidal areas, because for some activities in these areas, such as excavating a channel in a slough, it may not be feasible to dewater the work area. In addition, in-water work in tidal areas typically occurs during a low or receding tide, which would tend to concentrate fish into a smaller area of water at the same time that the in-water work is happening, increasing the chance that fish will be under boots or heavy equipment.

2.5.1.6 Desiccation

Any individual fish that elude capture prior to dewatering will become stranded in dewatered work areas, where they are expected to die from desiccation. For dewatering projects occurring in tidal or estuarine areas, there is often a large volume of water, and due to poor existing habitat conditions at restoration sites a low number of listed fish are expected to present, reducing the effectiveness of fish detection for relocation and increasing the risk of desiccation.

2.5.1.7 Turbidity/sediment mobilization

All project types involving ground disturbance in or adjacent to streams have the potential to increase turbidity and suspended sediment levels within the project work site and for a short distance downstream. Activity in the channel, such as wading in the river to catch fish for monitoring, installing large wood structures, or use of heavy equipment, will mobilize fine sediment already present in the stream and result in turbidity. In addition, a small amount of sediment from the banks may be incidentally introduced into the channel at any Project site.

Short-term increases in turbidity and suspended sediment levels associated with construction may temporarily negatively impact fish survival and growth if they lead to reduced availability of food, reduced feeding efficiency, or reduced ability to see and avoid predators. Small pulses of turbid water can cause salmonids to temporarily move from their established territories into less suitable habitat, possibly increasing competition and predation if the new habitat is of lower quality. Due to low streamflow during the construction period, NMFS expects that any sediment suspended by instream activity would settle to the substrate and return to baseline conditions within 15 minutes to one hour after disturbance. This short duration may not disturb fish enough to abandon their original habitat. Any fish that move into nearby habitat to avoid turbidity are expected to quickly return to the original habitat once the initial disturbance of sediment is over, with negligible effects to their fitness.

Major work in the channel will include use of cofferdams to delineate an area to be dewatered. Fish between the cofferdams will be relocated to habitat nearby, and any sediment introduced during in-water work in the dewatered area will be contained by the cofferdams, preventing it from entering nearby habitat. Once in-water work is complete for the season, sediment within the dewatered area will be introduced to the stream and briefly mobilized when the cofferdams are removed and flow is restored to the reach.

Studies of sediment effects during culvert construction determined that increased sediment accumulation within the streambed was measurable (relative to control levels within) at a range of 358 to 1,442 meters downstream of the culvert (Lachance et al. 2008). Turbidity is, therefore, expected to extend as far as 1,500 feet downstream of work areas. In tidal areas, this turbidity is expected to clear each day when tides inundate the affected work areas; the incoming tide would generally carry suspended sediments inshore and upstream, until the tide reverses and the turbid water travels in the reverse direction, out of the work area. In freshwater areas, turbidity should decline rapidly once the source of disturbance stops; the volume of water in these areas is expected to stay the same or decline during the construction season, which ends before the rainy season begins. Without disturbance from increased flow, sediment suspended in the water column is expected to rapidly settle onto the stream substrate. Each project will be required to control erosion, cover exposed dirt piles, and revegetate disturbed soils, which NMFS expects will reduce the sediment entering the stream to a great degree. Most of any newly introduced sediment that settles on the stream substrate is expected to exit the system during winter storms with scouring flows.

NMFS expects that the adherence to required protection measures described in the Proposed Action section of this document (Section 1.3) will reduce the extent, severity, and duration of turbidity and reduce suspended sediment levels enough that the most severe effect would be a short-term reduction in feeding. NMFS does not expect these temporary effects to feeding to decrease the individual fitness of any listed fish.

2.5.1.8 Effects of underwater sound

Temporary behavioral changes that fish may exhibit in response to noise (e.g., from use of explosives or pile driving) include startling, altering behavioral displays, avoidance, displacement, and reduced feeding success. Observations of juvenile coho and steelhead exposed to underwater sound from pile driving noise above the 150 dB behavioral threshold at the Mad River Bridges Highway 101 project indicated that juvenile salmonids quickly habituate to sub-injurious noise and resume normal surface-feeding behavior within a few minutes of the fist pile strikes (Mike Kelly, NMFS, personal observations 2009, 2011). Therefore, NMFS believes that periodic behavioral changes caused by sub-injurious sound exposure will not result in decreased fitness or survival of individual juvenile salmonids.

Barotrauma, or physical injury due to changes in water pressure, will not occur as a result of in-water pile driving carried out under the Program. Most pile driving will be conducted in or adjacent to dry channels, eliminating potential for barotrauma. For pile driving in wetted areas, the In-Water Pile Driving Protection Measures described in the Proposed Action require each project to do an hydroacoustic assessment and develop a pile driving plan to confirm that underwater sound pressure levels are expected to below the cSEL injury threshold criteria for peak pressure and accumulated sound exposure levels. The pile driving plan will identify the appropriate, site-specific attenuation, sound monitoring, dewatering, or fish relocation measures necessary to avoid injury and mortality. If, after this coordination, agency review of the resulting pile driving plan finds that cSEL levels will exceed the injury threshold levels, the project will not be included in the Program.

Where pile driving occurs in a wetted channel or floodplain, fish will be relocated to areas where sound levels are safe as necessary. However, it may not be feasible to dewater some tidal areas sufficiently to detect and remove all juvenile salmonids. Where there is sufficient depth, hydrophones will be deployed in these areas to monitor water pressure and signal the need to stop activities prior to exceedance of pressure threshold levels (see section 1.3.11.7 above). In circumstances where the floodplain cannot be effectively dewatered, and water is too shallow to deploy hydrophones, even if attenuation measures are employed NMFS anticipates that some juvenile fish could be killed by barotrauma. In such a circumstance, the agencies would not include the project in the Program.

2.5.1.9 Annual anticipated exposure estimates and mortality

The annual number of each salmonid species that may be exposed to the effects of program activities, and may be killed, during the course of Program implementation are summarized by diversity stratum below.

Table 3. Annual exposure estimates and anticipated injuries and mortality response of juvenile SONCC coho salmon resulting from three elements of fish handling, presented per diversity stratum.

SONCC Coho Salmon Diversity Stratum	Capture/handle/ release related to monitoring	PIT tagging related to monitoring	Fish capture/ relocation for restoration projects	Anticipated Injury and Mortality (3%)
Central Coastal	2500	600	500	108
Southern Coastal	3000	800	500	129
Interior Klamath	4000	1500	1000	195
Interior Trinity	500	100	500	33
Interior Eel	3000	800	500	129
Total	**13000**	**3800**	**3000**	**594**

Table 4. Annual exposure estimates and anticipated injuries and mortality response of CC Chinook salmon resulting from three elements of fish handling, presented per diversity stratum.

CC Chinook Salmon Diversity Stratum	Capture/handle/ release related to monitoring	PIT tagging related to monitoring	Fish Capture and Relocation for Restoration Projects	Anticipated Injury and Mortality (3%)
North Coastal	1500	400	500	72
North Mountain Interior	1500	400	500	72
Total	**3000**	**800**	**1000**	**144**

Table 5. Annual exposure estimates and anticipated injuries and mortality response of juvenile NC steelhead resulting from three elements of fish handling, presented per diversity stratum.

NC Steelhead Diversity Stratum	Capture/handle/ release related to monitoring	PIT tagging related to monitoring	Fish Capture and Relocation for Restoration Projects	Anticipated Injury and Mortality (3%)
Northern Coastal	2500	400	400	99
Lower Interior	2500	400	400	99
North Mountain Interior	2500	400	400	99
Total	**7500**	**1200**	**1200**	**297**

2.5.2. Effects to designated critical habitat

2.5.2.1 Effects of riparian and aquatic habitat disturbance

Effects of riparian vegetation disturbance on designated critical habitat are expected to be minor and temporary. In most cases, entire trees or shrubs in riparian areas that are part of a project footprint will be left in place and their branches or vegetation cut back to establish access. Where entire riparian plants must be removed (e.g., removal of a shrub to create access to place a large wood structure), NMFS expects the loss of riparian vegetation from any given project to be small, and limited to mostly shrubs and an occasional tree. Consistent with the Protection Measures, as much understory brush and as many trees as possible will be retained, to preserve shade and natural bank stabilization benefits. The plant species most likely to be cut back or removed (willows and other shrubs) will generally reestablish quickly (usually within one season). The required revegetation of disturbed riparian areas (and planting ratio of two new plants for each plant removed) described in the Protection Measures will further minimize the effect of any small, temporary loss of vegetation. As such removal of riparian vegetation will not normally remove aquatic habitat elements, any effects to fish are also expected to be minor and limited to temporary changes in shade and food availability until replanted vegetation is established (by the next spring or summer).

NMFS also expects aquatic habitat disturbance to be minor, episodic, and temporary - generally limited to compression of substrate, aquatic plants, and benthic prey from trampling and heavy equipment operation, and disturbance of benthic prey during pile driving activities. Any affected aquatic vegetation and benthic prey are expected to repopulate quickly (within a season).

2.5.2.2 Toxic chemicals

Effects of toxic chemicals on designated critical habitat are expected to be minor and temporary given the extensive protection measures described in the Proposed Action, which should effectively limit or eliminate entry of these chemicals into stream courses. In addition, designated critical habitat would be only temporarily affected by any trace amount of chemicals that enter the water, because contaminants will be swiftly diluted and rapidly flushed from the system, either immediately or after fall rains arrive.

2.5.2.3 Turbidity, sediment mobilization, and deposition of sediment on aquatic substrate

Turbidity, sediment mobilization, and deposition of fine sediment on aquatic substrate may affect water quality and the food resources available for juvenile development, which are two physical and biological features (PBFs) of designated critical habitat for SONCC coho salmon, CC Chinook salmon, and NC steelhead. When sediment settles out the water column, it may obscure benthic (bottom dwelling) aquatic invertebrates, which may reduce salmonid feeding efficiency. However, the amount of sediment entering waterways from Project activities is expected to be small, given the protection measures and project requirements discussed above. This small amount is not expected to kill or harm benthic aquatic macroinvertebrate prey populations or alter their behavior. Effects to water quality and salmonid prey items are expected to be minor and temporary, lasting from an hour to perhaps a day at a time at any given project site.

2.5.2.4 Dewatering

Benthic aquatic macroinvertebrate populations will die when their habitat is dewatered. As these benthic organisms are part of the food web that provides prey to juvenile salmonids, dewatering will reduce the amount of prey available and temporarily adversely affect the PBF associated with prey resources. The extent of macroinvertebrate loss from any given project may be small because the size of the dewatered area is a small fraction of the total size of the stream systems they occur in, although the dewatered area may represent a larger portion of available summer rearing habitat in any given small stream or reach. These effects will end once in-water work is over each year. Once flow is restored to a dewatered zone, macroinvertebrates from nearby populations typically recolonize it within one to two months (Cushman 1985; Attrill and Thomas 1996; Harvey 1986).

2.5.2.5 Temporary loss of channel habitat and prey resources

Floodplain reconnection projects that involve channel fill for hydraulic reconnection (such as when re-grading floodplains, which involves skimming earth off higher areas and moving it into lower areas) will result in a temporary loss of habitat in the portion of the channel that is filled. Once fall rains arrive, the stream will establish a new stream channel nearby, so upstream and downstream migratory salmonid access should not be impaired. A similar physical volume of habitat as occurred in the original channel should form quickly in the new channel as fall rains scour new pools. Aquatic vegetation and benthic prey are expected to colonize the area quickly (within a season).

2.5.2.6 Preclusion of natural channel form and function

The Program includes use of bio-engineering techniques, including the planting of native plant materials, willow walls, willow siltation baffles, brush mattresses, and brush bundles. These techniques are intended to resist lateral erosion while improving riparian and aquatic habitat. Habitat improvements include increased stream shade, increased production of invertebrates, providing for future recruitment of large woody material to streams, and trapping and binding fine sediment to reestablish riparian areas. The Program's bio-engineering techniques use a minimal amount of hard materials (e.g., rock), and are not intended to include traditional hard engineering techniques. The design guidelines described in the PBA (NOAA 2022) minimize the use of boulders and prevent the use of large amounts of rip rap or other hard materials to harden banks or prevent geomorphic processes of erosion from occurring. Further, the Program will not include projects that are merely protecting private property from bank erosion issues.

Bank stabilization, including that achieved through bio-engineering techniques, impacts the physical habitat in two general ways – by changing a dynamic, unrestrained stream that constantly evolves via hydrologic and geomorphic processes into a fixed, simplified channel, and by altering the physical land/water interface (i.e., streambank) that provides shelter, food, and other ecosystem benefits to juvenile salmonids. Unlike lining the entire streambank with rock riprap that results in a habitat interface lacking suitable juvenile fish habitat, the proposed bio-engineering methods will instead utilize natural material (e.g., live plantings, logs and root wads, boulders) to craft a streambank that will resist lateral erosion while providing complex rearing, feeding and sheltering habitat that is equivalent or better to than the streambank habitat already present. Replacement of poorly vegetated, eroding stream banks with bio-engineered stabilization and riparian planting will improve existing habitat at project sites, improving salmonid growth and survival.

Of greater concern than streambank habitat impacts is the long-term preclusion of natural fluvial and geomorphic processes resulting from bio-engineering when added to existing streambank stabilization in the action area. In most low gradient streams, the channel will naturally "meander", eroding laterally to dissipate its hydraulic energy while creating a sinuous longitudinal course. Meandering streams also create and maintain both the hydraulic and physical components of instream habitat used by fish and other aquatic species.

While the bio-engineered bank stabilization methods carried out under the Program will benefit degraded salmonid habitat by manually improving riparian and streambank habitat, the achieved habitat quality and persistence may fall short of what could be achieved naturally through dynamic channel processes if unhampered by the bank stabilization. Because of the perpetual nature of most bank stabilization structures, any impacts experienced by species with typically short life-spans (3 years for coho salmon, typically 3-4 for Chinook salmon and steelhead) will likely manifest as a continued depression in juvenile carrying capacity at the site level.

However, as noted above, the proposed bio-engineering approach is expected to improve habitat conditions relative to what currently exists within the channelized action area. We expect substantially more juvenile fish will be able to successfully rear in these areas after bio-engineering bank stabilization improves habitat conditions. This improvement may not fully counter-balance the ongoing impact on habitat function and carrying capacity caused by extending channelization at that site into the foreseeable future, but instead compensates for it to a fair degree at the site level.

Translating this remaining impact into actual injury/death at the individual fish level is inherently difficult, given the indeterminate nature of future programmatic actions (e.g., project location, project technique, current onsite habitat quality, current population dynamics of impacted fish, etc.), which necessitates the use of a habitat-based proxy. The habitat proxy NMFS chose to estimate the extent of fish loss is the length of bio-engineered streambank restored per project (bio-engineered streambank length must be less than 3x the active channel width). Because these sites are very small relative to the stream area available to rearing juveniles throughout the action area, NMFS expects overall reductions in juvenile fish numbers due to bioengineering to be minimal.

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.

Non-Federal activities that are reasonably certain to occur within the action area include those described in the environmental baseline and likely to continue into the future: agricultural practices, water withdrawals/diversions, mining, state or privately sponsored and funded habitat restoration activities on non-Federal lands and without Federal permit needs or funding, road work, timber harvest, and residential growth. NMFS assumes these activities, and similar resultant effects [as described in the Status of the Species (Section 2.2) and Environmental Baseline (Section 2.4) sections within this document] on listed salmonids will continue on an annual basis over time.

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 earlier in the discussion of Environmental Baseline (Section 2.4).

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. 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.

The abundance of SONCC coho salmon, CC Chinook salmon, and NC steelhead has declined from historic numbers. Nearly all populations of SONCC coho salmon are at a high risk of extinction. Long-term population trends suggest that many populations of NC steelhead have a negative growth rate. CC Chinook salmon have fragmented population structures, and the geographic distribution within the ESU has been reduced, particularly in southern and spring-run populations. Recent status reviews and all available information indicate that SONCC coho salmon, CC Chinook salmon, and NC steelhead are likely to become endangered in the foreseeable future.

Habitat degradation has been a major factor in the decline of these species, and poor habitat conditions continue to limit their recovery potential. In addition to ongoing concerns such as fine sediment and poor water quality resulting from legacy land management practices, persistent drought conditions across the entire action area impact water quantity and result in juvenile mortality as well as suppression of fish growth. Actions to restore habitat make up the vast majority of needed actions identified in each species' recovery plan. As described in the status of species and cumulative effects sections, NMFS expects that ongoing Federal and non-Federal actions to support human activities will continue. Some of these activities are expected to incidentally harm these species or adversely affect their designated critical habitat (e.g., agricultural practices, water withdrawals/diversions, road work, and timber harvest). Habitat restoration activities sponsored by state, federal, and private entities, as well as regulatory changes, are expected to provide an overall benefit to these species and their habitat.

During each year of the proposed action, up to 19,800 juvenile SONCC coho salmon, 4,800 juvenile CC Chinook salmon, and 9,900 juvenile NC steelhead may be captured and handled (relocation, measuring, tagging) during execution of Program activities across the entire Action Area. The vast majority of these fish, as well as other fish exposed to other habitat changes associated with the program (e.g. temporary elevated turbidity, etc.) will avoid having any detrimental response, aside from potential behavioral impacts to feeding behavior. As noted earlier, these behavioral impacts will likely be negligible, given their short duration and sub-injurious nature. At most, NMFS estimates that three percent of these fish may be injured or killed as a result of Program activities each year, or up to 594 SONCC coho salmon, 144 CC Chinook salmon, and 297 NC steelhead.

NMFS also anticipates small losses of juvenile listed salmonids resulting from channelization of portions of streams using bio-engineering techniques. Because these sites are very small relative to the stream area available to rearing juveniles throughout the action area, NMFS expects overall reductions in juvenile fish numbers due to bioengineering to be minimal.

Any mortalities from the Program will be spread across project locations within the extensive action area, which spans multiple diversity strata of each of the three salmonid species. At most, three percent of the fish captured on any given day at any given project would perish, leaving the majority of the fish in any location to persist unharmed (e.g., of 30 coho salmon relocated at Creek x on Day y, perhaps one would die). Similarly, any losses in carrying capacity due to streambank stabilization are likely minor and limited to the site level. Thus, while the abundance of juveniles in any given location may be slightly reduced, these numbers would likely be insignificant at the population level. In addition, NMFS expects the distribution of juvenile fish across the action area to generally remain unchanged.

NMFS does not expect juvenile mortality resulting from Program activities to impact future adult returns for SONCC coho salmon, CC Chinook salmon, or NC steelhead. Juvenile salmonids rearing within the action area will tend to occur in areas with the best habitat, while the Program's restoration activities will focus on areas with poor habitat; therefore, many juvenile salmonids occurring throughout the action area would not be subjected to potential injury or death from construction activities associated with the Program's projects, because they won't be present where these activities are occurring. In NMFS' judgment, these juveniles, along with those occurring in construction areas that are not adversely affected by Program activities, are likely to result in enough future spawning adult fish to outweigh any losses resulting from relocation efforts within the action area.

Minor or temporary adverse effects to critical habitat are expected during construction of projects. Some Program activities may prevent lateral channel migration to some degree, which can limit the degree of habitat improvement possible on a site-specific basis. However, the use of native riparian plants and logs/rocks to retard or stop such channel migration will create essential components of ESA-listed salmonid critical habitat where they do not currently exist, or enhance critical habitat where it is already functional. Further, the requirement that the bioengineered streambank length must be less than 3 times the active channel width ensures that only a small portion of a stream would be stabilized during any Program project. Overall, NMFS expects the Program will improve critical habitat by improving and enhancing a number of PBFs for all listed salmonids. NMFS expects this habitat improvement will improve the spawning and rearing success of subsequent generations, and so improve the distribution and abundance of SONCC coho salmon, CC Chinook salmon, and NC steelhead across the action area over time.

Inland portions of the action area could be subject to higher average summer air temperatures and lower total precipitation levels due to climate change. Although the total precipitation levels may decrease, the average rainfall intensity has increased and is expected to continue to increase in the future. Higher inland air temperatures would likely warm associated stream temperatures. Reductions in the amount of precipitation would reduce stream flow levels and estuaries may also experience changes in productivity due to changes in freshwater flows, nutrient cycling, and sediment amounts. Much of the action area is in the coastal fog belt which is likely to ameliorate many climate impacts for the foreseeable future relative to inland areas. Because most Program activities will restore habitat-forming processes, and particularly because the Program will result in restoration of many estuarine areas, NMFS expects it will help improve the resilience of species and habitats to climate change across the action area. Overall, the Program is unlikely to appreciably reduce the likelihood of survival and recovery of SONCC coho salmon, CC Chinook salmon, or NC steelhead; further, the Program is unlikely to appreciably diminish the value of designated critical habitat to the conservation of these 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 the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of SONCC coho salmon, CC Chinook salmon, or NC steelhead, or destroy or adversely modify their 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). "Harass" is further defined by interim guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "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.

The take exemption conferred by this incidental take statement is based upon the proposed action occurring as described in the biological opinion and in more detail in the Biological Assessment.

2.9.1. Amount or Extent of Take

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

2.9.1.1 Annual anticipated encounter estimates and mortality

The annual number of each salmonid species that may be encountered, and may die, are summarized by diversity stratum in Tables 3, 4 and 5 and summarized below.

In each reporting year (August 1 of one year to August 31 of the next), and across all diversity strata, NMFS expects that up to 13,000 juvenile coho salmon may be captured, handled, and released during monitoring activities (Table 3). Up to 3,800 juvenile SONCC coho salmon may be PIT-tagged each year. Up to 3,000 juveniles may be captured and relocated prior to dewatering for restoration projects. Overall, NMFS estimates that up to 3% of these juveniles may be injured or killed during the identified Program activities, or 594 juvenile coho salmon.

In each calendar year, and across all diversity strata, NMFS expects up to 3,000 juvenile Chinook salmon may be captured, handled, and released during monitoring activities (Table 4). Up to 800 juveniles may be PIT-tagged each year. Up to 1,000 juveniles may be captured and relocated prior to dewatering for restoration projects. Overall, NMFS estimates that up to 3% of these juveniles may die from the identified Program activities, or 144 juvenile Chinook salmon.

In each calendar year, and across all diversity strata, NMFS expects up to 7,500 juvenile steelhead may be captured, handled, and released during monitoring activities (Table 5). Up to 1,200 juveniles may be PIT-tagged each year. Up to 1,200 juveniles may be captured and relocated prior to dewatering for restoration projects. Overall, NMFS estimates that up to 3% of these juveniles may be injured or killed during the identified Program activities, or 297 juvenile steelhead.

NMFS also anticipates incidental take of listed salmonids resulting from channelization of portions of streams using bio-engineering techniques. Quantifying the number of individuals lost from the harm caused by the proposed stream channelization is inherently difficult. Complex and variable components such as individual fish behavior and how that behavior adapts to changes in habitat, will primarily influence the number of fish in the action area that are harmed. In addition, finding dead individuals will be difficult due to their small size and the presence of scavengers. In such circumstances, NMFS cannot provide a precise amount of take that would be caused by the proposed action and instead uses one or more surrogates to estimate the extent of incidental take. NMFS will use the length of bio-engineered streambank constructed per project as a surrogate for the extent of incidental take resulting from channelization of streams using bio-engineering techniques. If more than 3x the active channel width of a stream is channelized by a project implemented under this Program, the extent of take will have been exceeded.

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

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of SONCC coho salmon, CC Chinook salmon, and NC steelhead:

1. Minimize the amount or extent of incidental take of listed salmonids resulting from field activities in support of the Program.

2. Ensure that individual restoration projects and monitoring activities authorized annually through the Program will minimize take of listed salmonids, will monitor and report take of listed salmonids, and where feasible, will obtain specific project information to better assess the effects and benefits of salmonid restoration projects authorized through the Program.

2.9.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The NOAA Restoration Center 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: Minimize the amount or extent of incidental take of listed salmonids resulting from field activities in support of the Program.

    a. NOAA RC shall contact NMFS within 48 hours if injuries or mortality at any restoration project or monitoring site on any given day exceed three percent of the number of captured fish for any listed species. Fish capture and/or relocation will cease at the project site until NMFS is contacted. NMFS will review the activities resulting in take and determine if modified methods or additional protective measures are required before fish handling at the site may resume.

2. The following terms and conditions implement reasonable and prudent measure 2: Ensure that individual restoration projects and monitoring activities implemented annually through the Program will minimize take of listed salmonids, will monitor and report take of listed salmonids, and where feasible, will obtain specific project information to better assess the effects and benefits of salmonid restoration projects authorized through the Program.

    a. Throughout the calendar year, NOAA RC shall track the take resulting from all projects and monitoring carried out under the Program and compare it to the take described in the ITS. If the total number of fish of any species killed during Program activities exceeds the number of fish shown in the bottom row of Table 3, 4, or 5 of this document (from ITS, above), NOAA RC shall immediately notify the South Coast Branch Chief of the NMFS Northern California Office, Jeffrey Jahn, at 707-825-5173 or jeffrey.jahn@noaa.gov.

    b. By September 1 of each year, the RC will provide WCR CCO with a report of the previous year's restoration and monitoring activities. The report shall include information about each restoration project or monitoring effort as described below, unless other information or presentation is mutually agreed upon between WCR CCO and the RC prior to submission of report. The report should be submitted via email to Jeffrey Jahn at jeffrey.jahn@noaa.gov.

1. A numeric summary across all projects and monitoring activities of the number and species of fish encountered and killed during the annual reporting period. The summary should compare these numbers to those authorized in each diversity stratum for each species, as described in Tables 3, 4, and 5 of this document, and include at least the columns shown in Appendix II of the PBA (NOAA 2022).
2. A narrative summary of any requested variances from the limitations described in the Proposed Action and their resolution.
3. A map indicating the location of each project.
4. A narrative description of the activities that occurred during implementation including the problems addressed by each project, timing, restoration techniques, unforeseen issues, restoration metrics (acres/miles restored), and anything else that will describe the work that has been completed during the implementation season.
5. A narrative summary of the project objectives met, any project objectives that were not met, and a discussion of possible reasons for any that were not met.
6. A narrative summary of how any project-specific information collected during the previous year (such as effectiveness monitoring) was or should be used to assess the effects and benefits of salmonid restoration projects authorized through the Program.
7. For each project that employs bioengineering methods, the length of bio-engineered streambank restored per project compared to the active channel width of that project (the former must be less than 3x the latter).

c. If the annual estimates of take per species described in annual reports are exceeded by 10 percent or more in a single year, or if exceeded by any amount in three consecutive years, NOAA RC and the Corps will coordinate with NMFS to develop an adaptive management plan to incorporate additional minimization measures in project plans as needed.

2.9.5. Conservation Recommendations

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

NMFS has no ESA conservation recommendations for NOAA RC or the Corps at this time.

2.9.6. Reinitiation of Consultation

This concludes formal consultation for the NOAA RC's and Corps' Restoration Program for Northern California.

Under 50 CFR 402.16(a): "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: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If 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 written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

2.10. "Not Likely to Adversely Affect" Determinations

The ESA-listed threatened southern DPS of North American green sturgeon (*Acipenser medirostris*) and threatened southern DPS of Pacific eulachon (*Thaleichthys pacificus*) and their designated critical habitats occur within the action area. The NOAA RC determined the proposed action may affect, but is not likely to adversely affect southern DPS green sturgeon, southern DPS eulachon, and their critical habitats.

2.10.1. Southern DPS Green Sturgeon

Southern DPS green sturgeon inhabit estuaries along the west coast during the summer and fall months (Moser and Lindley 2007) and are known to use the North Humboldt Bay heavily (Goldsworthy et. al. 2016, Pinnix 2008). Juvenile southern DPS green sturgeon rear in their natal streams in California's Central Valley, so only sub-adult and adult Southern DPS green sturgeon are present in Humboldt Bay and are the only life stages of Southern DPS green sturgeon that could be exposed to the effects of the Project. Sub-adults range from 65-150 cm total length from first ocean entry to size at sexual maturity. Sexually mature adults range from 150-250 cm total length.

Data collected by the USFWS indicate that green sturgeon are found more frequently in the North Bay. Green sturgeon adults and subadults are temporary residents in Humboldt Bay from June through October, utilizing North Bay as summer-fall holding or feeding habitat, and the deeper waters of the North Bay Channel as a migratory corridor between the Pacific Ocean and Arcata Bay (Pinnix 2008). Green sturgeon are known to move rapidly within an estuary and travel within the top 6.5ft of a water column over deeper water at a speed of approximately 1.8ft per second. According to a study in the San Francisco Bay, green sturgeon that were near the surface of the water were also reported to swim in swift flowing regions of the bay, and were oriented in the direction of the current. The green sturgeon in Humboldt Bay will likely exhibit similar behavior and are expected to use the deeper waters of the Entrance Bay and the North Bay Channel for migration.

The NOAA RC has determined that the proposed action may affect, but is not likely to adversely affect, southern DPS green sturgeon and its designated critical habitat (NOAA 2022). Low numbers of adult southern DPS green sturgeon may be present at or near project sites within Humboldt Bay and could be exposed to brief periods of turbidity or acoustic noise during the high tidal cycles when they have access to the action area. The turbidity related to construction activities and dredging within the estuary is expected to be brief and acoustic noise is expected to be well below levels that cause any effects other than behavioral changes. Any minor increases in sediment and turbidity that convey to the estuary environment from tributaries will quickly dissipate within the larger spatial area of the receiving water body. Temporary increases in turbidity within the estuary are not expected to reduce feeding opportunities for green sturgeon. The majority of southern DPS green sturgeon are found in the North Bay and Entrance Bay, and most will not be exposed to possible effects to benthic food resources where impacts to the substrate may occur. Because prey resources will only be temporarily affected, and there is ample suitable habitat elsewhere, we do not expect any fitness related consequences to individuals.

Migratory corridors for southern DPS green sturgeon may also be temporarily affected by increases in turbidity. However, turbidity is unlikely to significantly affect southern DPS green sturgeon migratory behaviors as the species has reduced eyesight and relies on other senses to navigate. The action is not expected to significantly affect temperature, salinity, or dissolved oxygen. Minimization measures are likely to avoid introducing significant amounts of contaminants (fuel, etc.) into the action area. Such toxics would be further diluted by tides and currents. We do not expect adverse effects to green sturgeon needs for water depth as a diversity of depths will remain available to all southern DPS green sturgeon in the action area.

The proposed action is not expected to significantly alter the physical, chemical, and biological features of critical habitat for the southern DPS of green sturgeon in the action area. For the reasons listed above, the effects of the proposed action on southern DPS green sturgeon are considered insignificant. Therefore, we concur that the proposed action is not likely to adversely affect the SDPS green sturgeon or its critical habitat.

2.10.2. Southern DPS of Pacific eulachon

The southern DPS of Pacific eulachon (*Thaleichthys pacificus*) is listed as threatened under the Endangered Species Act (50 CFR 223.102(e)). Fish from the Southern DPS of Pacific eulachon may be within the action area in the Lower Klamath River, Redwood Creek, and Mad River and their estuaries during certain times of the year. The peak spawning entry of eulachon into river systems is typically during February and March (75 FR 13012), and Larson and Belchik (1998) noted that spawning migrations of eulachon have been found in the Lower Klamath River as early as December and as late as May. Newly hatched larvae are immediately washed downstream after hatching a few weeks after spawning (Moyle 2002). The NOAA RC does not expect eulachon will be present during restoration project implementation due the work windows (June 15 - November 1) not coinciding with when adult and juvenile eulachon will be in the action area (winter - spring). NOAA RC also does not expect eulachon will be encountered while performing effectiveness monitoring at other times of year due to past monitoring results. NMFS agrees that no life stages of eulachon are expected to be present in the action area during the construction season between June 15 and November 1, that encountering eulachon during monitoring activities is extremely unlikely, and that, therefore, all of the effects of the Proposed Action would be discountable for individual eulachon.

The PBFs for southern DPS eulachon critical habitat are: (1) freshwater spawning and incubation sites with water flow, quality and temperature conditions and substrate supporting spawning and incubation, (2) freshwater and estuarine migration corridors free of obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted, and (3) nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival (50 CFR 226.222(b)). The proposed action has the potential to affect the first two PBFs of southern DPS eulachon critical habitat, which relate to freshwater spawning and incubation sites and freshwater migration corridors in the action area. The potentially affected components of the freshwater and estuarine PBFs include substrate, water quality, passage, and forage.

While the proposed in-stream portions of the proposed action could disturb areas of potential spawning substrate, the streambed would return to a natural condition after the first few heavy rains of winter. Adult eulachon would not likely spawn in the location until after this time; therefore, disturbance to spawning substrate would be temporary and insignificant. Increases in turbidity during the first heavy winter rains would be short and of low magnitude, representing a small percentage of overall turbidity compared to background levels, and are not expected to decrease the quality of downstream spawning and rearing habitat or effect prey in any measurable way. These potential impacts to critical habitat will not be sustained long enough, or occur at sufficient intensity, to adversely affect downstream adult spawning, migration corridors, or juvenile rearing habitat.

Based on these analyses, NMFS concurs with NOAA RC's determination that the proposed action is not likely to adversely affect southern DPS eulachon and their critical habitat.

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

Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect Essential Fish Habitat (EFH). Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)].

This analysis is based, in part, on the EFH assessment provided by the NOAA Restoration Center (Northern California Office) (NOAA RC) and the San Francisco District of the U.S. Army Corps of Engineers (Corps), and the descriptions of EFH for Pacific Coast Salmon (PFMC 2016), Pacific Coast Groundfish (PFMC 2019a), and Coastal Pelagic Species (PFMC 2019b) contained in the fishery management plans (FMPs) developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

Essential Fish Habitat is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802[10]). "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.10). The term "adverse effect" means any impacts which reduce the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrates and loss of, or injury to, benthic organisms, prey species, and their habitats, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of it and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.910). The EFH consultation mandate applies to all species managed under a Fishery Management Plan (FMP) that may be present in the action area.

The FMPs for the Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species fisheries describe EFH, some of which will be adversely affected by the Project. Furthermore, the action area is part of designated Habitat Areas of Particular Concern (HAPCs) for the Pacific Coast Salmon and Pacific Coast Groundfish fisheries. HAPCs are described in the regulations as subsets of EFH that are identified based on one or more of the following considerations: the importance of the ecological function provided by the habitat; the extent to which the habitat is sensitive to human-induced environmental degradation; whether, and to what extent, development activities are, or will be stressing the habitat type; and the rarity of the habitat type (50 CFR 600.815(a)(8)). Designated HAPCs are not afforded any additional regulatory protection under MSA; however, federal projects with potential adverse impacts to HAPCs are more carefully scrutinized during the consultation process. The action area includes all of the HAPCs designated for the Pacific Coast Salmon fishery (Complex Channel and Floodplain Habitat, Thermal Refugia, Spawning Habitat, Estuaries, and Marine and Estuarine Submerged Aquatic Vegetation). It also includes two HAPCs designated for the Pacific Coast Groundfish fishery (Estuaries and Seagrass).

3.2. Adverse Effects to Essential Fish Habitat

Coho salmon and Chinook salmon are expected to occur seasonally within the action area. The Program's effects on salmon EFH are very similar to effects on coho salmon and Chinook salmon critical habitat, which are described in the biological opinion's Effects of the Action section (2.0). The adverse effects to EFH for managed species in the Pacific Coast Salmon, Pacific Coast Groundfish, and CPS fisheries, as well as effects to the HAPCs for Pacific Coast Salmon and Pacific Coast Groundfish fisheries, are described below.

Temporary effects of construction, including dewatering, pile driving, and water quality degradation, will cause adverse effects to EFH for all three fisheries. These construction activities will adversely affect the salmon HAPCs for Complex Channel and Floodplain Habitat, Estuaries, and Submerged Aquatic Vegetation, and the Estuaries and Seagrasses HAPCs for groundfish.

The Program includes components that may disrupt, harm, or kill prey items for MSA-managed species, including the likely disruption and potential death of aquatic macroinvertebrates and MSA-managed fish species (such as northern anchovies and krill) that are also potential prey for Pacific Coast Salmon. When EFH is subjected to heavy equipment work prey items may be crushed, and when EFH is dewatered, prey items may desiccate. In addition, all aspects of the program that result in death of juvenile salmonids (also described in Section 2.0) would adversely affect Pacific Coast Salmon EFH by harming the prey base.

Many of the adverse effects from the proposed action are temporary, because water quality and other disturbances will subside and improve over time. There may also be short-term reductions in eelgrass parameters shortly after each year's construction period, but eelgrass parameters are expected to begin to improve upon restoration of the tidal prism. Disruption, injury, and death of prey items will temporarily reduce the quality and quantity of EFH in the action area and interrupt the ability of EFH to provide the habitat needed for species to grow to maturity. Overall, the Program will improve and enhance the quantity and quality of EFH in the action area.

3.3. Essential Fish Habitat Conservation Recommendations

As described in the Proposed Action section, the Program includes measures to minimize the number of juvenile salmonids killed during implementation of Program projects. No further practical measures are available to further minimize take. In addition, no practical measures beyond those described in the Proposed Action are available to hasten recovery of eelgrass parameters or prey items. Therefore, NMFS did not identify any conservation recommendations for the Program.

3.3. Supplemental Consultation

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

4. Data Quality Act Documentation and Pre-Dissemination Review

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

4.1. Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are NOAA Restoration Center and the US Army Corps of Engineers. Other interested users could include those applying for inclusion in the Program, citizens of affected areas, and others interested in the conservation of the affected ESUs/DPSs. Individual copies of this opinion were provided to the NOAA Restoration Center and the US Army Corps of Engineers. The document will be available within 2 weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere 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 part 600.

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

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

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

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