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

January 31, 2022 **Refer to NMFS No:** WCRO-2021-01147

Tom Holstein
Environmental Branch Chief
California Department of Transportation, District 4
P.O. Box 23660, MS-1A
Oakland, California 94623-6371

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Bohemian Highway Bridge Replacement over the Russian River in Monte Rio, California

Dear Mr. Holstein:

Thank you for your letter of May 5, 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.). The County of Sonoma, in cooperation with the California Department of Transportation (Caltrans),[1] is proposing to replace the Bohemian Highway Bridge over the Russian River near the town of Monte Rio in Sonoma County, California.

In this biological opinion, we conclude that the proposed action is not likely to jeopardize the continued existence of the federally endangered Central California Coast (CCC) coho salmon (*Oncorhynchus kisutch*), or the threatened CCC steelhead (*O. mykiss*) and California Coastal (CC) Chinook salmon (*O. tshawytscha*). We also conclude the proposed action is not likely to result in the destruction or adverse modification of designated critical habitat for these listed species. However, NMFS anticipates that incidental take of all three species is reasonably certain to occur as a result of the proposed action. Therefore, an incidental take statement with terms and conditions is included with the enclosed biological opinion.

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson–Stevens Fishery Conservation and Management Act [16 U.S.C. 1855(b)] for this action. Based on NMFS' review of the likely effects of the proposed action on EFH, the proposed action will occur within an area identified as EFH managed under the Pacific Coast Salmon Management Plan. The proposed action includes design, staging, monitoring, and adaptive management strategies to avoid or minimize potential adverse effects to EFH. Thus, no additional EFH conservation recommendations are provided.

[1] Pursuant to 23 USC 327, and through a series of MOUs beginning June7, 2007, the Federal Highway Administration assigned, and Caltrans assumed responsibility for, compliance with Section 7 of the ESA and the MSA for federally-funded projects involving FHWA. Caltrans proposes to administer federal funds for the implementation of the proposed project. Thus, Caltrans is considered the federal action agency for this project.

Please contact Jodi Charrier of the California Coastal Office in Santa Rosa at 707-575-6069 or jodi.charrier@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: Keevan Harding, Caltrans, Keevan.Harding@dot.ca.gov
Copy to E-File: ARN 151422WCR2021SR00095

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

Bohemian Highway Bridge Replacement

NMFS Consultation Number: WCRO-2021-00147
Action Agency: California Department of Transportation

Affected Species and NMFS' Determinations:

ESA-Listed Species	**Status**	**Is Action Likely to Adversely Affect Species?**	**Is Action Likely to Jeopardize the Species?**	**Is Action Likely to Adversely Affect Critical Habitat?**	**Is Action Likely to Destroy or Adversely Modify Critical Habitat?**
Central California Coast Coho Salmon (*Oncorhynchus kisutch*)	Endangered	Yes	No	Yes	No
Central California Coast Steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
California Coastal Chinook Salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No

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

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

Issued By:

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Date: January 31, 2022

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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 (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 NMFS' North-Central Coast Office in Santa Rosa, California.

1.2. Consultation History

December 17, 2020 – The County of Sonoma (County) in cooperation with the California Department of Transportation (Caltrans) led a virtual site visit and provided an overview of the project with regulatory agencies.

May 5, 2021 – NMFS received an email from Caltrans which contained the Biological Assessment for the Bohemian Highway Bridge over Russian River Replacement [STPLZ-5920 (135), Caltrans 2021] (BA) and request for formal Section 7 consultation.

June 4, 2021 – NMFS sent an email to Caltrans with NMFS' comments on the BA and a request for additional information in order to initiate the Section 7 process.

June 30, 2021 – The County in cooperation with Caltrans led a virtual meeting to discuss and address NMFS' comments and information request.

July 19, 2021 – Caltrans provided the additional information to NMFS via email which was sufficient to begin the Section 7 consultation.

July 26, 2021 – The County hosted a meeting with Caltrans and NMFS to discuss adding potential mitigation options in Dutch Bill Creek to the project description.

July 26 – September 10, 2021 – NMFS coordinated both internally and externally with CDFW and restoration partners to explore mitigation options in Dutch Bill Creek. Discussions focused on recovery priorities for three federally listed salmonids, budget caps for Caltrans, timing and process for providing payment of mitigation funds, and Section 7 consultation process for ensuring mitigation impacts are fully analyzed and take is included in this opinion.

September 10, 2021 – Caltrans and NMFS conducted a phone call to finalize the proposed mitigation approach to be added to the project description.

September 13, 2021 – NMFS provided Draft language regarding off-site restoration to be included as part of the project description to Caltrans and the County for review.

October 4, 2021 – Emails exchanged between NMFS and Caltrans regarding mitigation status update. Caltrans still awaiting internal approval for proposed language and budget.

October 5, 2021 – The County called NMFS to discuss proposed mitigation approach and also to request contact information for the two potential restoration partners in the Dutch Bill Creek Watershed.

November 3, 2021 – The County approved proposed mitigation language via email to NMFS.

November 4, 2021 – NMFS emailed the County and Caltrans with notification that due to the delay in mitigation approval, the Section 7 consultation would be paused and the original due date of December 1, 2021 would likely be extended.

November 8, 2021 – Caltrans approved proposed mitigation language and dollar amount via email to NMFS. NMFS emailed the County and Caltrans with notification that the Opinion would be moving forward for internal review.

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 (50 CFR 600.910). We considered, under the ESA, whether the proposed action would cause any other activities and determined that it would not.

The County, in cooperation with Caltrans, proposes to replace the Bohemian Highway Bridge with a new alignment over the Russian River in the unincorporated community of Monte Rio, Sonoma County, California (Figure 1). The County is the lead agency pursuant to the California Environmental Quality Act. Caltrans is the lead agency pursuant to the National Environmental Policy Act, the ESA and the MSA. The project area is in a region of relatively high seismicity. The most recent Caltrans Bridge Inspection Report for the existing multi span slab bridge notes a number of structural deficiencies and identifies the bridge as fracture critical (Caltrans, 2019). The purpose of the project is to provide a safe and reliable crossing for vehicles, bicycles, and pedestrians on the Bohemian Highway over the Russian River.

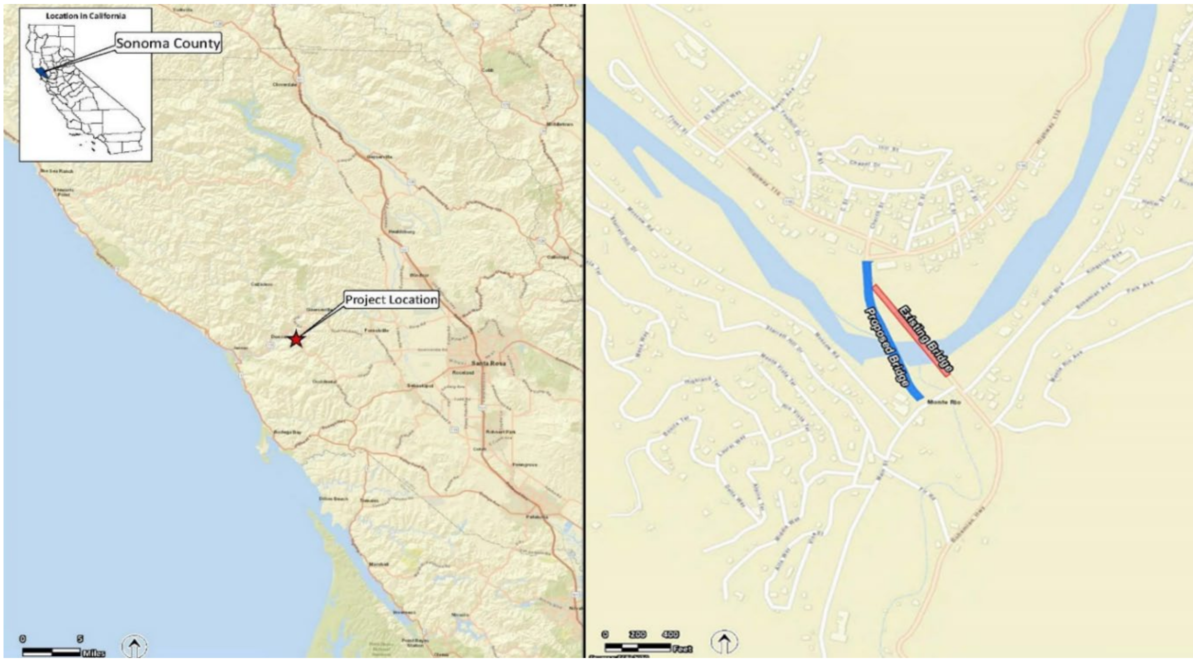

Figure 1. Map of the project location, including the existing and proposed bridge alignments on the lower Russian River, near the town of Monte Rio in Sonoma County, California (modified from Caltrans 2021).

Construction for the bridge replacement is estimated to begin in 2025 and will be implemented over three consecutive work seasons and require work within the ordinary high-water mark (OHWM). The first two seasons will include construction of the new bridge and roadway approaches and the third season will include demolition of the existing bridge. Work within the top of bank and outside of the low flow channel will begin April 15 and in-water work will occur from June 15 to October 15.

Project components include: installing temporary culverts and gravel work pads in the Russian River and Dutch Bill Creek, demolition of the exiting bridge, construction of the new bridge, and slope stabilization. The proposed alignment for the new bridge will connect to Main Street, west of the existing bridge and east of Moscow Road, and terminate at State Route 116 to the north. The bridge design will clear span the regular flow of the Russian River with no piers in the water. The roadway cross section will accommodate two 12-foot vehicular lanes (one lane in each direction), concrete barriers, a steel arch, 5-foot shoulders/Class II bike lanes, and 6-foot pedestrian sidewalks on both sides of the bridge. The proposed replacement bridge will be approximately 846 feet long, vary in width from 52 feet at the approaches and 60 feet at the main span, and composed of the following:

- The south approach will be a continuous cast-in-place concrete post-tensioned slab structure with three spans ranging from 60 to 65 feet long.
- The main span over the Russian River will be a 390-foot-long steel tied arch structure. The peak of the arch will be approximately 65 feet high above the deck.
- The north approach will be a continuous cast-in-place concrete post-tensioned box girder structure with three spans ranging from 80 to 85 feet long.

The bridge will be supported on concrete bents with deep, large-diameter cast-in-drilled hole (CIDH) piles, embedded up to approximately 120 feet below existing grade and 60 feet below the estimated scour line. Two abutments and eight piers are proposed. The piers at bents 2, 3, 6, 7 and 8 will be supported on two 8-foot diameter CIDH pile shafts and the piers at bents 4 and 5 will be supported on four 8-foot diameter CIDH pile shafts. The abutments will be supported on several smaller diameter CIDH pile shafts. Permanent steel casings may be used for the CIDH piles. Rock slope protection (RSP) will be installed at both abutments. All RSP will be placed outside the top of bank, but within the floodplain. Approximately 0.35 acres of new RSP will be placed at the southern bank of the existing bridge and abutment 8 along the Russian River and another 0.11 acres placed at abutment 1 along Dutch Bill Creek.

The proposed bridge profile will be raised to meet the 100-year flood level of 47.7 feet, with a longitudinal grade to accommodate the pedestrians crossing the bridge. The proposed structure will not entirely clear the estimated 100-year flood water levels due to relatively low elevations of the approach roadways and limitations on how much they can be raised. However, preliminary analysis indicates that flooding conditions of the proposed bridge will be a substantial improvement from the existing structure. In situations where the existing bridge would be overtopped by flood waters, less than 100 feet of the new bridge at the approaches would undergo pressure flow or become overtopped.

The new bridge will drain via deck drains that outlet to bioretention areas at both ends of the bridge to allow sediment and particulates to be filtered prior to entering the waterways. Sidewalks may be drained directly onto the roadway or may have separate drain inlets. Post construction stormwater best management practices (BMP) will be implemented to achieve any required permanent water quality treatment and volume capture of the project area. It is anticipated that stormwater treatment basins of approximately 100 square feet by 2 to 3 feet in depth will be required near each new bridge abutment.

Season One

The piles, bent caps, abutments, and wingwalls will be constructed during the first season of construction. Falsework towers will be required for construction of the reinforced concrete bent caps. Equipment to construct the new bridge will include drill rigs, cranes, backhoes, and concrete trucks. Following construction or by October 15, all falsework and the compactable aggregate will be removed from the channel while the river-run gravel will remain in place.

In order to construct the new bridge on the south side, an approximately 30-foot-wide by 150-foot-long access path will be constructed along the western bank of Dutch Bill Creek, roughly along the existing access pathway to the river next to Noel's Automotive. The bank will be cleared and grubbed of vegetation to allow worker and equipment access to the construction area, and the bank will be graded outside of the wetted channel and OHWM to install a work pad for construction equipment. In addition, a gravel work pad may be required in Dutch Bill Creek to construct the new bridge on the south side of the river.

On the northern side of the project area, an approximately 30-foot-wide by 400-foot-long access path will be constructed between the Monte Rio Recreation and Parks District (MRRPD) parking lot and Sandy Beach, west of the new bridge alignment. It is expected that this access path will be in place through final completion of construction. Public vehicle and pedestrian access to Big Rocky Beach outside of the construction zone will be through the existing driveway from the MRRPD parking lot to the parking area east of the existing bridge. Public access to the boat ramp west of the project area and restroom facilities across from the MRRPD Community Center will be maintained via the existing paved access road through the Community Center parking lot.

To construct the bridge on the north side of the river, an approximately 40-foot-wide by 45-foot-long gravel work pad will be installed at the edge of Sandy Beach. It is assumed that the gravel work pad will be installed just within the OHWM of the river, leaving approximately 50 feet of river channel unrestricted. Depending on site conditions and water levels during the first year of construction, portions of the gravel pad are expected to be outside the wetted channel of the river. The work pad will be constructed with imported, clean, river-run material brought in by trucks. The gravel will be placed in the river by slowly pushing it out from the dry riverbed using a bulldozer in a way that will not impound water and trap fish. A top layer of compactable aggregate (likely separated by a layer of filter fabric) may be used on top of the river gravel to support the weight of construction equipment.

In order to prevent drilled holes from collapsing during drilling, a vibratory hammer will vibrate or twist steel casings for the CIDH piles and a drill rig will drill the holes within the casing. If drilling muds are used to keep the hole from collapsing, a mud that is non-toxic to aquatic life will be used and all muds will be contained. Retaining walls may be constructed at the north approach of the bridge at the end of the first construction season and may continue beyond the October 15 timeline since they are outside the top of bank. It is likely that the retaining walls will be supported on CIDH piles, construction of the piles will require the use of temporary casings, and depending on ground water levels during construction, the use of slurry may be required. Shoring may be required to protect the existing roadway during construction of the walls.

Season Two

Construction of the bridge and roadway approaches will be completed during the second season and staging areas will remain unchanged from the first construction season. However, the public vehicle and pedestrian access to Big Rocky Beach on the north side of the river will be shifted slightly to the west and on the south side of the river, the construction access path will be extended down slope towards the river, ending at the water's edge. It is estimated that the construction access path will be approximately 30-feet wide by 330-feet long.

Falsework will be required to construct the north and south cast-in-place concrete approach spans, and falsework towers may be required for construction of the steel arch span across the river. To provide access for construction equipment and to support falsework, a gravel work pad over large pipe culverts (to allow for the diversion of water through the construction work area) will be constructed across the width of the Russian River. The gravel work pad will extend approximately 90 feet east and west of the new bridge footprint (approximately 180-foot-long total), and the pipe culverts will extend approximately 15 feet beyond the gravel work pad.
The pad will be constructed with imported, clean, river-run material and placed in the river by slowly pushing it out from the dry riverbed/beach using a bulldozer in a way that would not

impound water and trap fish. Culverts will be placed parallel to river flow and seated along the channel bottom. A gravel dam will be constructed at the head of the culverts to direct water into the pipes, then a filter dam would be constructed at the downstream end, creating a confined pool of water between the dams. The diversion dam will be lined with impermeable plastic and the filter dam will be lined with filter fabric. The work pad will be completed by filling in the confined pool between the two dams with imported clean river run gravel and adding a top layer of compactable aggregate rock (likely separated by a layer of filter fabric) on top of the river gravel to support the weight of construction equipment. If any fish are present in the confined pool, they will be captured and relocated by a qualified biologist following an approved fish relocation plan.

If water is flowing at the confluence of Dutch Bill Creek and the Russian River, a pipe culvert will be installed in a similar manner to convey water from the mouth of Dutch Bill Creek, under the gravel work pad, and into either the river or into one of the pipe culverts conveying the flow of the river through the work pad.

Following the completion of in-channel work, and prior to October 15, the work pad will be removed as follows. Immediately prior to work pad removal, block nets will be installed upstream of the work pad or at the inlet to the culvert(s) to prevent fish from entering the water diversion culverts. The compactable aggregate layer of the pad will be removed and loaded directly onto a truck for transport and disposal at an acceptable location. After all of the compactable aggregate is removed from the top, as much river-run gravel will be removed from the pad as is feasible without encountering water or onsite gravels. Riverrun gravel will also be removed to expose the water diversion culverts. The culverts will then be lifted out of the channel, starting with the downstream section of each culvert, working back upstream. Each culvert section will be lifted slowly from the upstream end, so that water remaining in the culvert will flow out in the downstream direction. Then workers using hand shovels will smooth out the gravel to re-establish normal flow through the channel. The remaining river-run gravel will be left in the channel to be transported downstream with winter flows. After the pad has been smoothed and the reestablished channel has stabilized, all equipment will be removed from the low flow channel, along with all surplus materials and debris. The block nets will be removed, and fish will be allowed to return to the site. A qualified biologist will be onsite during culvert removal in the unlikely event that any fish remain in the culvert or become stranded by the culvert removal. The biologist will inspect any areas of ponded water created by removal of each section of culvert to ensure they are clear of fish.

Work outside of the low flow channel, such as completion of the retaining wall at the north approach, conform paving, above deck construction, and revegetation will continue beyond the October 15 timeframe. The new bridge will be opened at the end of the second season or early in the third season.

Season Three

The new bridge will be completed and the existing bridge will be removed during the third construction season. Construction staging areas are anticipated to be the same as in the first season, except the construction area will be expanded east of the existing bridge to allow for demolition. A gravel work pad similar to what was described in the second season will be installed across the width of the flowing river channel under the existing bridge at Big Rocky Beach using similar methods. The gravel work pad will extend approximately 60 feet west and 40 feet east of the existing bridge footprint (approximately 230 feet total), and the pipe culverts will extend approximately 20 feet beyond the gravel work pad.

The existing bridge will be demolished either by cutting the bridge deck in sections or jackhammering. The existing piers will be cut to approximately three to four feet below the river bottom. In order to prevent debris from falling into the river, a protective structure or catch will be utilized under the bridge deck.

There are two potential options for treatment of the southern abutment: a) The southern abutment may be removed, and the embankment regraded and filled to match existing topography. Installation of RSP may be required to prevent scour during flood events; the RSP may be buried or partially buried; or b) The southern abutment may remain in place and the top few feet of the abutment wall and wingwalls will be removed to reduce loading and to hide the old abutment. The face of the abutment will then be buried under fill and RSP; the RSP may be buried or partially buried. As natural light allows, RSP will be planted with vegetation. The southern approach to the existing bridge structure may be revegetated. The area of the RSP will be approximately 30 feet wide by 120 feet long under both options.

For the northern abutment, the upper few feet will be demolished and the remaining abutment and embankment will be buried or partially buried in RSP. The area of RSP will be approximately 75 feet wide and 160 feet long.

All access roads will be regraded to match existing topography and appropriate erosion control BMPs, including revegetation, will be applied. Revegetation efforts will begin in the fall following completion of the project.

Avoidance and Minimization Measures

The project has been designed to reduce impacts on the river channel and listed salmonids. The new bridge will clear span the low flow channel of the Russian River and Dutch Bill Creek, minimizing the installation of bridge piers within the OHWM. The bridge piles will be cast in steel shells that will be oscillated (not driven) into place to avoid impacts from pile driving. Directional lighting will be utilized to reduce overspill onto the Russian River.

Construction of the project will include removal of three existing concrete bridge bents from the main channel and a remnant abandoned pier, located within the OHWM of the Russian River. The proposed bridge will have minimal fill within the OHWM of the Russian River and no fill within Dutch Bill Creek. Therefore, with the removal of the existing structures, permanent obstructions within the OHWM of the Russian River will be reduced.

Caltrans proposes to include avoidance and minimization measures (AMMs) that will be implemented before, during, and after construction to prevent and minimize project-related effects to CCC coho salmon and steelhead and CC Chinook salmon, and their designated critical habitat. These measures include: working within the designated construction work window (June 15 – October 15); ensuring proper handling and relocation of listed species during the installation and removal of culverts and gravel work pads; implementing erosion control best management practices (BMPs); minimizing effects to riparian vegetation; ensuring establishment of revegetation areas; preventing introduction of contaminants into creeks; and ensuring complete removal and proper disposal of all construction waste. A more detailed description of these measures can be found in Section 2.4 of the BA (CalTrans 2021).

Specific parameters are required to ensure the culverts are constructed in a way that is appropriate for fish passage (e.g., size, water quality, velocity). Since the river is mobile and there may be slight shifts in course from season to season, the County must design the culverts prior to construction each year. The contractor will design the best possible version, based on the river conditions during that specific construction season. All applicable passage criteria within NMFS 2019 *Guidelines for Salmonid Passage at Stream Crossings* will be followed (Appendix A).

Off-site Restoration

As part of the Project, Caltrans will also provide funding for a restoration project within Dutch Bill Creek that will be implemented by a local, experienced restoration practitioner in the amount of $250,000. Funds for this project will be provided to a local conservation agency/practitioner with experience in Dutch Bill Creek at or before the start of construction. Approval of the proposed restoration project will be subject to review and approval by NMFS to ensure that the project results in long-term benefits to the listed salmonid species that will be impacted by the bridge replacement. Eligible restoration projects are categorized as follows: instream habitat improvements, instream barrier modification for fish passage improvement, streambank and riparian habitat restoration, upslope watershed restoration, removal of small dams (permanent, flashboard and other seasonal), creation of off-channel/side-channel habitat features and water conservation projects (developing alternative off-stream water supply, water storage tanks, and water measuring devices).

Habitat restoration projects authorized by NMFS will be designed and implemented following the techniques and minimization measures presented in CDFW's *California Salmonid Stream Habitat Restoration Manual, Fourth Edition, Volume II, Part IX: Fish Passage Evaluation at Stream Crossings; Part X: Upslope Assessment and Restoration Practices; Part XI: Riparian Habitat Restoration; and Part XII: Fish Passage Design and Implementation* (Flosi *et al.* 2010, CDFW Manual) in order to maximize the benefits of the project while minimizing potential short-term, adverse impacts to salmonids, other aquatic and terrestrial species, and stream and riparian habitat. Additionally, all protective AMM's from NMFS' *Restoration Center's Programmatic Biological Opinion for Restoration Projects* (NMFS 2016, Appendix A) will be followed and implemented. The chosen project will be specifically designed to implement a recovery action or actions as detailed in NMFS 2012 and 2016b.

The qualifying restoration practitioner will be required to carry out all post-restoration implementation monitoring and submit a report summarizing the results of the project to NMFS. This will include photo-documentation; as-built designs on engineered projects; evidence that required avoidance, minimization, and mitigation measures were implemented; and information about number (and species) of fish captured and relocated, and any fish injury or mortality that resulted from the project.

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

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, 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.

2.1. Analytical Approach

This 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 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 designations of critical habitat for CCC coho salmon, and steelhead and CC Chinook salmon uses 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.

To conduct the assessment presented in this opinion, NMFS examined an extensive amount of information from a variety of sources. Detailed background information on the biology and status of the listed species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, and governmental and non-governmental reports. For information that has been taken directly from published, citable documents, those citations have been reference in the text and listed at the end of this document.

Additional information regarding the potential effects of the proposed activities on the listed species, their anticipated response to these actions, and the environmental consequences of the actions was formulated from the aforementioned resources, and the following:

- Caltrans. 2021. (BA) - Biological Assessment for the Bohemian Highway Bridge Over Russian River Replacement. Bridge No. 20C0018. Project No. STPLZ-5920(135). April 2021. 131pp.
- NMFS 2012 - Final Recovery Plan for Central California Coast coho salmon Evolutionarily Significant Unit. Southwest Region, Santa Rosa, California. September 2012.
- NMFS 2016a - 5-Year Review: Summary and Evaluation of California Coastal Chinook Salmon and Northern California Steelhead. National Marine Fisheries Service, West Coast Region. April. 61pp.
- NMFS 2016b - Final Coastal Multispecies Recovery Plan: CC Chinook Salmon, Northern California Steelhead, CCC Steelhead. West Coast Region, Santa Rosa CA. October 2016.

The issues NMFS is obliged to address in this opinion are wide-ranging, complex, and often not directly referenced in scientific literature. We base many of our conclusions on explicit assumptions informed by the available evidence. By this, we mean to make a reasonable effort to compile the best scientific and commercial empirical evidence related to the analysis and to then apply general and specific information on salmonid biology from the published literature to make inferences and establish our conclusions. In some cases, we have used the results of recent project specific studies or analyses conducted in the action area. In other situations, only more general local data are available on species presence or absence, and habitat condition. Where necessary, we have used this information and combined it with more general information from the scientific literature to infer salmonid response to the proposed action. In several instances, we make reasonable inferences that rely mainly on information in the scientific literature, because local data are not available.

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.

NMFS assesses four population viability[2] parameters to discern the status of the listed Evolutionarily Significant Units (ESUs) and Distinct Population Segments (DPSs) and to assess each species ability to survive and recover. These population viability parameters are: abundance, population growth rate, spatial structure, and diversity (McElhany *et al.* 2000). While there is insufficient data to evaluate these population viability parameters quantitatively, NMFS has used existing information to determine the general condition of the populations in the CCC coho salmon and CC Chinook salmon ESUs and CCC steelhead DPS and the factors responsible for the current status of these listed species.

We use these population viability parameters as surrogates for "reproduction, numbers, and distribution" in the regulatory definition of "jeopardize the continued existence of" (50 CFR 402.02). For example, abundance, population growth rate, and distribution are surrogates for numbers, reproduction, and distribution, respectively. The fourth parameter, diversity, is related to all three regulatory criteria. Numbers, reproduction, and distribution are all affected when genetic or life history variability is lost or constrained, resulting in reduced population resilience to environmental variation at local or landscape-level scales.
This opinion analyzes the effects of the proposed action on the following federally-listed species' ESUs, DPS, and designated critical habitat.

CCC coho salmon ESU
Endangered (70 FR 37160; June 28, 2005)
Critical habitat designation (64 FR 24049; May 5, 1999);

[2] NMFS defines a viable salmonid population as "an independent population of any Pacific salmonid (genus *Oncorhynchus*) that has a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100- year time frame" (McElhany *et al*. 2000).

CCC steelhead DPS
Threatened (71 FR 834; January 5, 2006)
Critical habitat designation (70 FR 52488; September 2, 2005);

CC Chinook salmon ESU
Threatened (70 FR 37160; June 28, 2005)
Critical habitat designation (70 FR 52488; September 2, 2005).

2.2.1. CCC Coho Salmon Status

Historically, the CCC coho salmon ESU was comprised of approximately 76 coho salmon populations. Most of these were dependent populations that needed immigration from other nearby populations to ensure their long-term survival. There are now 11 functionally independent populations (meaning they have a high likelihood of surviving for 100 years absent anthropogenic impacts) and 1 potentially independent population of CCC coho salmon (Spence *et al.* 2008, Spence *et al.* 2012). Most of the populations in the CCC coho salmon ESU are currently not viable, hampered by low abundance, range constriction, fragmentation, and loss of genetic diversity.

Brown *et al*. (1994) estimated that annual spawning numbers of coho salmon in California ranged between 200,000 and 500,000 fish *in* the 1940s. Abundance declined further to 100,000 fish by the 1960s, then to an estimated 31,000 fish in 1991. In the next decade, abundance estimates dropped to approximately 600 to 5,500 adults (NMFS 2005). CCC coho salmon have also experienced acute range restriction and fragmentation. Adams *et al.* (1999) found that in the mid-1990s, coho salmon were present in 51 percent (98 of 191) of the streams where they were historically present, and documented an additional 23 streams within the CCC coho salmon ESU with no historical records. Recent genetic research has documented reduced genetic diversity within subpopulations of the CCC coho salmon ESU (Bjorkstedt *et al.* 2005), likely resulting from inter-breeding between hatchery fish and wild stocks.

Available data from the few remaining independent populations suggests population abundance continues to decline, and many independent populations essential to the species' abundance and geographic distributions have been extirpated. This suggests that populations that historically provided support to dependent populations via immigration have not been able to provide enough immigrants to support dependent populations for several decades. The viability of many of the extant independent CCC coho salmon populations over the next couple of decades is of serious concern. These populations may not have sufficient abundance levels to survive additional natural or human caused environmental change. The overall risk of CCC coho salmon extinction remains high, and the most recent status review reaffirmed the ESU's endangered status (Rogers 2016).

The substantial decline in the Russian River coho salmon abundance led to the formation of the Russian River Coho Salmon Captive Broodstock Program (RRCSCBP) in 2001. Under this program, offspring of wild captive-reared coho salmon are released as juveniles into tributaries within their historic range with the expectation that some of them will return as adults to naturally reproduce. Coho salmon have been released into several tributaries within the lower Russian River watershed as well as in Salmon, Walker, and Redwood Creeks.

The five CCC coho diversity strata defined by Bjorkstedt *et al.* (2005) no longer supports viable populations. The Russian River and Lagunitas Creek populations are relative strongholds for the species compared to other CCC coho salmon populations. According to Williams *et al.* (2016), CCC coho salmon abundance has improved slightly since 2011 within several independent populations, although all populations remain well below their recovery targets. Within the Lost Coast – Navarro Point stratum, current population sizes range from 4 to 12 percent of proposed recovery targets. Recent sampling within Pescadero Creek and San Lorenzo River, the only two independent populations within the Santa Cruz Mountains strata, suggest coho salmon have likely been extirpated within both basins.

In positive developments, excess broodstock adults from the Russian River and Olema Creek were stocked into Salmon Creek and the subsequent capture of juvenile fish indicates successful reproduction occurred. Scott Creek experienced the largest coho salmon run in a decade from 2014 to 2015, and researchers recently detected juvenile coho salmon within four dependent watersheds (San Vincente, Waddell, Soquel and Laguna creeks) where they were previously thought to be extirpated. In the fall of 2020, over 10,000 juvenile coho were released into Pescadero Creek.

2.2.2. CCC Steelhead Status

Historically, approximately 70 populations[3] of steelhead existed in the CCC steelhead DPS (Spence *et al.* 2008, Spence *et al.* 2012). About 37 of these were considered independent, or potentially independent (Bjorkstedt *et al.* 2005). The remaining populations were dependent upon immigration from nearby CCC steelhead DPS populations to ensure their viability (McElhaney *et al*. 2000, Bjorkstedt *et al*. 2005).

While historical and present data on abundance are limited, CCC steelhead numbers are substantially reduced from historical levels. A total of 94,000 adult steelhead were estimated to spawn in the rivers of this DPS in the mid-1960s, including 50,000 fish in the Russian River - the largest population within the DPS (Busby *et al.* 1996). Though still below historic levels, the trend of adult returns to the Warm Springs and Coyote Valley fish facilities on the Russian River has improved since the 1980s and '90s. Abundance estimates for smaller coastal streams in the DPS indicate low but stable levels with recent estimates for several streams (Lagunitas, Waddell, Scott, San Vicente, Pudding, Caspar creeks) of individual run sizes of 500 fish or less (62 FR 43937; August 18, 1997). Some loss of genetic diversity has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt *et al.* 2005). In San Francisco Bay streams, reduced population sizes and fragmentation of habitat has likely also led to loss of genetic diversity in these

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[3] Population as defined by Bjorkstedt *et al.* 2005 and McElhaney *et al.* 2000 as, in brief summary, a group of fish of the same species that spawns in a particular locality at a particular season and does not interbreed substantially with fish from any other group. Such fish groups may include more than one stream.

populations.

A 2008 viability assessment of CCC steelhead concluded that populations in watersheds that drain to San Francisco Bay are highly unlikely to be viable, and the limited information available did not indicate that any other CCC steelhead populations were demonstrably viable (Spence *et al*. 2008). Although there were average returns (based on the last ten years) of adult CCC steelhead during 2007/08, research monitoring data from the 2008/09 and 2009/10 adult CCC steelhead returns show a decline in returning adults across their range compared to the previous ten years. The lack of adequate spawner surveys within the Russian River precludes the estimation of wild steelhead escapement within the basin; however, hatchery returns suggest the vast majority of returning fish are of hatchery origin. Information from years of the Coastal Monitoring Program in the Santa Cruz Mountains suggests that population sizes there are higher than previously thought. However, the long-term downward trend in the Scott Creek population, which has the most robust estimates of abundance, is a source of concern. Population-level estimates of adult abundance are not available for any of the seven independent populations (i.e., Novato Creek, Corte Madera Creek, Guadalupe River, Saratoga Creek, Stevens Creek, San Francisquito Creek, and San Mateo Creek) inhabiting the watersheds of the coastal strata.

The scarcity of information on CCC steelhead abundance continues to make it difficult to assess whether conditions have changed appreciably since the previous status review assessment (Williams *et al*. 2016). The most recent status update concludes that steelhead in the CCC DPS remain "likely to become endangered in the foreseeable future", as new and additional information does not appear to suggest a change in extinction risk (Howe 2016). NMFS concluded that the CCC steelhead DPS shall remain listed as threatened (81 FR 33468; May 26, 2016).

2.2.3. CC Chinook Salmon Status

The CC Chinook salmon ESU includes all naturally spawned populations of Chinook salmon from rivers and streams south of the Klamath River, in Humboldt County, to the Russian River. Seven artificial propagation programs were considered part of the ESU at the time of listing: the Humboldt Fish Action Council (Freshwater Creek), Yager Creek, Redwood Creek, Hollow Tree, Van Arsdale Fish Station, Mattole Salmon Group, and Mad River Hatchery fall-run Chinook hatchery programs.

The CC Chinook salmon ESU was historically comprised of approximately 32 Chinook salmon populations (Bjorkstedt *et al.* 2005). About 14 of these populations were independent, or potentially independent. The remaining populations were likely more dependent upon immigration from nearby independent populations than dependent populations of other salmonids (Bjorkstedt *et al.* 2005). Data on CC Chinook salmon abundance, both historical and current, is sparse and of varying quality (Bjorkstedt *et al.* 2005). Estimates of absolute abundance are not available for populations in this ESU (Myers *et al.* 1998). In 1965, CDFG (1965) estimated escapement for this ESU at over 76,000. 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). Between 2000 and 2020, the average number of adult Chinook salmon counted at Mirabel Dam on the Russian River was 2,716 fish (no data was obtained in 2014 and 2015) (SCWA website 2021).

CC Chinook salmon populations remain widely distributed throughout much of the ESU. Notable exceptions include the area between the Navarro River and Russian River and the area between the Mattole and Ten Mile River populations (Lost Coast area). The lack of Chinook salmon populations both north and south of the Russian River (the Russian River is at the southern end of the species' range) makes it one of the most isolated populations in the ESU. Myers *et al.* (1998) reports no viable populations of Chinook salmon south of San Francisco, California.

Because of their prized status in the sport and commercial fishing industries, CC Chinook salmon have been the subject of many artificial production efforts, including out-of-basin and out-of-ESU stock transfers (Bjorkstedt *et al.* 2005). Therefore, it is likely that CC Chinook salmon genetic diversity has been significantly adversely affected despite the relatively wide population distribution within the ESU. An apparent loss of the spring-run Chinook life history in the Eel River Basin and elsewhere in the ESU also indicates risks to the diversity of the ESU.

Williams *et al.* (2016) summary of previous status reviews (Good *et al.* 2005, Williams *et al.* 2011) concluded that the loss of representation from one diversity stratum, the loss of the spring-run history type in two diversity substrata, and the diminished connectivity between populations in the northern and southern half of the ESU pose a concern regarding viability for this ESU. The latest status review of CC Chinook salmon determined that there is no change in the extinction risk for this ESU, and NMFS affirmed that the CC Chinook salmon ESU should remain listed as threatened (NMFS 2016a). NMFS's recovery plan (NMFS 2016b) for the CC Chinook salmon ESU identified the major threats to recovery as: channel modification, roads, logging and timber harvesting; water diversions and impoundments; and severe weather.

2.2.4. Status of Critical Habitat

PBFs for CCC steelhead and CC Chinook salmon critical habitat within freshwater include:

- freshwater spawning sites with water quantity and quality conditions and substratesupporting spawning, incubation and larval development;
- freshwater rearing sites with:
  - water quantity and floodplain connectivity to form and maintain physical habitatconditions and support juvenile growth and mobility;
  - water quality and forage supporting juvenile development;
  - natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, andundercut banks;
- freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanginglarge wood, aquatic vegetation, large rocks

and boulders, side channels, and undercutbanks supporting juvenile and adult mobility and survival.

For CCC 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, 24059; May 5, 1999).

The condition of designated critical habitat for CCC coho salmon and steelhead, and CC Chinook salmon, specifically 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[4]: logging, agriculture, mining, urbanization, stream channelization and bank stabilization, 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 andwood 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 52488). Diversion and storage of river and stream flow has dramatically altered the natural hydrologic cycle in many of the streams within coho and Chinook salmon ESUs and steelhead DPSs. Altered flow regimes can delay or preclude migration, dewater aquatic habitat, and strand fish in disconnected pools, while unscreened diversions can entrain juvenile fish.

2.2.5. Additional Threats to Listed Species and Critical Habitat

Another factor affecting the rangewide status of coho salmon, steelhead, and Chinook salmon, and their critical habitat at large, is climate change. Impacts from global climate change are already occurring in California and listed salmonids here may have already experienced some detrimental impacts. For example, average annual air temperatures, heat extremes, and sea level have all increased in California over the last century (Kadir *et al.* 2013). California has a history of episodic droughts. However, the state has experienced a two-decade period of persistently warm and dry conditions. The five-year period from 2012 to 2016 was the driest since record keeping began (Williams *et al.* 2016). The extreme drought conditions for most of California from January 2020 through August 2021 have resulted from the lowest total precipitation and near-highest temperatures recorded since 1895 (Mankin *et al.* 2021).

The threat to salmonids from global climate change will continue to increase in the future.

[4] Other factors, such as over fishing and artificial propagation have also contributed to the current population status of these species. All these human induced factors have exacerbated the adverse effects of natural environmental variability from such factors as drought and poor ocean productivity.

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 be comprised of higher temperatures (Hayhoe *et al.* 2004, Moser *et al.* 2012; Kadir *et al.* 2013). Total precipitation in California will likely decline and critically dry years may increase (Lindley *et al.* 2007; Schneider 2007; Moser *et al.* 2012).

For Northern California, most models project heavier and warmer precipitation. Extreme wet and dry periods are projected, increasing the risk of both flooding and droughts. Many of these changes are likely to further degrade salmonid habitat by reducing stream flow during the summer and raising summer water temperatures. 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.

Although wildfires are an integral ecological feature in California, they are expected to increase in frequency and magnitude (Westerling *et al.* 2011, Moser *et al.* 2012, and Goss *et al.* 2020). In 2020, the Walbridge fire alone burned over 55,000 acres and included approximately half of the CCC coho salmon spawning habitat available in the lower Russian River tributaries. In the same year, the CZU Lightning Complex fire burned 86,500 acres in San Mateo and Santa Cruz Counties. Of the nine historic CCC coho salmon populations in the Santa Cruz Mountains identified in the recovery plan, six experienced burning, of which three experienced severe burning. These three populations (Gazos Creek, Waddell Creek, and Scott Creek) represented some of the highest quality habitat for CCC coho salmon south of San Francisco (J. Casagrande, personal communication 2020). Wildfires can increase wet-season runoff, reduce summertime surface flows, and increase stream temperatures (Boughton *et al*. 2007). When wildfires are followed by heavy rains in areas which are geomorphically unstable, high flows may cause an increase in sediment delivery to streams via debris torrents (Spina and Tormey 2000, Keeley 2006), that cover habitats and fish alike.

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).

2.3. Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for this project is the area that will be directly and indirectly impacted by the proposed installation and removal of the Bohemian Bridge located in the community of Monte Rio in Sonoma County. The action area also includes the area(s) potentially affected by the off-site restoration project within the Dutch Bill Creek Watershed. The newly constructed bridge will be located approximately 7 miles from the coastline and span the mainstem of the Russian River and the confluence the

Dutch Bill Creek tributary. The action area includes the permanent project footprint, temporary construction work areas, potential staging areas, and bank to bankwidth of the Russian River, upstream approximately 500 feet and approximately 1.5 miles downstream of the project site. The action area is based on observations made by a NMFS biologist during the installation of the summer crossing of the Russian River at Vacation Beach in May 2002 where turbidity extended one and a half miles downstream (NMFS 2009, 2021). The action area is extended upstream approximately 500 feet due to the potential disturbances caused by the heavy equipment and the disturbances to the wetted channel, which may cause fish to move upstream.

Features in the action area include the existing Bohemian Highway Bridge, Russian River, Dutch Bill Creek, and portions of MRRPD Monte Rio Beach and parking areas, Main Street, Moscow Road, and Bohemian Highway. Public beaches are on the north and south sides of the river and areas directly to the north and south ends of the bridge are occupied by small commercial businesses. Beyond the main commercial areas, surrounding land use is generally residential, but also includes other stores and restaurants, a skate park, elementary school, and several inns and hotels along the north and south sides of the river.

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 Russian River Watershed covers approximately 1,485 square miles, is 110 miles long and includes over 200 tributaries that provide anadromous salmonid habitat. The headwaters are in Potter and Redwood Valleys, approximately 15 miles north of Ukiah in Mendocino County. The proposed project is located is within the lower portion of the watershed which is confined in a narrow valley with limited floodplain area and steep forested hillsides. This reach of the Russian River is stable with little meander or movement from one year to the next with a sandy, gravel beach on the north bank, and a steep, vegetated south bank. The Dutch Bill Creek sub-watershed covers 55 square miles and flows for 8 miles starting from its headwaters north of Occidental. The lower reach of Dutch Bill Creek consists of steep vegetated banks and dries in late summer and early fall. Vegetation within the action area is dominated by Oregon Ash Groves and Sandbar Willow thickets.

This area has a Mediterranean climate characterized by cool wet winters with typically high runoff, and dry warm summers characterized by greatly reduced instream flows. Fog is a dominant climatic feature along the coast, generally occurring daily in the summer and not infrequently throughout the year. The average annual rainfall is 31.2 inches, falling during the winter and early spring as rain. The average air temperatures range from 46° to 72° F.

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 Russian River Watershed. In addition, these high natural runoff rates have been increased by road systems, urbanization, 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 Russian River Watershed contain a relatively large sediment load, typically deposited throughout the lower gradient reaches of these systems. The land use around the project sites is primarily rural residential and with some agriculture, mainly vineyards. The upland areas are predominately forested with rural residences.

2.4.1 Status of CCC Coho Salmon, CCC Steelhead, and CC Chinook Salmon in the Action Area

In 2001, the RRCSCBP was developed, whereby coho salmon and steelhead are spawned and raised at the Warm Springs Hatchery and Coyote Valley Fish Facility respectively, as mitigation for the loss of spawning and rearing habitats caused by construction of Coyote Valley and Warm Springs dams. It has become the largest coho salmon recovery hatchery program in California. Since 2013, California Sea Grant (CSG) and the Sonoma County Water Agency (SCWA) implement the Coastal Monitoring Plan which includes genetic analysis and annual monitoring of the distribution and survival of stocked juvenile salmon and the subsequent return of adult coho to the Russian River. CSG has established long-term life cycle monitoring in Willow, Dutch Bill, Green Valley, and Mill Creeks. SCWA conducts life cycle monitoring in Dry Creek for coho salmon and steelhead and operates a life cycle monitoring station at the Mirabel dam site on the mainstem Russian River (at river kilometer 39.67) aimed at assessing status and trends of adult Chinook salmon. CSG and SCWA's efforts also include basin-wide spawner surveys in the Russian River for coho salmon and steelhead, and basin-wide snorkel surveys for juvenile coho salmon.

CCC Coho Salmon

Information on the historic run size of coho salmon in the Russian River is limited. Late 19th and early 20th Century records are sparse, or non-specific as to species (Chase *et al*. 2007). They once occupied many tributaries throughout the basin, probably reared in backwater areas of the main stem, and were a major component of the fish community (Spence et. al. 2005). Bjorkstedt (2005) concluded that coho salmon existed as two populations in the Russian River: a large independent population in the lower basin, and a smaller ephemeral population that occupied tributaries in the northwest corner of the basin. The lower river population represented what was historically the largest and most dominant source population in the ESU. They are now restricted to a few tributaries in the lower watershed (CDFG 2002), and rear only in isolated areas of suitable habitat.

The RRCSCBP was initiated to reestablish self-sustaining runs of coho salmon in tributary streams within the Russian River Basin (Obedzinski *et al*. 2007). This program currently releases approximately 200,000 juvenile offspring of wild captive-reared coho salmon into 20-30 Russian River tributaries within their historic range with the expectation that a portion of them will return to these areas as adults to naturally reproduce (PACT 2019). According to CSG spawner surveys, the estimated annual adult hatchery coho salmon returns to the Russian River from 2010 to 2021 range from 200 fish to over 700. The estimated number of hatchery coho salmon adults returning during the winter of 2019/20 was 547, the third highest on record and adults or redds were observed in 16 of the 32 coho salmon streams surveyed. (CSG 2020). In the summer of 2020, young of the year coho salmon were detected in 31 of the 43 streams surveyed (CSG 2020a). Adult coho salmon can begin migrating in the lower mainstem Russian River as early as late September and into tributaries around mid-November (CSG 2021, unpublished data). Coho salmon smolt out- migration occurs from March to June (SCWA 2021).

Monitoring of coho salmon populations in the Russian River basin has shown that Dutch Bill Creek plays an important role in providing habitat for rearing juveniles and according to the joint CDFW and NMFS Priority Action Coho Team (PACT, formed in 2011), is considered essential for recovery. As part of the RRCSCBP, thousands of pre-smolt and smolt coho salmon are released each year into Dutch Bill Creek. The smolt to adult ratio includes the probability of smolts surviving the riverine, estuarine, and ocean environments from when they leave the tributary until they returned as adults. Though smolt to adult ratios are quite low in Dutch Bill Creek, averaging 0.5 percent from 2010 through 2017 (CSG 2020), trends for estimated adult coho salmon abundance show that returns appear to be stable since 2013 (SCWA 2021) (Table 1). In 2020, CSG snorkeled over 7 miles of Dutch Bill Creek and estimated nearly 2,000 young of the year coho salmon occupied the creek, mostly in the upper reaches (CSG 2020a). This is a positive indication of spawning success.

Table 1. Trends in estimated adult coho salmon in Dutch Bill Creek from 2013 through 2020.

Year	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Adult coho salmon returns	15	18	33	69	40	49	42

Preservation of locally adapted genotypes is critical to the recovery of the CCC coho salmon ESU. Genetic analyses of coho salmon sampled from Russian River tributaries are consistent with what would be expected for a population with such extremely reduced abundance. A review by Bjorkstedt (2005) found both strong departures from genetic equilibrium and evidence of recent,severe population bottlenecks. Historical hatchery practices may also have contributed to these results. This evidence suggests an acute loss of genetic diversity for the Russian River coho salmon population.

Based on the decline in abundance, restricted and fragmented distribution, and lack of genetic diversity, the Russian River population of coho salmon is in immediate danger of extinction. The wild population is considered functionally extirpated. The Russian River population itself is in the middle of the CCC coho salmon ESU's range and inhabits a watershed that represents fully a third of the ESU by area. For these reasons, irrespective of the condition of the watershed, the Russian River has great potential to provide important geographic continuity, diversity, and habitat space for the species. The continued existence of CCC coho salmon in the Russian River is, therefore, significant to the survival andrecovery of the entire CCC coho salmon population.

CCC Steelhead

Russian River steelhead runs once ranked as the third largest in California behind the Klamath and Sacramento rivers. The Russian River was renowned as one of the world's finest steelhead rivers during the l930's and on through the 1950's (SEC 1996). SEC (1996) reported historic Russian River catch estimates for steelhead: 15,000 for the 1936 sport catch, and 25,000 for the 1956/57 sport catch. These estimates are based on best professional judgment by a CDFG employee and, for the latter estimate, a sportswriter. Other estimates include one of 57,000 steelhead made in 1957 (SEC 1996). Since the mid-20th Century, Russian River steelhead populations have declined. Estimates based on best professional judgment infer a wild run of 1,750 to 7,000 fish near the end of the 20th Century (Busby 1996). Hatchery returns averaged 6,760 fish for the period 1992/93 to 2006/07, and ranged from 2,200 to 11,828 fish. Though there were challenges with sampling conditions, SCWA's estimate for the 2019/20 spawner season was 1,606 redds in the Russian River basin (SCWA 2020). The information available suggests that recent basin-wide abundance of wild steelhead has declined considerably from historic levels. A limited catch-and-release hatchery sport fishery still offers a fishing season for hatchery steelhead in the Russian River.

Reproduction of the Russian River steelhead population is primarily dependent on tributary spawning outside the action area. In 2019/20, CSG detected 27 steelhead redds in Dutch Bill Creek, mostly concentrated in the lower reach. This uncharacteristically high number of redds (usually less than 10), may have been due to the release of adult hatchery steelhead in the mainstem Russian River across from Dutch Bill Creek. Steelhead also rear in the mainstem, but in very low numbers. Degraded rearing habitat and low densities indicate the mainstem within the action area is not currently capable of supporting large numbers of rearing juvenile steelhead. The mainstem throughout the action area and beyond, although degraded for rearing, is used as a migration corridor for by out-migrating smolts and returning adult steelhead. Steelhead begin returning to the Russian River in December, with the run continuing into April in the mainstem and into May in some of the tributaries.

Hatchery practices have also impacted steelhead populations within the action area. Since the 1870's, millions of hatchery-reared salmonids have been released into the Russian River Basin. The combination of planting out-of-basin stocks, hatchery selecting processes, and interbreeding have led to a decrease in salmonid genetic diversity and loss of local adaptations (SEC 1996). The Coyote Valley Fish Facility, located upstream of the action area primarily produces and releases steelhead which have the potential to effect naturally-produced steelhead within the action area.

Despite declines in abundance, steelhead remain widely distributed within the basin (NMFS 2005). The primary exceptions to this are the barriers to anadromy caused by the Coyote Valley Dam and Warm Springs Dam. The Coyote Valley Dam has blocked approximately 21 percent of the historical habitat of the Upper Russian River population, and the Warm Springs Dam has blocked approximately, 56 percent of the Dry Creek population's historical habitat (Spence 2006).

While the steelhead population has declined dramatically in the Russian River over the past several decades, its current numbers, distribution, and diverse use of habitat will likely provide much stronger resistance to environmental and anthropogenic disturbance when compared to coho salmon and Chinook salmon. However, no information exists that demonstrates that the decline in the Russian River steelhead population has stabilized.

CC Chinook Salmon

Chinook salmon use the mainstem Russian River through the action area strictly as a migration corridor. Chinook salmon currently spawn mostly in Dry Creek and in the mainstem of the Russian River from Healdsburg to Ukiah. Though Chinook salmon have been observed in the lower reaches of Dutch Bill Creek, it is likely that they moved in from the Russian River for short periods of time and do not use the creek for spawning or rearing. Steiner Environmental Consulting (SEC) (l996) reported that there were no Chinook salmon population estimates in the Russian River Watershed until the 1960's, and by that time the returns appeared strongly associated with periods of sustained hatchery supplementation. Estimated Chinook salmon escapement was1,000 in 1966 (CDFG 1966) and 500 in 1982 (COE 1982). SEC (1996) reported that despite heavy planting in Dry Creek during the 1980’s, a viable Chinook salmon run was not established. Returns to Warm Springs Dam from 1980 to 1996 ranged between zero and 304, with the biggest count in 1988. Hatchery supplementation was finally terminated in 1996.

Since 2000, SCWA has conducted annual counts of CC Chinook salmon moving past the Mirabel Dam water diversion facility located approximately 23 river kilometers upstream from the proposed project. Between 2000 and 2020, the average number of adult Chinook salmon counted at Mirabel Dam was 2,716 fish (no data was obtained in 2014 and 2015). 2012 saw the highest count at 6,730 adult Chinook salmon, and in 2020, 602 were counted, the lowest total since counting began (SCWA website 2021). These data suggest a fluctuating, but stable population of Chinook salmon in the Russian River. However, the decrease in adult escapement in past couple of years is concerning.

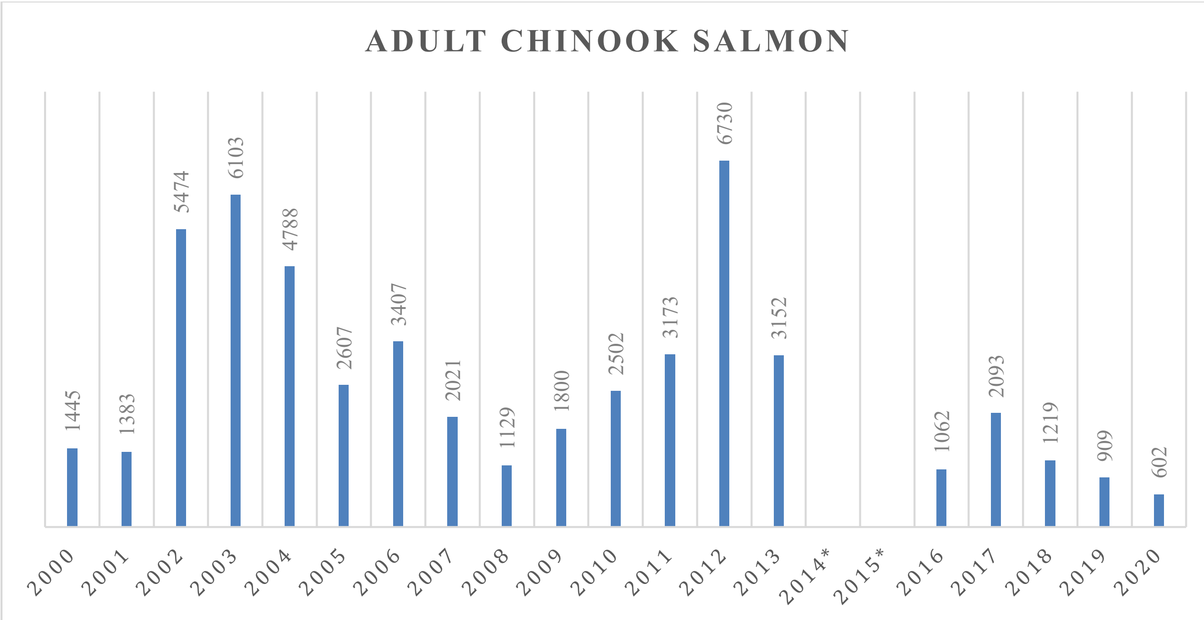

Figure 2. Trends in estimated adult Chinook salmon in the Russian River at Mirabel Dam from 2000 through 2020. *Video cameras not operated in 2014 and 2015 due to construction. Data taken from https://www.sonomawater.org/chinook. Accessed on September 16, 2021.

Genetic diversity is an important measure of viability as well. Genetic analysis of Russian River Chinook salmon suggests they are not closely related to either the nearby Eel River or Central Valley Chinook salmon, and likely evolved as part of a diverse group of native coastal populations (Hedgecock 2002). A history of hatchery stocking, however, has likely had some effect on genetic diversity (Bjorkstedt *et al.* 2006, Chase *et al.* 2007).

The Russian River is the largest watershed in the CC Chinook Diversity Stratum and likely has the largest population. This population is also at the southern extent of the species range. Its extinction would, therefore, constitute a substantial range restriction, the loss of the largest population in the stratum, and probably the loss of a unique genetic component of the ESU. For these reasons, the survival and recovery of the Russian River population of CC Chinook is important to the conservation of the ESU as a whole.

2.4.2 Status of Critical Habitat in the Action Area

The functioning of salmonid critical habitat within the lower mainstem Russian River has been compromised by changes in flow, temperature and fine sediment loading resulting from upstream dams and diversions. In 1922, the completion of Scott Dam forming Lake Pillsbury on the upper Eel River allowed the storage and diversion of water from that basin to the Russian River Basin. Subsequently, the construction of the Coyote Valley Dam in 1958 in the upper Russian River Basin and the construction of the Warn Springs Dam on Dry Creek in 1982 further altered the flows and sediment routing in the Russian River. Environmental Consulting (SEC) (1996) cite unpublished data from the California State Water Resources Control Board (CSWRCB), which state that there are over 500 small dams on the Russian River and its tributaries.

The action area is also influenced by the annual installation of two summer dams approximately 3 to 4 miles upstream on the mainstem Russian River. Johnson's Beach summer dam in Guerneville impounds water to approximately one mile downstream of the Odd Fellows crossing. The second dam is the Vacation Beach summer dam, which is located just upstream of the Vacation Beach summer crossing and impounds water upstream to the Johnson's Beach summer dam.

Increased summer flows and the installation of these two summer dams, along with fine sediment loading through the winter and spring period have decreased the value of salmonid rearing habitat within the action area and have also created habitat conditions more favorable to introduced and native warm-water fish species such as Sacramento pikeminnow (*Ptychocheilus grandis*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieui*), striped bass (*Marone saxatilis*), and green sunfish (*Lepomis cyanellus*).

These dams have a variety of functions including residential, commercial, and agricultural water supply, flood and/or debris control, and recreation. These small dams interfere with fish migration, affect sediment transport, and affect water flow and temperature. Forestry and agriculture are other significant land uses within the basin, and there are some in-channel gravel mining operations. Brown and Moyle (1991) reported that logging and mining in combination with naturally erosive geology have led to significant aggradation of up to 10 feet in some areas of Austin Creek, a lower Russian River tributary.

The riverbed material of the Russian River consists mostly of alluvial deposits of igneous and sedimentary origin. The upper reaches of the river have a dominant substrate of gravel with cobbles. However, by the time the river nears the Guerneville area, additional fine sediment has entered the river system and the dominant substrate is gravel mixed with a large sediment load. The substrate in the action area lacks clean, loosely compacted, gravel in cool water with highly dissolved oxygen and an inter-gravel flow necessary for spawning. Lack of clean gravel and high water temperatures are two of the factors that make the areas in the lower river unsuitable for spawning habitat. However, the lower river is used by all the salmonid species as a migration corridor to the upper reaches of the mainstem and to the tributaries of the upper and lower river.

The Russian River was included on the 2013 CWA section 303(d) list of water quality limited segments. The pollution factors for the Russian River vary by sub-watershed, but commonly include sediment, temperature, dissolved oxygen, various nutrients, and many chemical pollutants and pathogens. Forestry, agriculture, dams with flow regulation, urban and land development, and nonpoint sources are listed as the potential sources for these factors. Lake Sonoma, a reservoir impounded by Warm Springs Dam, is included on the section 303(d) list because of elevated levels of mercury associated with historic mining. Total maximum daily load (TMDL) is a regulatory term in the CWA, describing a plan for restoring impaired waters that identifies the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards (www.epa.gov). Currently, there is no approved TMDL for the Russian River watershed.

Since 2015, NOAA has been working with partners to evaluate the viability of Forecast-

Informed Reservoir Operations (FIRO) in achieving improved flood management, water supply, and environmental flows associated with the operations of Lake Mendocino, the reservoir created by the Coyote Valley Dam. The FIRO program, authorized by the U.S. Army Corps of Engineers, allows reservoiroperators to use forecasts to inform the storage and release of water in the portion of the flood control pool. If effective, FIRO will provide several benefits for listed salmonids, including: increased cold-water pool availability, more reliable and higher minimum in-stream flows, and better water quality conditions.

We rely on information from section 2.2.5 with respect to the broader climatic variables influencing the current condition of habitat in the action area. Variables such as air temperature, wind patterns, and precipitation are likely influencing localized environmental conditions, such as water temperature, stream flow, and food availability. These local environmental conditions can affect the biology of listed species and the functioning of critical habitat and its value for conservation. The combination of climate change effects and effects of past and current human activities on local environmental conditions further reduce the current condition of available habitat for listed species in the lower Russian River.

Rearing habitat in the mainstem of the Russian River is marginal; primarily due to elevated stream temperatures, fine sediment loading, and the abundance of warm-water predator fish species. Overwinter and outmigration habitat conditions are also poor because the mainstem channel lacks habitat complexity and velocity refuge and carries a high level of fine sediment (Ritter and Brown 1971, COE 1982, Beach 1996, CDFG 2001). Therefore, salmonid habitat conditions within the action area are poor and are not anticipated to improve in the immediate future.

In 1894, a railroad was constructed along the entire length of Dutch Bill Creek to facilitate intensive logging efforts. For over a century, the watershed was stripped of its redwood forests which led to its current state: critically low streamflows and streambed drying across large portions of Dutch Bill Creek during the late summer and fall. Pool disconnection and streambed drying are common in the low-gradient alluvial reaches near its confluence with the Russian River, but can also occur in the prime spawning and rearing reaches in the central portion of the creek. The current major land use in the Dutch Bill Creek watershed is unmanaged forestland, but there are areas of vineyards, and concentrated residential development, including the communities of Occidental and Camp Meeker.

The coho salmon population decline in Dutch Bill Creek triggered intensive efforts to restore salmon habitat. For nearly two decades, the Dutch Bill Creek watershed has been the site of intensive efforts to enhance habitat for endangered fish species and restore watershed processes. Extensive work has been undertaken to improve fish passage and enhance habitat within the creek. This instream work has been coupled with efforts to reduce sedimentation and improve water quality through erosion control projects, with a focus on the network of unpaved roads throughout the watershed. And in the past several years, water conservation, water storage and streamflow enhancement projects have been designed and built to ensure that the stream has enough flow year-round to support a healthy aquatic community.

Starting in 2009, the Russian River Coho Water Resources Partnership (Partnership)[5] developed a Streamflow Improvement Plan for Dutch Bill Creek which identified the following priority actions that have since been implemented:

- Reducing or eliminating direct dry season diversions from mainstem Dutch Bill Creek and its tributaries with institutional and residential users.
- Pursuing flow releases from ponds and spring-to surface- water reconnection.
- Assessing the impact of stormwater runoff and exploring infiltration and groundwater recharge opportunities.

Other conservation efforts in Dutch Bill Creek include:

- <u>The Westminster Woods Water Conservation and Storage Project -</u> The Westminster Woods Camp and Conference Center partnered with Gold Ridge RCD and the Partnership to irrigate its playing fields with stored spring water, alleviating the need to take water from the creek during the summer/fall dry season. The Westminster Woods water storage project now source 175,000 gallons of water per year from nearby springs.
- <u>The Dutch Bill Creek Water Release Project</u> **-** In collaboration with the Partnership, the Gold Ridge RCD also participated in the release of water from the Camp Meeker system, which pumps from the Russian River mainstem, into upper Dutch Bill Creek to support summer stream flows. The Partnership also negotiated with several area agricultural operators to release late season water from large ponds.
- <u>Installation of Large Woody Debris</u> - Several instream large woody debris structures designed to improve winter rearing and spawning habitat for coho salmon and steelhead have been installed.
- <u>Culvert and dam removal</u> - Before 2009, the upper reaches of Dutch Bill Creek, historically prime spawning habitat for the endangered coho and steelhead salmon, were blocked to salmon by the Market Street culvert and Camp Meeker dam. In collaboration with community partners, the Gold Ridge RCD worked to decommission and replace both the dam and culvert with passable structures. Fish access was further improved with instream fish passage enhancement structures.

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 (see 50 CFR 402.02). 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 the factors set forth in 50 CFR 402.17(a) and (b).

[5] The Partnership consists of a multidisciplinary collaboration among CSG, Gold Ridge Resource Conservation District, Occidental Arts and Ecology Center's WATER Institute, Sonoma Resource Conservation District, and Trout Unlimited, with support from the National Fish and Wildlife Foundation and SCWA.

2.1.1 <u>Effects Due to Constructing the New Bridge and Removing the Existing Structure</u>

The timing of the bridge replacement will avoid the majority of both juvenile and adult salmonid and steelhead migrations through the action area (Tables 2 and 3). However, there may be some overlap with the following species and life-history stages: 1) late out-migrating juvenile salmonids and steelhead; 2) a high likelihood with the beginning of adult Chinook salmon migration in all three construction seasons; and 3) a low possibility of overlap with early adult coho salmon migration. NMFS believes the likelihood of the project impacting adult coho salmon or adult steelhead upstream migration is low since the majority of upstream migration of coho salmon does not begin until the latter half of November and the peak run for adult steelhead typically occurs from December through April. Due to the project's proximity to the highly productive Dutch Bill Creek, a small number of juvenile coho salmon and steelhead may rear in the action area and may be present during construction activities. Therefore, juvenile coho salmon, Chinook salmon, and steelhead as well as adult Chinook salmon are expected to be most affected by the proposed action.

Table 2. Federally listed fish species and respective life history stages that are most likely to be in the action area and affected by project activities during the construction work window from June 15 – October 15.

Species	**Life History Stage**	**Likelihood to be in Action Area During Construction**	**Timing of Potential Effects**
Coho salmon	Rearing Juveniles	Medium	June- Oct
	Out-migrating Smolts	Medium	June
	Migrating Adults	Low	Sep - Oct
Chinook salmon	Rearing Juveniles	Low	June- Oct
	Out-migrating Smolts	Medium	June
	Migrating Adults	High	Aug-Oct
Steelhead	Rearing Juveniles	Medium	June- Oct
	Out-migrating Smolts	Medium	June
	Migrating Adults	None	May (outside of work window)

Juveniles and Smolts

In-water construction work will occur from June 15 to October 15. During the late-spring construction period, there is the potential for juvenile coho salmon, Chinook salmon, and steelhead to be in the action area. The start of construction date will minimize effects to out-migrating salmonid smolts since the majority of outmigration for these species occurs prior to June 15. However, salmonid outmigration monitoring conducted by the SCWA at the Mirabel dam has confirmed that small numbers of salmonid smolts out-migrate through June in some years. During outmigration, most downstream movements of salmonid are not continuous, but are interspersed with periods of holding and feeding (Moser *et al.* 1991). During holding, salmonids occupy areas in the stream with cover (Raleigh *et al.* 1984), including shallow water along stream banks (Moyle 2002). It is unlikely that juveniles and smolts rear or hold in the lower Russian River during the proposed construction period due to lack of cover and high temperatures. However, it is still possible for juveniles and smolts to be in the action area during project activities, especially coho salmon and steelhead, since they successfully spawn and rear in Dutch Bill Creek. Therefore, it is possible that low numbers of out-migrating coho salmon, Chinook salmon and steelhead smolts, as well as rearing juvenile coho and steelhead, may be affected by the following during implementation of the proposed project:

- Crushing or displacement during placement of culverts and gravel work pads within the wetted channel;
- Increased stress or mortality due to fish relocation;
- Delayed or constricted passage or stranding due to changes in hydrology;
- Reduced fitness or behavioral changes due to degraded water quality;
- Behavioral changes from exposure to higher stream temperatures or predator avoidance due to reduced riparian cover or changes in structural shade;
- Loss of food source.

Adults

There is also the potential for adult coho salmon and Chinook salmon to migrate through the action area and be affected by project activities. Detections of adult Chinook salmon at Mirabel Dam, approximately 23 river kilometers upstream from the action area, can start as early as August in some years and typically peak from mid-late October (SCWA website 2021). Adult coho salmon typically begin their winter migration into the lower Russian River in November, continuing through January. However, there have been a few detections of adult coho salmon downstream of the action area at Duncan Mills, as early as late September (CSG 2020a). Adult steelhead begin returning to the Russian River in December, with the run continuing into May for some of the upper river or tributaries. Spawning for any species is unlikely in the mainstem of the Russian River, but both coho salmon and steelhead migrate through the action area to spawn in Dutch Bill Creek.

The primary concern regarding adult salmonids migrating upstream is they must have streamflows that provide suitable water depths for successful upstream passage (Bjornn and Reiser 1991). In addition, it is important to preserve streamflows that provide adequate depths and velocities supporting suitable and preferred habitats for temporary holding and resting. Installing and removing culverts and gravel work pads and working with loud, heavy machinery in the mainstem Russian River and confluence of Dutch Bill Creek over three consecutive work seasons may cause a delay in adult salmonid migration timing or disrupt migration behavior and potentially even result in the reduced reproductive success for coho salmon and Chinook salmon. Adult salmonids may also be exposed degraded water quality, including temporarily increased turbidity.

Streamflow

As part of the project, the County plans to place 3 to 4 large culverts parallel to flow in approximately 250 feet of the mainstem Russian River, overlain by clean gravel, and topped with base rock and fill. If the mouth of Dutch Bill Creek is wetted during the construction season, a similar, but smaller iteration of this culvert/work pad project component will be placed in Dutch Bill Creek. Although this method works well for preventing contaminants from entering the river (easier to clean spills and hard to hide spills), and eliminates vibrations and the need for water diversion, specific parameters are required to ensure the culverts are constructed in a way that is appropriate for fish passage.

Figure 3. Timing of life stages for the salmonids and steelhead present in the Russian River and its tributaries. The red box represents the overlap with the construction period of the proposed project from June 15 – October 15.

Hydrologic variability within years must be considered when designing the specific culvert configuration prior to the start of construction each year over the 3-year project duration. During the low flow season (approximately late May through October) releases from WSD for water supply significantly affect stream flow and available rearing habitat for steelhead and coho salmon, which rear in freshwater habitats throughout the summer months. Minimum instream requirements in the lower Russian River from Dry Creek to the mouth range from 125 cfs in a normal water year to 85 cfs in a dry year, and 35 cfs in a critically dry year.[6] At the USGS 'Hacienda' streamflow gage near Guerneville, median flow during the period of July 1 through September 30 is generally in the range of 150 to 200 cfs in normal years. During the extreme drought conditions of 2021, the SWQCB issued a Temporary Change Order, lowering minimum instream flow in the Lower Russian River to 35 cfs, (as measured on a five-day running average of average daily stream flow). Given the Mediterranean climate in central, coastal California and the near absence of rainfall-runoff events in the action area between late May and early October, these flows can likely be relied upon for design consideration. However, storm events in April or early October can trigger much higher flows. For instance, flows greater than 16,000 cfs were measured at the Hacienda gage in April of 2003 and 2006 (USGS website, accessed Sept. 21, 2021).

Adult anadromous salmonids need to migrate from the ocean back to freshwater spawning grounds to complete their life cycle. In some watersheds, salmonids need enough time and sufficient opportunity to swim dozens or even hundreds of miles to return to their natal streams for spawning. The goal of the culvert/gravel work pad design will be to provide hydraulic conditions within the culverts that mimic the streamflows of the natural waterway(s) upstream and downstream of the action area and allow migrating adult and juvenile fish volitional passage through the fishway in a safe and timely manner. The design will provide flows (amount, timing, frequency, and duration) needed to support each type of habitat that anadromous fish need to complete their life-cycle. To achieve these hydraulic conditions a fishway must have sufficient depth for fish to swim; velocities within the swimming ability of the fish; and turbulence levels that do not confuse fish or prevent them from being able to swim through. All applicable passage criteria within NMFS 2019 *Guidelines for Salmonid Passage at Stream Crossings* will be incorporated into the culvert configuration each construction season (Appendix A). Even with appropriately sized and placed culverts, NMFS expects that migratory behavior of both smolt and adult fish that swim through the action area will be affected due to changes in hydrology and construction disturbances.

Based on observations made during previous Vacation Beach crossing installations, changes in flow and dewatering of the river channel are expected to occur as gravel is pushed into the wetted channel and culverts are installed or removed. An increase in downstream flow will occur as the flow is concentrated through the installed culverts. Concentrating the flow in this manner may also result in the dewatering of part of the channel directly downstream. The adverse effects of rapid, artificial fluctuations in stream flows on fisheries resources are well documented (Cushman 1985). Reductions in downstream flow have the potential to strand juvenile fish along

[6] Russian River in-river flow minimums are mandated by the 1987 SWQCB Order Number D1610 and 2016 Temporary Urgency Change Petition to lower summer flows. NMFS' 2008 Russian River BiOp, requires the SCWA to request lower minimum instream flow requirements in the Russian River and Dry Creek in order to improve conditions for listed fish. The SCWA is currently preparing an Environmental Impact Report (EIR) for the proposed Fish Habitat Flows and Water Rights Project (Fish Flow Project) to reduce set flows for the watershed.

stream banks, or they may cause fish to become isolated in small pools or other marginal habitats. Risk of stranding is generally highest where the channel slope in areas subjected to dewatering is gentle or irregular. Fish stranded in dewatered areas are vulnerable to both desiccation and increased predation from birds or mammals and they may be subjected to higher rates of mortality due to the effects of deteriorating water quality (e.g., elevated temperatures).

Fish Relocation

The placement and removal of gravel and culverts into the flowing water of the Russian River and Dutch Bill Creek with heavy equipment has the potential to harm or kill smaller salmonids and steelhead that occupy the area and seek refuge in the substrate interstices in response to the disturbance. Larger juvenile coho salmon, Chinook salmon, and steelhead, including smolts, are less prone to crushing as they will likely flee the area, but may be forced out of their rearing or holding areas to either downstream or upstream of the crossing to lower quality instream habitat and may suffer an increased risk of predation. Fish discovered in the stream channel within the project site will be removed and relocated by a qualified biologist to an appropriate stream reach that will minimize impacts to captured fish as well as fish that are residing at the release site.

Fish relocation activities may injure or kill rearing juvenile salmonids or steelhead because of the associated risk that collecting poses to fish, including stress, disease transmission, injury, or death (Hayes 1996). The amount of injury and mortality attributable to fish capture varies widely depending on the method used, the ambient conditions, and the expertise and experience of the field crew. The effects of seining and dip-netting on juvenile fish include stress, scale loss, physical damage, suffocation, and desiccation. Electrofishing can kill juvenile steelhead, and researchers have found serious sub-lethal effects including spinal injuries (Nielsen 1998, Nordwall 1999). Although sites selected for relocating fish will likely have similar water temperature as the capture site and should have ample habitat, in some instances relocated fish may endure short-term stress from crowding at the relocation sites. Relocated fish may also have to compete with other native and non-native fishes for available resources such as food and habitat. Some of the fish at the relocation sites may move and reside in areas that have more suitable habitat and lower fish densities. As each fish moves, competition is expected to remain localized to a small area or quickly diminish as fish disperse.

Most of the impacts to coho salmon, Chinook salmon, and steelhead associated with fish relocation is anticipated to be non-lethal; however, a very low number of rearing juveniles (mostly young of the year) captured may be injured or die. The number of fish affected by increased competition is not expected to be significant at most fish relocation sites, based upon the suspected low number of relocated fish inhabiting the small project areas. Harmful effects of fish relocation activities are expected to be significantly reduced by implementing measures to reduce stress and potential for injury or death. NMFS expects that fish relocation activities associated with this action will not significantly reduce the number of returning coho salmon, Chinook salmon, and steelhead adults. Fish relocation activities will occur during the summer low-flow period after most of the emigrating smolts have left the proposed project site and before the majority of the adult fish travel upstream in the late fall. Therefore, the majority of the fish that may be captured will be juveniles, generally young of the year and one-year age classes. Although most mortalities of during relocation activities are likely to occur almost exclusively at the young of the year stage, there is a potential of unintentional mortality of older age-class fish. Based on prior experience with current relocation techniques and protocols likely to be used to conduct the fish relocation, unintentional mortality of juvenile coho salmon, Chinook salmon, and steelhead expected from capture and handling procedures is not likely to exceed 3 percent. Mortality from these activities can be reduced to near 1 percent with increased skill and experience of the operator, and field crew conducting the work.

Water Quality

Turbidity is the degree to which water loses its transparency due to the presence of suspended sediment. A Turbidity level greater than five nephelometric turbidity units (NTU) is considered visible turbidity and turbidity levels above 25 NTU have been shown to cause reductions in salmonid growth (Sigler *et al*. 1984). Salmonids have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are adapted to such high pulse exposures. Deposition of fine sediments can reduce incubation success (Bell 1991), interfere with primary and secondary productivity (Spence *et al.* 1996), and degrade cover for juvenile salmonids (Bjornn and Reiser 1991). Chronic, moderate turbidity can harm newly-emerged salmonid fry, juveniles, and even adults by causing physiological stress that reduces feeding and growth and increases basal metabolic requirements (Bjornn and Reiser1991, Servizi and Martens 1991, Spence *et al.* 1996). Older salmonids typically move laterally and downstream to avoid turbid plumes (McLeay *et al.* 1984, 1987, Sigler *et al.* 1984, Lloyd 1987, Servizi and Martens 1991).

Based on the effects described above, it is anticipated that Chinook salmon, coho salmon, and steelhead smolts, and rearing juvenile salmonids and steelhead within the action area may be affected by short-term increases in turbidity caused during the placement/removal of culverts and gravel work pads into the flowing water. These pulses of turbidity may cause fish to move downstream or upstream of the project area to avoid the turbidity. Pulses of increased turbidity are not anticipated to reach lethal levels, but may result in salmonids and steelhead temporarily vacating preferred habitat areas and temporarily reducing their feeding efficiency. The behavioral modifications affecting small numbers of juvenile fish will likely result in less fitness of individual fish due to occupation of less suitable habitat, reduced feeding,and potentially greater intra and interspecific competition which, along with increased predation risks, will result in a very minor reduction in survival rates. Due to the timing of the installation, low numbers of out-migrating coho salmon, Chinook salmon and steelhead smolts, and rearing juvenile salmonids and steelhead are anticipated to be affected.

To decrease the impacts of turbidity, the proposed project will use only imported, clean, river-run gravel for the construction of the instream work pads. Levels of increased turbidity will fluctuate as materials are placed and removed from the flowing water. Based on observations and data collected during previous years, increased turbidity will be temporary, occurring during the placement and removal of instream culverts and gravel work pads and fall back within a normal range after two to six hours after these project components are installed. Water samples were taken by a County biologist 100 feet downstream of the Vacation Beach crossing prior to, during, and after the input of material into the flowing water at on July 10, 2019. NTU levels rose from 3.25 to 3.9 immediately upon placing gravel into the channel. However, the levels dropped below initial baseline to 2.95 NTU 30 minutes later (NMFS 2009, 2021).

Salmonids may be exposed to degraded water quality due to stormwater runoff from the bridge and approach roadways. Recent studies have identified the degradation of some tires as a causal factor in salmonid mortalities, even in concentrations of less than one part per billion (Tian *et al*. 2020). The identified contaminant, 6-PPD quinone, has been found where both rural and urban roadways drain into waterways (Sutton *et al.* 2019). Studies have identified this issue and determined the cause of observed mortalities of adult and juvenile coho salmon in both field (Scholz *et al.* 2011) and laboratory settings respectively (Chow *et al*. 2019). More recent unpublished examinations of juvenile steelhead and Chinook salmon by NMFS Northwest Fisheries Science Center, and partners, also indicate mortality of up to 40 percent for steelhead and up to 10 percent for Chinook (McIntyre and Scholz, unpublished results, 2020).

It is necessary to prevent exposure to 6-PPD quinone to the maximum extent practicable in order to protect listed salmonids; the project proponent can determine how to accomplish this task. NMFS recommends that the contribution of contaminants from infrastructure projects be offset and reduced by ensuring that stormwater from proposed new roads, and other infrastructure, is prevented from flowing directly into a water body. Instead, stormwater runoff should be diverted to flow into vegetated areas between the roadway and the waterbody. The first flush into a waterbody carries the highest concentration of tire particles, oils, greases, heavy metals, etc. from automobiles. Diverting the stormwater runoff into a vegetated area prior to entering the waterbody, allows it to infiltrate into soils through large amounts of organic matter. This infiltration is expected to mitigate deleterious effects to salmonids by the process of binding the 6-PPD quinone, filtering out tire particles, and removing other contaminants related to automobiles (polycyclic aromatic hydrocarbons, oil, greases, metals, etc.) by preventing it from reaching the waterbody (Caltrans 2003; McIntrye *et al.* 2015).

The community of Monte Rio is in a Municipal Separate Storm Sewer System (MS4) compliance area. The County is utilizing the City of Santa Rosa's December 2020 Storm Water Low Impact Development Technical Design Manual to assure the project is meeting the conditions of the MS4. The manual guides the County in best practices to reduce storm water pollution, protect water quality, and promote groundwater recharge. Compliance with the manual is intended to satisfy the specific requirements of Order No. R1-2015-0033, National Pollutant Discharge Elimination System (NPDES) No. CA0025054 NPDES Permit, and Waste Discharge Requirements for Discharge from the Municipal Separate Storm Sewer Systems.

In compliance with the MS4, the County is designing permanent bioretention features as a component of the project. Any stormwater that is captured on the new bridge deck will move to bioretention areas on either side of the bridge that will allow sediment and particulates to be filtered prior to entering the waterways. An Initial Storm Water Low Impact Development Submittal will be prepared during the final design phase of the project that will demonstrate compliance with Phase I MS4 Permit as issued by North Coast Regional Water Quality Control Board. In addition to the permanent bioretention features, the County will be required to comply with all water quality conditions set forth in the United States Army Corps of Engineers Section 404 Nationwide 14 permit, North Coast Regional Water Quality Control Board Section 401 Water Quality Certification, as well as the California Department of Fish and Wildlife Section

1602 Lake and Streambed Alteration agreement. These regulatory agencies will require robust temporary and permanent BMPs to ensure water quality is sufficiently protected during and post construction activities. At a minimum, conditions will include restrictions on chemical contaminants and/or sediments from entering the channel, stabilizing the soils during and after construction, and re-establishment of vegetation.

Heavy construction equipment will be utilized during both the installation and removal of the summer crossing. Oils and similar substances from construction equipment can contain a wide variety of hydrocarbons, some of which evaporate rapidly while others sorb to sediments and may persist for long periods of time. These polynuclear aromatic hydrocarbons (PAHs) can prove harmful to benthic communities (EPA 1993) which are a salmonid food source. In a study conducted by Pitt *et al.* 1995 (reviewed in EPA 1999), 50 percent of samples from parking areas were found to be highly or moderately toxic, 67 percent of samples from streets were found to be moderately toxic and 34 percent of samples from landscaped areas were found to be highly or moderately toxic. Some of the identified chronic toxicity effects to benthic invertebrates in the study are decreased growth and respiration rates.

Construction equipment utilized for the proposed action has the potential to leak toxic chemicals, including metals and petroleum hydrocarbons, in to the riverbed and banks. Fluid leaking from construction equipment or cars can also contain metals, which do not degrade in the environment (e.g., mercury, cadmium, lead, chromium) and bioaccumulate in aquatic organisms. Some of the sub-lethal effects that metals can cause in salmonids include: immobilization and impaired locomotion, reduced growth, reduced reproduction, elevated oxygen consumption, genetic damage, impaired metabolism, alteration of gill tissue structure, tumors and lesions, developmental abnormalities, behavior changes (avoidance), immunosuppression (decreased resistance to bacterial infection), and impairment of olfactory and brain functions (Eisler 2000).

During installation and removal, equipment refueling, fluid leakage and maintenance activities risk, it is proposed that no motorized equipment will be left within the river channel (top of bank to top of bank) overnight unless absorbent material is placed under the equipment to contain any leaking fluids. However, this does not completely minimize all the risks. Fluid leakage can occur during operation, refueling and during maintenance activities. There is a potential for leakage of toxic chemicals to occur during construction that may have the potential to affect juvenile and adult coho salmon, Chinook salmon, and steelhead. Most of the work will occur outside of the wetted channel, which reduces the chance that toxic chemicals will be released in the flowing water. If there is a leak, NMFS anticipates that it can be contained prior to entering the flowing water, thus making it unlikely that salmonids will be adversely affected.

Habitat and Cover

Cover is an important habitat component for juvenile salmonids and smolts, both as velocity refuge and as a means of avoiding predation (Shirvell 1990, Meehan and Bjornn 1991, Moyle 2002). Salmonid juveniles will balance their use of cover and foraging habitats based on their competing needs for energy acquisition and safety (Bradford and Higgins 2001). Critical forms of cover include submerged vegetation, woody debris, and the interstitial spaces of stream bed gravel substrate (Raleigh *et al*. 1984). Juveniles will respond to threats of predation, including overhead motions, by huddling together and/or fleeing to nearby cover (Bugert and Bjornn 1991). Few young-of-the-year are found more than one meter from cover (Raleigh *et al*. 1984). Juvenile steelhead, particularly the younger, smaller individuals, have a notable responseto disturbance; they rely on nearby substrate particles (i.e., gravel) for cover more so than other salmonids (Chapman and Bjornn 1969, Everest and Chapman 1972).

Fish migrating through and rearing within the action area will experience degraded aquatic habitat caused by the project for varying durations. However, the installation of vegetated (Rock Slope Protection (RSP) or other hardening structures as part of the new bridge will be installed at the top of bank (none within OHWM) and is not expected to be much larger or more robust than the existing structure(s). Approximately 0.35 acres of RSP will be placed at the existing bridge and at abutment 8 in the Russian River and 0.11 acres will be placed at abutment 1, near Dutch Bill Creek. Therefore, reduced fitness and survival of coho salmon, Chinook salmon, and steelhead due to loss of benthic habitat and channel alteration is expected to be minimal at both the individual and population level.

The proposed project, once constructed, will result in an increase of approximately 0.16 acres of permanent structural shade (from the new, larger bridge) over the mainstem Russian River and 0.05 acres over Dutch Bill Creek. The only vegetation anticipated to be removed for the entire project is approximately 0.5 acres of riparian vegetation near the mouth of Dutch Bill Creek. The new bridge structure will be about 30 feet over the water, which would allow adequate light for riparian growth to return. NMFS does not expect these small changes in shade due to either the increased bridge size or removal of riparian vegetation to have any significant impacts on listed fish.

The new bridge will clear span the low flow channel of the Russian River and Dutch Bill Creek, minimizing the installation of bridge piers within the OHWM. The bridge piles will be cast in steel shells that will be oscillated (not driven) into place to avoid impacts from pile driving. Construction of the project will include removal of three existing concrete bridge bents from the main channel of the Russian River. A remnant abandoned pier, located within the OHWM of the Russian River, from a previous bridge at the site, will also be removed. The proposed bridge will have minimal fill within the OHWM of the Russian River and no fill within Dutch Bill Creek. Therefore, with the removal of the existing structures, permanent obstructions within the OHWM of the Russian River will be reduced.

Food Availability

Juvenile salmonids rely on a mixture of terrestrial and aquatic invertebrates (Rundio and Lindley 2008; Grunblatt *et al*. 2019). Direct loss of aquatic macro invertebrates will likely result when organisms are buried or crushedduring placement of culverts and gravel in the wetted channel. Localized losses in benthic macro invertebrate abundance are expected when substrates are modified (Thomas 1985; Harvey 1986). These organisms are consumed by salmonids, and may represent a substantial portion of their diet at various times of the year. The effect of macro invertebrate loss on salmonids is likely to be temporary because rapid recolonization of the disturbed areas is expected. Reported rates of recolonization range from about one month (Thomas 1985) to 45 days (Harvey 1986). Drift from upstream is likely to provide food supply downstream, as well as insect drop from riparian plants in the action area and upstream unaffected by the project. Since impacts to the substrate will be localized to a small area within the watershed, and the habitat in the action area is not considered highly productive for juvenile rearing, no adverse effects to salmonids are anticipated.

2.1.2 Effects Due to Implementation of Off-site Restoration

In order to improve summer survival of coho salmon and steelhead in Dutch Bill Creek, CSG has recommended that increased efforts to enhance streamflow during the dry season and habitat enhancement projects that increase overwintering habitat may have an immediate benefit to the recovery of listed fish (CSG 2020a). PACT recommends restoring and improving stream habitat in coastal watersheds as a high priority recovery action to prevent further extirpations of CCC ESU coho salmon populations (PACT 2019). To address these needs and offset impacts caused by the bridge replacement, Caltrans will fund an off-site restoration project within Dutch Bill Creek. Potential project types include: instream habitat improvements, instream barrier modification for fish passage improvement, streambank and riparian habitat restoration, upslope watershed restoration, removal of small dams (permanent, flashboard and other seasonal), creation of off-channel/side-channel habitat features and water conservation projects (developing alternative off-stream water supply, water storage tanks, and water measuring devices). The effects of these activities are furthered detailed in Section 2.4 of NMFS' *Restoration Center's Programmatic Biological Opinion for Restoration Projects* and is adopted here by reference (NMFS 2016) (Appendix B).

Of these proposed project types, riparian habitat restoration actions occurring outside of the wetted channel are expected to have only beneficial effects to fish and their habitat. All others may cause a low level of temporary adverse effects to listed species but ultimately result in a long-term benefit. Despite the different scope, size, intensity, and location of these proposed restoration actions, the potential adverse effects to listed salmonids all result from dewatering, fish relocation, and increased sediment into rivers and streams. Dewatering, fish relocation, and structural placement will result in direct effects to listed salmonids, where a small percentage of individuals are expected to be injured or killed. The effects from increased sediment mobilization into streams are usually indirect effects, where the effects to habitat, individuals, or both, are reasonably certain to occur and are later in time. These impacts plus those due to: 1) noise, motion, and vibration disturbance from heavy equipment operation; 2) disturbance to riparian vegetation; 3) chemical contamination from equipment fluids; and 4) reduced benthic macroinvertebrate community will all be either avoided or significantly minimized due to implementation of all protective AMMs from Section 1.3.7 of NMFS' *Restoration Center's Programmatic Biological Opinion for Restoration Projects* (NMFS 2016) (Appendix B).

The selected restoration project will be for the purpose of restoring degraded salmonid habitat and is intended to improve instream cover, pool habitat, spawning gravels, and flow levels; remove barriers to fish passage; and/or reduce or eliminate erosion and sedimentation sources. The project will help to implement recovery actions or strategies in recovery plans for the affected species (NMFS 2012, 2016b). Although the habitat restoration project may cause small losses to the juvenile life history stage of coho salmon or steelhead in the project areas during construction, all of these projects are anticipated to improve salmonid habitat and survival and contribute to recovery of the species over the long-term.

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.

For the purpose of this analysis, the action area that is the subject of this opinion is limited to the permanent project footprint, temporary construction work areas, potential staging areas, and bank to bank width of the Russian River (including the mouth of Dutch Bill Creek), upstream approximately 500 feet and approximately 1.5 miles downstream of the project site, as well as the off-site restoration area within Dutch Bill Creek, as described above in Section 2.3 above. Actions occurring outside of the action area may affect the action area. For example, a new water diversion upstream may affect flows in the action area.Therefore, future actions occurring in the watershed may be considered cumulative effects, depending upon their specific location and impact. Future Federal actions, including the ongoing operation of dams, hatcheries, fisheries, water withdrawals, and land management activities will be reviewed through separate ESA section 7 consultation processes and are not considered here.

Additional development, tourism, and accompanying infrastructure construction is expected to occur in the Russian River Watershed based on the general and specific plans of local communities and Sonoma County. Additional development is likely to lead to increasing water demands, which may impact stream flows if current allocations are not being fully utilized. Agricultural activities surrounding the action area are primarily the cultivation of crops, mainly viticulture. The impacts of this land use on aquatic species include decreased bank stability, loss of shade and cover-producing riparian vegetation, increased sediment inputs, decreased ground and surface water supply, and elevated coliform bacteria levels. Vineyard development and management will continue to impact salmonid habitat by increasing sediment delivery to streams, diverting and decreasing stream flow, and encroaching on riparian habitat.

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 Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

As independent populations, federally endangered CCC coho salmon and threatened CCC steelhead and CC Chinook salmon within the Russian River watershed, including Dutch Bill Creek, are important to the recovery of the ESU and DPS, respectively. Many independent populations of CCC coho salmon that supported the species' overall numbers and geographic distributions in the past have been extirpated and steelhead and Chinook salmon numbers are substantially reduced from historic levels. The Russian River is the largest watershed within the CCC coho salmon ESU and is critical to the survival and recovery of the species. The steelhead and Chinook salmon populations that use the action area, while substantially reduced from historical numbers, appear to be relatively stable. CCC coho salmon abundance has improved slightly since 2011 within several independent populations, although all populations remain well below their recovery targets. These populations are likely to persist with enough resiliency to rebound from limited impacts for the foreseeable future. However, due to their low numbers, the continuation of impacts from current baseline conditions to the population's numbers, distribution, or reproduction could limit their chance of survival and recovery. The recovery of these populations will, therefore, depend upon programs that protect and restore aquatic habitats in watersheds and the continued reduction of impacts from land use and water withdrawal.

Dutch Bill Creek is one of the few remaining tributaries in the lower Russian River that still supports spawning and rearing for coho salmon as well as for steelhead. Dutch Bill Creek is also an integral stream for the RRSCBP conservation hatchery program and is one of the four such tributaries assigned for life cycle monitoring as part of the Coastal Monitoring Program. The populations of coho salmon that use the action area are also critical in sustaining and recovering this species because they are likely to be relied upon as both natural and managed "source" populations as part of the RRSCBP. The action area is within a core priority area for protection and restoration as detailed in the CCC coho salmon recovery plan (NMFS 2012a). Therefore, further degradation of the Russian River watershed (and tributaries including Dutch Bill Creek) could appreciably affect the survival and recovery chances of this listed species by reducing the number of fish available to repopulate the species.

The action area represents a relatively small portion of the overall CCC coho salmon, CCC steelhead, and CC Chinook salmon geographic range. Small populations are more vulnerable to demographic and environmental fluctuations than are larger populations (Gilpin and Soule 1986, Pimm *et at.* 1988), while each small population also acts as a buffer against extinction of the species. The species' relatively broad distribution throughout the species' ranges is a positive indicator because species with broad distributions may allow a species to avoid environmental fluctuations and stochastic events as a whole (Pimm *et al.* 1988), even if they suffer local extirpation. However, the value of these watersheds to salmonids remains significant given the current degraded condition of habitat throughout the ESUs and DPS. Because degraded habitat conditions, and thus lowered carrying capacity, throughout the species' range are not expected to improve dramatically in the near future, remaining areas of habitat which appear to support relatively large sub-populations are judged highly important.

Global climate change presents another real threat to the long-term persistence of listed salmonids, especially when combined with the current depressed population status and human caused impacts. Regional (*i.e.,* North America) climate projections for the mid to late 21st Century expect more variable and extreme inter-annual weather patterns, with a gradual warming pattern in general across California and the Pacific Northwest. However, extrapolating these general forecasts to the smaller action area is difficult, given local nuances in geography and other weather-influencing factors. The risk of increased water temperatures, wildfires, and drought will persist in the action area due to climate change over the next several decades, reinforcing the likelihood of reduced carrying capacity in the action area due to loss of habitat.

The construction of a new bridge and demolition of the old structure over three consecutive work seasons may adversely affect all life stages of coho salmon and Chinook salmon, as well as juvenile and smolt steelhead, and designated critical habitat for all three species. A small number of rearing coho salmon and steelhead fry or juveniles, which do not flee the area where gravel is pushed into standing or flowing water, may be crushed while taking refuge in the interstices of the substrate when temporary culverts and gravel work pads are placed and removed from, the Russian River and Dutch Bill Creek. Increases in turbidity and degraded water quality via stormwater runoff and noise from construction equipment may result in behavior modifications that result in short-term behavioral changes of individual fish. The behavioral modifications of juvenile Chinook and coho salmon and steelhead which may result from project impacts, (i.e., reduced feeding rates, occupation of less suitable habitat, and potentially greater intra and/or inter-species competition), will likely result in less fitness of individual fish. Reduced fitness of individual fish, along with potentially increased predation risks, may result in a minor reduction in survival rates. Passage of adult fish and smolts may be disrupted or hindered due to in-water construction activity and changes in hydrology from culvert/work pad installation. Delayed or modified migration behavior could affect long-term reproductive success and the ability for individual fish to survival.

The ultimate effect of changes in the distribution and productivity of salmon and steelhead due to project impacts will vary with life stage, the duration and severity of the stressor, the frequency of stressful situations, the number and temporal separation between exposures, and the number of contemporaneous stressors experienced (Newcombe and Jensen 1996; Shreck 2000). Overall, the action area is very small compared to the total number of miles of critical habitat available in each species' recovery domain. The number of individual salmonids and steelhead that may be adversely affected or killed during proposed action activities is expected to make up a very small portion of the individuals within the action area, a smaller portion of the Russian River watershed populations, and subsequently an even smaller portion of the overall ESUs and DPS. Because the quality of habitat in and around the action area is adequate to support rearing salmonids, NMFS expects fish will be able to find food and cover in the vicinity of the project site as needed during construction activities.

It is unlikely that the small loss of salmon and steelhead from freshwater life history stages resulting from this proposed action, via the effects of replacing the Bohemian Bridge (i.e., placement and movement of instream gravel, fish relocation activities, altered stream hydrology/morphology, impaired water quality, and degraded riparian habitat conditions), would impact future adult returns such that impacts would occur to the populations' resilience and persistence over time. As noted in the effects section, effects from the proposed action are likely to be limited to small areas within the action area. In addition, given the small reduction in the growth and survival of fish that will be directly affected, primarily at the fry, parr, and smolt life stages, the relatively low intensity and severity of that reduction at the population level, any adverse effects to fish growth and survival are likely to be inconsequential to the populations inhabiting the action area. Moreover, the proposed restoration project in Dutch Bill Creek is also reasonably certain to lead to some degree of population enhancement within the vicinity of the action area, including more normal growth and development and improved survival. Thus, likely having long-term beneficial effects on population structure.

The adverse effects of the proposed action will be too short-term, and limited to harm or kill more than a small number of (largely) juvenile fish across the range of a single population. Thus, it is unlikely that the small losses of fish resulting from this proposed action would impact future adult returns. The resilience and persistence of these populations, their numbers, reproduction, and distribution, are unlikely to be meaningfully reduced by the proposed action. Habitat changes resulting from this project is limited to a very small area. The bridge will be designed to clear-span the main channel of the Russian River and is high enough that any vegetation that is disturbed or removed from the bridge footprint should be able to regrow. The proposed project includes removal of three existing concrete bridge bents and an existing pier from the main channel of the Russian River. The proposed bridge will have minimal fill within the OHWM of the Russian River and no fill within Dutch Bill Creek. Therefore, with the removal of the existing structures, permanent obstructions and hard surfaces within the OHWM of the Russian River will be reduced. Consequently, we do not expect that implementation of the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of the CCC coho salmon ESU, CCC steelhead DPS or CC Chinook salmon ESU in the wild by reducing their numbers, reproduction, or distribution. The bridge replacement is also not likely to diminish the value of designated critical habitat in the Russian River or Dutch Bill Creek.

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 CCC coho salmon, CC Chinook salmon or 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.

2.9.1. Amount or Extent of Take

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

Bridge Replacement

The construction activities associated with the replacement of the Bohemian Bridge, conducted from June 15 to October 15, over three work seasons by the County, as funded by the CalTrans, is reasonably certain to result in incidental take of federally endangered CCC coho and threatened CC Chinook salmon and CCC steelhead in the form of injury, harm, or mortality as follows:

In this opinion, NMFS determined that a low-level of incidental take in the form of harm of any freshwater life stage of CCC coho salmon or CC Chinook salmon, and juvenile or smolt CCC steelhead is reasonably certain to occur from habitat-related impacts (altered stream hydrology/morphology, impaired water quality, and degraded riparian habitat conditions) due to the construction activities associated with the bridge replacement. NMFS expects this incidental take be mostly localized and occur within the action areas. The precise number of these listed salmonids that are expected to be incidentally taken resulting from these habitat-related impacts cannot be accurately quantified because: 1) these species are relatively small (especially as eggs, alevins, and juveniles); 2) these species live in aquatic environments where visibility is often low, hiding cover is often available, and predators feed; 3) exactly how many adults that will migrate through the action area will experience delays or behavioral modifications is unknown; and 4) we cannot precisely predict where and when habitat impacts may affect these species later in their life cycles. NMFS will, therefore, use the following incidental take surrogates pursuant to 50 CFR 402.14(i)(1)(i).

As described in the preceding opinion, based on prior experience with current relocation techniques and protocols likely to be used to conduct the fish relocation, unintentional mortality of listed salmonids expected from capturing and handling fish is not likely to exceed three percent of the total fish handled. The amount of incidental take during fish relocation will be considered exceeded if more than three percent of the total fish handled are injured or killed during any construction activity.

Off-site Restoration

Implementation of a pre-approved off-site restoration project within Dutch Bill Creek is expected to result in incidental take of CCC coho salmon and threatened CCC steelhead in the form of injury, harm or mortality during dewatering and fish relocation activities. NMFS expects no more than three percent of the juvenile salmon and steelhead captured will be injured or killed during dewatering and fish relocation activities.

Therefore, incidental take is limited to minimal mortality and harm associated with the Bohemian Bridge replacement and implementation of off-site restoration within Dutch Bill Creek. All salmonids and steelhead present in the action area annually during construction activities between June 15 and October 15 may be harassed or harmed by project activities. NMFS expects that no lethal take will occur to adult salmonids and steelhead. Incidental take which results in mortality is limited to the juvenile life stage for coho salmon, Chinook salmon, and steelhead which may take refuge in the interstitial spaces of the substrate in the immediate area where gravel will be pushed into standing or flowing water, or those possibly stranded downstream due to minor dewatering of the river's edge. Incidental take which results in harm is limited to: 1) juvenile salmonids and steelhead occupying the action area during the period of construction and off-site restoration which may be subjected to a temporarily degraded water quality causing behavioral modifications; and 2) adult salmonids migrating through the action area which many experience migration delays, which may result in a minor reduction in survival rates

2.9.2. Effect of the Take

In this 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).

1. Measures shall be taken to minimize the amount or extent of incidental take due to construction activities associated with the Bohemian Bridge replacement and off-site restoration within Dutch Bill Creek.

2. Measures shall be taken to reduce delivery of contaminants from fuel leaks or storm run-off from road approaches and the bridge from being delivered directly into the river.

3. Measures shall be taken to monitor the amount and extent of incidental take by reporting

the results of fish relocation activities as well as other project details.

2.9.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, Caltrans must comply (or must ensure that any applicant complies) with the following terms and conditions. Caltrans or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the terms and condition, protective coverage for the proposed action would likely lapse.

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

1. The applicant will develop and submit a fish relocation plan to NMFS for review and approval within 30 days from the start of construction.

2. The applicant shall provide the design plans for culvert installation for each of the three work seasons to NMFS for review and approval within 60 days from the start of construction.

3. The applicant shall retain a qualified biologist with expertise in the areas of salmonid and steelhead biology, behavior, habitat relationships; and biological monitoring. The applicant shall ensure that all fisheries biologists working on this project be qualified to monitor fish presence and behavior in a manner which minimizes all potential risks to ESA-listed salmonids and steelhead.

4. If ESA-listed fish are handled, the biologist shall ensure that the fish are handled with extreme care and they shall be kept in water to the maximum extent possible during rescue activities. All captured fish shall be kept in cool, shaded, aerated water protected from excessive noise, jostling, or overcrowding any time they are not in the stream, and fish shall not be removed from this water except when released. To avoid predation the biologist shall have at least two containers and segregate young-of-year fish from larger age-classes and other potential aquatic predators. Captured salmonids shall be relocated as soon as possible to a suitable instream location where suitable habitat conditions are present to allow for survival of transported fish and fish already present.

5. The biologist shall be on-site during all construction events to ensure that all ESA-listed fish are avoided to the maximum extent practicable and any use of seining or block-nets is in accordance with BMPs developed to minimize potential harmful effects or mortality.

The following term and condition implements reasonable and prudent measure 2:

1. Construction equipment used within the river channel will be checked each day prior to work within the river channel (top of bank to top of bank) and, if necessary, action will be taken to prevent fluid leaks. If leaks occur during work in the channel, the County or their contractors will contain the spill and removed the affected soil.

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

1. In order to monitor the impact of incidental take, Caltrans or the County must notify the NMFS Santa Rosa Office by letter or email within 30 days after project completion each year and describe in detail any incidental take that occurred during the project. This shall include the species taken, date taken, type of take (injury or mortality), number taken, and fork length of any mortalities.

    a. Any injuries or mortality that exceeds three percent shall be reported to the NMFS Santa Rosa Office by email within 48 hours and construction activities shall cease until a NMFS biologist is on site to oversee the remainder of any fish relocation activities.
    b. Any salmonid or steelhead mortalities must be retained, placed in an appropriately sized whirl-pack or zip-lock bag, labeled with the date and time of collection, fork length, location of capture, and frozen as soon as possible. Frozen samples must be retained until specific instructions are provided by NMFS.

2. The applicant will prepare an implementation monitoring report following each year that construction activities occur and submit to NMFS annually by January 1. The monitoring report should include the following:

    a. Project identification;
    b. Permittee name, permit number, and project name;
    c. Caltrans and County contact persons;
    d. Start and end dates of construction activities;
    e. Summary of habitat conditions – Include photos (including both river banks, upstream and downstream views, and the bridge construction itself) of the project site before, during and after construction activities;
    f. Results of downstream turbidity monitoring before, during and after construction.

2.10. Conservation Recommendations

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

1. Caltrans and the County are encouraged to explore alternatives that would reduce or alleviate the need to place fill material in the flowing waters of the Russian River or Dutch Bill Creek.

2. Caltrans and the County are encouraged to explore alternatives that would reduce or alleviate the need to work in the flowing waters of the Russian River or Dutch Bill

Creek during the adult Chinook outmigration window from early September through October 15.

2.11. Reinitiation of Consultation

This concludes formal consultation for the Bohemian Bridge Replacement in Monte Rio, 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 ITS 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."

3. MAGNUSON–STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

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

This analysis is based, in part, on the EFH assessment provided by Caltrans and descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

Pacific coast salmon EFH may be adversely affected by the proposed action. Specific habitats identified in the PFMC (2014) for pacific coast salmon include habitat areas of particular concern (HAPCs), identified as: 1) complex channels and floodplain habitats; 2) thermal refugia; and 3) spawning habitat. HAPCs for coho salmon and Chinook salmon include all waters, substrates, and associated biological communities falling within critical habitat areas described above in the accompanying biological opinion for the project located on the mainstem of the Russian River. The existing habitat at the project site lacks adequate in-stream cover and experiences too much solar exposure to provide good habitat for coho salmon or Chinook salmon year-round. There is no spawning habitat within the project location. However, the site provides a migration corridor for adults and juveniles of both species.

3.2. Adverse Effects on Essential Fish Habitat

The potential adverse effects of the Project on EFH have been described in the preceding biological opinion and include disturbance of the channel bed and banks, temporary loss of wetted habitat, and temporary loss of riparian vegetation. Therefore, the effects of the project on ESA-listed species are anticipated to be the same as the effects to EFH in the action area.

3.3. Essential Fish Habitat Conservation Recommendations

Section 305(b)(4)(A) of the MSA authorizes NMFS to provide EFH Conservation Recommendations that will minimize adverse effects of an activity on EFH. Although temporary potential adverse effects are anticipated as a result of the project activities, the proposed minimization and avoidance measures, and BMPs in the accompanying biological opinion are sufficient to avoid, minimize, and/or mitigate for the anticipated effects. Therefore, no additional EFH Conservation Recommendations are necessary at this time that would otherwise offset the adverse effects to EFH.

3.4. Supplemental Consultation

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

4. Data Quality Act Documentation and Pre-Dissemination Review

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

4.1. Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are Caltrans and the County of Sonoma. Individual copies of this opinion were provided to these agencies. 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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Appendix A: NMFS 2019 *Guidelines for Salmonid Passage at Stream Crossings*

National Marine Fisheries Service

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GUIDELINES FOR SALMONID PASSAGE AT STREAM CROSSINGS

For Applications in California at Engineered Stream Crossings to Facilitate Passage of Anadromous Salmonids

Original Issue Date: September 2001

Addendum Issue Date: September 2019

ADDENDUM

NMFS 2001 GUIDELINES FOR SALMONID PASSAGE AT STREAM CROSSINGS

August 30, 2019

Applicable to anadromous salmonid watersheds of California

The National Marine Fisheries Service, Southwest Region, issued *Guidelines for Salmonid Passage at Stream Crossings* in September, 2001. Since that time there has been more field-based monitoring of juvenile salmonid migration behaviors, along with scientific study of the diversity of California's hydrologic conditions[1] and new laboratory-based research on juvenile fish leaping ability.[2] Additionally, the 2001 guidelines are sometimes applied in settings for which they were not intended. For these reasons we hereby amend the 2001 guidelines with the following modifications.

1. The NMFS 2001 guidelines apply to the design of fish passage projects for stream crossings (e.g., culverts and bridges), inside stream crossing structures, and to adjacent inlet and outlet works to the structure in anadromous fish watersheds of California.
2. The maximum hydraulic drop for juvenile salmonids is increased from 6" to 12" as a general guideline. Site specific considerations may justify a different maximum hydraulic drop such as the presence of very small or critically endangered fish, very cold water, or matching the gradient of the local reference reach)
3. The high fish passage design flow for all hydraulic designs should be 50% of the 2-year event (where less than 20 years of gauge data exist) or the 1% exceedance flow during the migration season (where 20+ years of gauge data exist.

New guidelines for most salmonid habitat settings including stream crossings are in preparation, with anticipated issuance in 2022. Until new guidelines are issued, NMFS requests that users of the 2001 (California) stream crossing design guidelines

1. Apply the guidelines to the settings where they are intended,

2. Explore alternative approaches as prioritized in 2001,

3. Seek technical assistance for all other fish passage problems.

Please direct questions regarding this Addendum and the NMFS 2001 Guidelines to:
Environmental Services Branch Supervisor
National Marine Fisheries Service
777 Sonoma Avenue, Suite 325
Santa Rosa, CA 95404
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[1] Lang and Love, August 2014, *Comparing Fish Passage Opportunity Using Different Fish Passage Design Flow Criteria in Three West Coast Climate Zones*, prepared for National Marine Fisheries Service, Santa Rosa, CA.
[2] *NMFS Technical Memo - Interim Juvenile Jump Test Results*, NMFS-Santa Rosa, August 2019.

GUIDELINES FOR SALMONID PASSAGE AT STREAM CROSSINGS

For Applications in California at Engineered Stream Crossings to Facilitate Passage of Anadromous Salmonids

1.0 INTRODUCTION

This document provides guidelines for design of stream crossings to aid upstream and downstream passage of migrating salmonids. It is intended to facilitate the design of a new generation of stream crossings, and assist the recovery of threatened and endangered salmon species. These guidelines are offered by the National Marine Fisheries Service, Southwest Region (NMFS-SWR), as a result of its responsibility to prescribe fishways under the Endangered Species Act, the Magnuson-Stevens Act, the Federal Power Act, and the Fish and Wildlife Coordination Act. The guidelines apply to all public and private roads, trails, and railroads within the range of anadromous salmonids in California.

Stream crossing design specifications are based on the previous works of other resource agencies along the U.S. West Coast. They embody the best information on this subject at the time of distribution. Meanwhile, there is mounting evidence that impassable road crossings are taking a more significant toll on endangered and threatened fish than previously thought. New studies are revealing evidence of the pervasive nature of the problem, as well as potential solutions. Therefore, this document is appropriate for use until revised, based on additional scientific information, as it becomes available.

The guidelines are general in nature. There may be cases where site constraints or unusual circumstances dictate a modification or waiver of one or more of these design elements. Conversely, where there is an opportunity to protect salmonids, additional site-specific criteria may be appropriate. Variances will be considered by the NMFS on a project-by-project basis. When variances from the technical guidelines are proposed, the applicant must state the specific nature of the proposed variance, along with sufficient biological and/or hydrologic rationale to support appropriate alternatives. Understanding the spatial significance of a stream crossing in relation to salmonid habitat within a watershed will be an important consideration in variance decisions.

Protocols for fish-barrier assessment and site prioritization are under development by the California Department of Fish and Game (CDFG). These will be available in updated versions of the *California Salmonid Stream Habitat Restoration Manual*. Most streams in California also support important populations of non-salmonid fishes, amphibians, reptiles, macroinvertebrates, insects, and other organisms important to the aquatic food web. Some of these may also be threatened or endangered species and require "ecological connectivity" that dictate other design criteria not covered in this document. Therefore, the project applicant should check with the local Fish and Game office, the U.S. Fish and Wildlife Service (USFWS), and/or tribal biologists to ensure other species are fully considered.

The California Department of Transportation Highway Design Manual defines a culvert as “a closed conduit which allows water to pass under a highway," and in general, has a single span of less than 20 feet or multiple spans totaling less than 20 feet. For the purpose of fish passage, the distinction between bridge, culvert or low water crossing is not as important as the effect the structure has on the form and function of the stream. To this end, these criteria conceptually apply to bridges and low water crossings, as well as culverts.

2.0 PREFERRED ALTERNATIVES AND CROSSINGS

The following alternatives and structure types should be considered in order of preference:

1. *Nothing* - Road realignment to avoid crossing the stream
2. *Bridge* - spanning the stream to allow for long term dynamic channel stability
3. *Streambed simulation strategies* - bottomless arch, embedded culvert design, or ford
4. *Non-embedded culvert* - this is often referred to as a hydraulic design, associated with more traditional culvert design approaches limited to low slopes for fish passage
5. *Baffled culvert, or structure designed with a fishway* - for steeper slopes

If a segment of stream channel where a crossing is proposed is in an active salmonid spawning area then only full span bridges or streambed simulations are acceptable.

3.0 DESIGNING NEW AND REPLACEMENT CULVERTS

The guidelines below are adapted from culvert design criteria published by many federal and state organizations including the California Department of Fish and Game (CDFG, 2001). It is intended to apply to new and replacement culverts where fish passage is legally mandated or important.

3.1 Active Channel Design Method

The Active Channel Design method is a simplified design that is intended to size a culvert sufficiently large and embedded deep enough into the channel to allow the natural movement of bedload and formation of a stable bed inside the culvert. Determination of the high and low fish passage design flows, water velocity, and water depth is not required for this method since the stream hydraulic characteristics within the culvert are intended to mimic the stream conditions upstream and downstream of the crossing. This design method is usually not suitable for stream channels that are greater than 3% in natural slope or for culvert lengths greater than 100 feet. Structures for this design method are typical round, oval, or squashed pipes made of metal or reinforced concrete.

- Culvert Width - The minimum culvert width shall be equal to, or greater than, 1.5 times the active channel width.
- Culvert Slope - The culvert shall be placed level (0% slope).
- Embedment - The bottom of the culvert shall be buried into the streambed not less than 20% of the culvert height at the outlet and not more than 40% of the culvert height at the inlet.

3.2 Stream Simulation Design Method

The Stream Simulation Design method is a design process that is intended to mimic the natural stream processes within a culvert. Fish passage, sediment transport, flood and debris conveyance within the culvert are intended to function as they would in a natural channel. Determination of the high and low fish passage design flows, water velocity, and water depth is not required for this option since the stream hydraulic characteristics within the culvert are designed to mimic the stream conditions upstream and downstream of the crossing. The structures for this design method are typically open bottomed arches or boxes but could have buried floors in some cases. These culverts contain a streambed mixture that is similar to the adjacent stream channel. Stream simulation culverts require a greater level of information on hydrology and geomorphology (topography of the stream channel) and a higher level of engineering expertise than the Active Channel Design method.

- Culvert Width - The minimum culvert width shall be equal to, or greater than, the bankfull channel width. The minimum culvert width shall not be less than 6 feet.
- Culvert Slope - The culvert slope shall approximate the slope of the stream through the reach in which it is being placed. The maximum slope shall not exceed 6%.
- Embedment - The bottom of the culvert shall be buried into the streambed not less than 30% and not more than 50% of the culvert height. For bottomless culverts the footings or foundation should be designed for the largest anticipated scour depth.

3.3 Hydraulic Design Method

The Hydraulic Design method is a design process that matches the hydraulic performance of a culvert with the swimming abilities of a target species and age class of fish. This method targets distinct species of fish and therefore does not account for ecosystem requirements of non-target species. There are significant errors associated with estimation of hydrology and fish swimming speeds that are resolved by making conservative assumptions in the design process. Determination of the high and low fish passage design flows, water velocity, and water depth are required for this option.

The Hydraulic Design method requires hydrologic data analysis, open channel flow hydraulic calculations and information on the swimming ability and behavior of the target group of fish. This design method can be applied to the design of new and replacement culverts and can be used to evaluate the effectiveness of retrofits of existing culverts.

- Culvert Width - The minimum culvert width shall be 3 feet.
- Culvert Slope - The culvert slope shall not exceed the slope of the stream through the reach in which it is being placed. If embedment of the culvert is not possible, the maximum slope shall not exceed 0.5%.
- Embedment - Where physically possible, the bottom of the culvert shall be buried into the streambed a minimum of 20% of the height of the culvert below the elevation of the tailwater control point downstream of the culvert. The minimum embedment should be at least 1 foot. Where physical conditions preclude embedment, the hydraulic drop at the outlet of a culvert shall not exceed the limits specified above.

Hydrology for Fish Passage under the Hydraulic Design Method

- **High Fish Passage Design Flow** - The high design flow for adult fish passage is used to determine the maximum water velocity within the culvert. Where flow duration data is available or can be synthesized the high fish passage design flow for adult salmonids should be the 1% annual exceedance. If flow duration data or methods necessary to compute them are not available then 50% of the 2 year flood recurrence interval flow may be used as an alternative. Another alternative is to use the discharge occupied by the cross-sectional area of the active stream channel. This requires detailed cross section information for the stream reach and hydraulic modeling. For upstream juvenile salmonid passage the high design flow should be the 10% annual exceedance flow.
- **Low Fish Passage Design Flow** - The low design flow for fish passage is used to determine the minimum depth of water within a culvert. Where flow duration data is available or can be synthesized the 50% annual exceedance flow or 3 cfs, whichever is greater, should be used for adults and the 95% annual exceedance flow or 1 cfs, whichever is greater, should be used for juveniles.

Maximum Average Water Velocities in the Culvert at the High Fish Passage Design Flow - Average velocity refers to the calculated average of velocity within the barrel of the culvert. Juveniles require 1 fps or less for upstream passage for any length culvert at their High Fish Passage Design Flow. For adult salmonids use the following table to determine the maximum velocity allowed.

Culvert Length (ft)	Velocity (fps) - Adult Salmonids
<60	6
60-100	5
100-200	4
200-300	3
>300	2

Minimum Water Depth at the Low Fish Passage Design Flow - For non-embedded culverts, minimum water depth shall be twelve 12 inches for adult steelhead and salmon, and six 6 inches for juvenile salmon.

Juvenile Upstream Passage - Hydraulic design for juvenile upstream passage should be based on representative flows in which juveniles typically migrate. Recent research (NMFS, 2001, in progress) indicates that providing for juvenile salmon up to the 10% annual exceedance flow will cover the majority of flows in which juveniles have been observed moving upstream. The maximum average water velocity at this flow should not exceed 1 fps. In some cases over short distances 2 fps may be allowed.

Maximum Hydraulic Drop - Hydraulic drops between the water surface in the culvert and the water surface in the adjacent channel should be avoided for all cases. This includes the culvert inlet and outlet. Where a hydraulic drop is unavoidable, its magnitude should be evaluated for both high design flow and low design flow and shall not exceed 1 foot for adults or 6 inches for juveniles. If a hydraulic drop occurs at the culvert outlet, a jump pool of at least 2 feet in depth should be provided.

3.4 Structural Design and Flood Capacity

All culvert stream crossings, regardless of the design option used, shall be designed to withstand the 100-year peak flood flow without structural damage to the crossing. The analysis of the structural integrity of the crossing shall take into consideration the debris loading likely to be encountered during flooding. Stream crossings or culverts located in areas where there is significant risk of inlet plugging by flood borne debris should be designed to pass the 100-year peak flood without exceeding the top of the culvert inlet (Headwater-to-Diameter Ratio less than one). This is to ensure a low risk of channel degradation, stream diversion, and failure over the life span of the crossing. Hydraulic capacity must be compensated for expected deposition in the culvert bottom.

3.5 Other Hydraulic Considerations

Besides the upper and lower flow limit, other hydraulic effects need to be considered, particularly when installing a culvert:

- Water surface elevations in the stream reach must exhibit gradual flow transitions, both upstream and downstream. Abrupt changes in water surface and velocities must be avoided, with no hydraulic jumps, turbulence, or drawdown at the entrance. A continuous low flow channel must be maintained throughout the entire stream reach.
- In addition, especially in retrofits, hydraulic controls may be necessary to provide resting pools, concentrate low flows, prevent erosion of stream bed or banks, and allow passage of bedload material.
- Culverts and other structures should be aligned with the stream, with no abrupt changes in flow direction upstream or downstream of the crossing. This can often be accommodatedby changes in road alignment or slight elongation of the culvert. Where elongation would be excessive, this must be weighed against better crossing alignment and/or modified transition sections upstream and downstream of the crossing. In crossings that are unusually long compared to streambed width, natural sinuosity of the stream will be lost and sediment transport problems may occur even if the slopes remain constant. Such problems should be anticipated and mitigated in the project design.

4.0 RETROFITTING CULVERTS

For future planning and budgeting at the state and local government levels, redesign and replacement of substandard stream crossings will contribute substantially to the recovery of salmon stocks throughout the state. Unfortunately, current practices do little to address the problem: road crossing corrections are usually made by some modest level of incremental, low cost "improvement" rather than re-design and replacement. These usually involve bank or structure stabilization work, but frequently fail to address fish passage. Furthermore, bank stabilization using hard point techniques frequently denigrates the habitat quality and natural features of a stream. Nevertheless, many existing stream crossings can be made better for fish passage by cost-effective means. The extent of the needed fish passage improvement work depends on the severity of fisheries impacts, the remaining life of the structure, and the status of salmonid stocks in a particular stream or watershed.

For work at any stream crossing, site constraints need to be taken into consideration when selecting options. Some typical site constraints are ease of structure maintenance, construction windows, site access, equipment, and material needs and availability. The decision to replace or improve a crossing should fully consider actions that will result in the greatest net benefit for fish passage. If a particular stream crossing causes substantial fish passage problems which hinder the conservation and recovery of salmon in a watershed, complete redesign and replacement is warranted. *Consolidation and/or decommissioning of roads can sometimes be the most cost-effective option*. Consultations with NMFS or CDFG biologists can help in selecting priorities and alternatives.

Where existing culverts are being modified or retrofitted to improve fish passage, the Hydraulic Design method criteria should be the design objective for the improvements. However, it is acknowledged that the conditions that cause an existing culvert to impair fish passage may also limit the remedies for fish passage improvement. Therefore, short of culvert replacement, the Hydraulic Design method criteria should be the goal for improvement but not necessarily the required design threshold.

Fish passage through existing non-embedded culverts may be improved through the use of gradient control weirs upstream or downstream of the culvert, interior baffles or weirs, or in some cases, fish ladders. However, these measures are not a substituted for good fish passage design of new or replacement culverts. The following guidelines should be used:

- **Hydraulic Controls -** Hydraulic controls in the channel upstream and/or downstream of a culvert can be used to provide a continuous low flow path through culvert and stream reach. They can be used to facilitate fish passage by establishing the following desirable conditions: Control depth and water velocity within culvert, concentrate low flows, provide resting pools upstream and downstream of culvert and prevent erosion of bed and banks. A change in water surface elevation of up to one foot is acceptable for adult passage conditions, provided water depth and velocity in the culvert meet other hydraulic guidelines. A jump pool must be provided that is *at least* 1.5 times the jump height, or a minimum of two feet deep, whichever is deeper.

- **Baffles** - Baffles may provide incremental fish passage improvement in culverts with excess hydraulic capacity that cannot be made passable by other means. Baffles may increase clogging and debris accumulation within the culvert and require special design considerations specific to the baffle type. Culverts that are too long or too high in gradient require resting pools, or other forms of velocity refuge spaced at increments along the culvert length.

- **Fishways -** Fishways are generally not recommended, but may be useful for some situations where excessive drops occur at the culvert outlet. Fishways require specialized site-specific design for each installation. A NMFS or CDFG fish passage specialist should be consulted.

- **Multiple Culverts** - Retrofitting multiple barrel culverts with baffles in one of the barrels may be sufficient as long as low flow channel continuity is maintained and the culvert is reachable by fish at low stream flow.

5.0 OTHER GENERAL RECOMMENDATIONS

Trash racks and livestock fences should not be used near the culvert inlet. Accumulated debris may lead to severely restricted fish passage, and potential injuries to fish. Where fencing cannot be avoided, it should be removed during adult salmon upstream migration periods. Otherwise, a minimum of 9 inches clear spacing should be provided between pickets, up to the high flow water surface. Timely clearing of debris is also important, even if flow is getting around the fencing. Cattle fences that rise with increasing flow are highly recommended.

Natural or artificial supplemental lighting should be provided in new and replacement culverts that are over 150 feet in length. Where supplemental lighting is required the spacing between light sources shall not exceed 75 feet.

The NMFS and the CDFG set in-stream work windows in each watershed. Work in the active stream channel should be avoided during the times of year salmonids are present. Temporary crossings, placed in salmonid streams for water diversion during construction activities, should meet all of the guidelines in this document. However, if it can be shown that the location of a temporary crossing in the stream network is not a fish passage concern at the time of the project, then the construction activity only needs to minimize erosion, sediment delivery, and impact to surrounding riparian vegetation.

Culverts shall only be installed in a de-watered site, with a sediment control and flow routing plan acceptable to NMFS or CDFG. The work area shall be fully restored upon completion of construction with a mix of native, locally adapted, riparian vegetation. Use of species that grow extensive root networks quickly should be emphasized. Sterile, non-native hybrids may be used for erosion control in the short term if planted in conjunction with native species.

Construction disturbance to the area should be minimized and the activity should not adversely impact fish migration or spawning. If salmon are likely to be present, fish clearing or salvage operations should be conducted by qualified personnel prior to construction. If these fish are listed as threatened or endangered under the federal or state Endangered Species Act, consult directly with NMFS and CDFG biologists to gain authorization for these activities. Care should be taken to ensure fish are not chased up under banks or logs that will be removed or dislocated by construction. Return any stranded fish to a suitable location in a nearby live stream by a method that does not require handling of the fish.

If pumps are used to temporarily divert a stream to facilitate construction, an acceptable fish screen must be used to prevent entrainment or impingement of small fish. Contact NMFS or CDFG hydraulic engineering staff for appropriate fish screen specifications. Unacceptable wastewater associated with project activities shall be disposed of off-site in a location that will not drain directly into any stream channel.

6.0 POST-CONSTRUCTION EVALUATION AND LONG TERM MAINTENANCE AND ASSESSMENT

Post-construction evaluation is important to assure the intended results are accomplished, and that mistakes are not repeated elsewhere. There are three parts to this evaluation:

1) Verify the culvert is installed in accordance with proper design and construction procedures.
2) Measure hydraulic conditions to assure that the stream meets these guidelines.
3) Perform biological assessment to confirm the hydraulic conditions are resulting in successful passage.

NMFS and/or CDFG technical staff may assist in developing an evaluation plan to fit site-specific conditions and species. The goal is to generate feedback about which techniques are working well, and which require modification in the future. These evaluations are not intended to cause extensive retrofits of any given project unless the as-built installation does not reasonably conform to the design guidelines, or an obvious fish passage problem continues to exist. Over time, the NMFS anticipates that the second and third elements of these evaluations will be abbreviated as clear trends in the data emerge.

Any physical structure will continue to serve its intended use only if it is properly maintained. During the storm season, timely inspection and removal of debris is necessary for culverts to continue to move water, fish, sediment, and debris. In addition, all culverts should be inspected at least once annually to assure proper functioning. Summary reports should be completed annually for each crossing evaluated. An annual report should be compiled for all stream crossings and submitted to the resource agencies. A less frequent reporting schedule may be agreed upon for proven stream crossings. Any stream crossing failures or deficiencies discovered should be reported in the annual cycle and corrected promptly.

8.0 DEFINITIONS

These definitions apply to terms used in this document. Meanings may differ when used in another context and are not legal unless otherwise noted. Definitions were shortened, paraphrased or adapted to fit regional conditions and for ease of understanding.

Active Channel: A waterway of perceptible extent that periodically or continuously contains moving water. It has definite bed and banks which serve to confine the water and includes stream channels, secondary channels, and braided channels. It is often determined by the "ordinary high water mark" which means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

Bankfull: The point on a streambank at which overflow into the floodplain begins. The floodplain is a relatively flat area adjacent to the channel constructed by the stream and overflowed by the stream at a recurrence interval of about one to two years. If the floodplain is absent or poorly defined, other indicators may identify bankfull. These include the height of depositional features, a change in vegetation, slope or topographic breaks along the bank, a change in the particle size of bank material, undercuts in the bank, and stain lines or the lower extent of lichens and moss on boulders. Field determination of bankfull should be calibrated to known stream flows or to regional relationships between bankfull flow and watershed drainage area.

Bedload: Sand, silt, and gravel, or soil and rock debris rolled along the bottom of a stream by the moving water. The particles of this material have a density or grain size which prevents movement far above or for a long distance out of contact with the streambed under natural flow conditions.

Fish Passage: The ability of both adult and juvenile fish to move both up and down stream.

Flood Frequency: The frequency with which a flood of a given discharge has the probability of recurring. For example, a "100-year" frequency flood refers to a flood discharge of a magnitude likely to occur on the average of once every 100 years or, more properly, has a one-percent chance of being exceeded in any year. Although calculation of possible recurrence is often based on historical records, there is no guarantee that a "100-year" flood will occur at all within the 100-year period or that it will not recur several times.

Flood Prone Zone: Spatially, this area generally corresponds to the modern floodplain, but can also include river terraces subject to significant bank erosion. For delineation, see definition for floodplain.

Floodplain: The area adjacent to the stream constructed by the river in the present climate and inundated during periods of high flow.

Flow Duration Curve: A cumulative frequency curve that shows the percentage of time that specified discharges are equaled or exceeded. Flow duration curves are usually based on daily streamflow and describe the flow characteristics of a stream throughout a range of discharges without regard to the sequence of occurrence. If years of data are plotted the annual exceedance flows can be determined.

Ordinary High Water Mark: The mark along the bank or shore up to which the presence and action of the water are common and usual, and so long continued in all ordinary years, as to leave a natural line impressed on the bank or shore and indicated by erosion, shelving, changes in soil characteristics, destruction of terrestrial vegetation, or other distinctive physical characteristics.

Roads: For purposes of these guidelines, roads include all sites of intentional surface disturbance for the purpose of vehicular or rail traffic and equipment use, including all surfaced and unsurfaced roads, temporary roads, closed and inoperable roads, legacy roads, skid trails, tractor roads, layouts, landings, turnouts, seasonal roads, fire lines, and staging areas.

Section 10 and 404 Regulatory Programs: The principal federal regulatory programs, carried out by the U.S. Army Corps of Engineers, affecting structures and other work below mean high water. The Corps, under Section 10 of the River and Harbor Act of 1899, regulates structures in, or affecting, navigable waters of the U.S. as well as excavation or deposition of materials (e.g., dredging or filling) in navigable waters. Under Section 404 of the Federal Water Pollution Control

Act Amendments (Clean Water Act of 1977), the Corps is also responsible for evaluating application for Department of the Army permits for any activities that involve the placement of dredged or fill material into waters of the United States, including adjacent wetlands.

Waters of the United States: Currently defined by regulation to include all navigable and interstate waters, their tributaries and adjacent wetlands, as well as isolated wetlands and lakes and intermittent streams.

END

Please direct questions regarding this material to:

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Appendix B: NMFS' *Restoration Center's Programmatic Biological Opinion for Restoration Projects*

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
777 Sonoma Avenue, Room 325
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JUN 14 2016

Refer to NMFS No: WCR-2015-3755

Patrick Rutten
NOAA Restoration Center Supervisor
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Aaron O. Allen, Ph.D.
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Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Program for restoration projects within the NOAA Restoration Center's Central Coastal California Office jurisdictional area in California

Dear Mr. Rutten and Dr. Allen:

Thank you for your letter of November 3, 2015, 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 and the U.S. Army Corps of Engineers (Corps) review and permit restoration projects (Program) within NMFS' Santa Rosa Office jurisdictional area in California.

This document transmits NMFS biological opinion (BO) and Essential Fish Habitat (EFH) consultation, based on our review of the NOAA Restoration Center (RC) proposal to review fisheries restoration projects and the Corps' proposal to permit these projects pursuant to section 404 of the Clean Water Act (33 U.S.C. 1344) and section 10 (§10) of the Rivers and Harbors Act of 1899. The biological opinion analyzes the effects of the proposed action on endangered Central California Coast (CCC) coho salmon (*Oncorhynchus kisutch*), and threatened Northern California (NC) steelhead (*O. mykiss*), threatened CCC steelhead, threatened South-Central California Coast (S-CCC) steelhead, California Coastal (CC) Chinook (*O. tshawytscha*), and their designated critical habitats in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

NMFS concludes the RC and Corps' proposed action is not likely to jeopardize the continued existence of threatened CCC steelhead, S-CCC steelhead, NC steelhead, CC Chinook and endangered CCC coho salmon, or adversely modify or destroy designated critical habitats for listed salmonids and, therefore, an incidental take statement is included with this BO. The incidental take statement includes reasonable and prudent measures necessary and appropriate to minimize incidental take of these species. In addition, this letter transmits our concurrence that the proposed action is not likely to adversely affect certain ESA listed species.

NMFS also concludes the proposed actions will have minimal adverse effects to Chinook salmon and coho salmon, Pacific groundfish, and Coastal pelagic EFH. Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), authorizes NMFS to provide EFH Conservation Recommendations to minimize adverse effects of an activity to EFH. Because adverse effects to EFH will be minimal and multiple habitat conservation measures are included in the project description and appendices, EFH Conservation Recommendations are not necessary. However, if the proposed action is modified in a manner that may adversely affect EFH, the RC and Corps will need to reinitiate EFH consultation with NMFS.

Please contact Tom Daugherty at (707) 469-4057, Tom.Daugherty@noaa.gov if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

for

William W. Stelle, Jr.
Regional Administrator

Enclosure

cc: Joe Pecharich, NOAA Restoration Center
Holly Costa, Army Corps of Engineers
Katerina Galacatos, Army Corps of Engineers
NMFS File No: 151422WCR2016SR00226
Copy to Chron File

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

Program to fund, and/or permit restoration projects within the NOAA Restoration Center's Central Coastal California Office jurisdictional area in California

NMFS Consultation Number: WCR-2015-3755
Action Agencies: National Oceanic and Atmospheric Administration's Restoration Center (RC) and United States Army Corps of Engineers, San Francisco District

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?*	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
CCC coho salmon (*Oncorhynchus kisutch)*	Endangered	Yes	No	No
California coastal Chinook (*O. tshawytscha*)	Threatened	Yes	No	No
NC steelhead (*O. mykiss*)	Threatened	Yes	No	No
CCC steelhead (*O. mykiss*)	Threatened	Yes	No	No
S-CCC steelhead (*O. mykiss*)	Threatened	Yes	No	No
Green Sturgeon (*Acipenser medirostris*)	Threatened	*No		

*Please refer to section 2.11 for the analysis of species or critical habitat that are not likely to be adversely affected.

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

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

Issued By: ______________ for

William W. Stelle, Jr.
Regional Administrator

Date: JUN 14 2016

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1. INTRODUCTION

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

1.1 Background

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

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

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

1.2 Consultation History

On November 3, 2015, NOAA's National Marine Fisheries Service (NMFS) received a letter from the NOAA Restoration Center (RC) requesting formal consultation pursuant to section 7(a)(2) of the Endangered Species Act (ESA), as amended (16 U.S.C. § 1531 *et seq*.), and its implementing regulations (50 CFR § 402). The request for consultation was in regards to NOAA Restoration Center's Central Coastal California Office Restoration Program (Program) implemented by the NOAA Restoration Center (RC) and the Army Corps of Engineers (Corps) that will fund and permit restoration actions within the NOAA Restoration Center's Santa Rosa Office jurisdictional area. Included in the consultation package was a Biological Assessment (BA) for the proposed action titled "*Biological Assessment for Fisheries Habitat Restoration Projects in the Jurisdiction of the NMFS Santa Rosa Office*", dated November 2, 2015. This consultation also included one meeting NMFS and the RC staff on December 11, 2016, when the package was deemed complete. This consultation meeting resulted in some changes to the original proposed action analyzed in the BA, including the increase in project size for dewatering projects.

The consultation concerns the effects of the proposed program and associated restoration activities on endangered Central California Coast (CCC) coho salmon (*Oncorhynchus kisutch*), threatened Northern California (NC), CCC, and South-Central California Coast (S-CCC) steelhead (*Oncorhynchus mykiss*), and threatened California Coastal (CC) Chinook salmon (*Oncorhynchus tshawytscha*). Designated critical habitat for CCC coho salmon, CCC and S-CCC steelhead, NC steelhead, and CC Chinook may be affected by the proposed projects included in the Program.

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02).

The RC proposes to fund restoration projects in Humboldt (CCC Coho ESU only), Mendocino (excluding the Eel and Mattole River watersheds), Sonoma, Marin, Napa, Solano, Contra Costa, Alameda, Santa Clara, San Francisco, San Mateo, Santa Cruz, San Benito, Monterey and San Luis Obispo counties (Figure 1). The Corps proposes to issue permits for the proposed projects under section 10 of the Rivers and Harbors Act of 1899, and section 404 of the Federal Water Pollution Control Act, as amended (Clean Water Act (CWA)), as necessary. The restoration projects will be within the NMFS's Santa Rosa Office jurisdictional area (Figure 1) and include projects permitted from 2016 forward into the future. Proposed restoration projects are categorized as follows: instream habitat improvements, instream barrier modification for fish passage improvement, streambank and riparian habitat restoration, upslope watershed restoration, removal of small dams (permanent, flashboard and other seasonal), creation of off-channel/side-channel habitat features and water conservation projects (developing alternative off-stream water supply, water storage tanks, , and water measuring devices). Projects that will not be authorized under this program include water diversion or required bypass flow requirements, flow operations from dams, large construction projects, or other projects requiring take authorization that are not specific to RC restoration proposed actions described below.

RC staff in Santa Rosa, California will administer and oversee the program to facilitate implementation of the restoration projects occurring in the jurisdiction of the Santa Rosa Office of NOAA's National Marine Fisheries Service (Program). This biological opinion analyzes projects that meet the restoration project requirements set forth by the RC, and require a Corps permit. All restoration projects included in the Program and analyzed by this biological opinion will be subject to the administration process described in Section 1.5, *Oversight and Administration*. Restoration projects may be submitted to the Program by either the Corps or the RC. The RC will take the lead for the Program and participate in the screening of individual projects under consideration for inclusion in the Program, and will track implementation of individual projects. Such tracking will include documentation and reporting to the NMFS Santa Rosa Office of the number, type and location of projects and any incidental take that result from individual projects under this Program.

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

Habitat restoration projects authorized by the Program will be designed and implemented following the techniques and minimization measures presented in CDFW's *California Salmonid Stream Habitat Restoration Manual, Fourth Edition, Volume II, Part IX: Fish Passage Evaluation at Stream Crossings; Part X: Upslope Assessment and Restoration Practices; Part XI: Riparian Habitat Restoration; and Part XII: Fish Passage Design and*

Implementation (Flosi *et al.* 2010, hereafter referred to as "CDFW Manual") in order to maximize the benefits of each project while minimizing potential short-term, adverse impacts to salmonids, other aquatic and terrestrial species, and stream and riparian habitat. Additionally, Program restoration project activities that are not described in the current CDFW Manual will also be part of the proposed Program and are listed below starting at 1.3.5.

Additional avoidance and minimization measures will be necessary for all projects in order to reduce the potential for ancillary impacts to both salmonids and other riparian and aquatic species and their habitats. These measures are described under "*Section 1.3.7 Protection Measures.*"

1.3.1 Program Activities Described in the CDFW Manual

1.3.1.1 Instream Habitat Improvements

Instream habitat structures and improvements are intended to provide predator escape and resting cover, increase spawning habitat, improve upstream and downstream migration corridors, improve pool to riffle ratios, and add habitat complexity and diversity. Specific techniques for instream habitat improvements may include: placement of cover structures (divide logs; engineered logjams; complex wood jams; digger logs; spider logs; and log, root wad, and boulder combinations, *etc.*), boulder structures (boulder weirs, vortex boulder weirs, boulder clusters, and single and opposing log wing-deflectors, *etc.*), log structures (log weirs, upsurge weirs, single and opposing log wing-deflectors, engineered log jams, and Hewitt ramps, *etc.*), and placement of imported spawning gravel. Implementation of these types of projects may require the use of heavy equipment (*i.e.*, self-propelled logging yarders, mechanical excavators, backhoes, helicopters, *etc.*), however, hand labor will be used when possible. Large woody debris (LWD) may also be used to enhance pool formation and improve stream reaches. Projects may include both anchored and unanchored logs, depending on site conditions and wood availability. Depending upon complexity of the project after it is reviewed by an RC technical monitor, a NMFS or CDFW engineer will be given the chance to review and comment on select projects' designs if needed and decide the level of review required.

1.3.1.2 Instream Barrier Modification for Fish Passage Improvement

Instream barrier modification projects are intended to improve anadromous salmonid passage and increase access to currently inaccessible or difficult-to-access salmonid habitat. Projects may include those designed to improve fish passage at existing culverts, bridges, small dams, flood control structures, and paved and unpaved fords, or Arizona crossings, through replacement, removal, or retrofitting of these existing structures. These projects may include the use of gradient control weirs upstream or downstream of the barriers to control water velocity, water surface elevation, and/or provide sufficient pool habitat to facilitate jumps. Also, interior baffles or weirs may be used to mediate velocity and the effects of shallow sheet flow, or roughened ramps to provide stability and make up grade around other in-stream structures. Weirs and baffles may also be used to improve passage in flood control channels (particularly concrete-lined channels). Implementing these types of projects may require the use of heavy equipment (*i.e.* mechanical excavators, backhoes, cranes, *etc.*).

Part IX of the CDFW Manual, *Fish Passage Evaluation at Stream Crossings*, provides consistent methods for evaluating fish passage through culverts at stream crossings, and will aid in assessing fish passage through other types of stream crossings, such as bridges and paved or hardened fords. The objectives of Part IX are to provide the user with: consistent methods for evaluating salmonid passage though stream crossings; ranking criteria for prioritizing stream crossing sites for treatment; treatment options to provide unimpeded fish passage; a stream crossing remediation project checklist; guidance measures to minimize impacts during stream crossing remediation construction; and methods for monitoring the effectiveness of corrective treatments.

The most recent chapter in the CDFW Manual (Part XII), *Fish Passage Design and Implementation,* provides technical guidance for the design of fish passage projects at stream crossings, small dams and water diversion structures. The objectives of CDFW Part XII are to "guide designers through the general process of selecting a design approach for passage improvement." It provides "concepts, a design framework, and procedures to design stream crossings and fishways that satisfy ecological objectives, including: efficient and safe passage of all aquatic organisms and life stages, continuity of geomorphic processes such as the movement of debris and sediment, accommodation of behavior and swimming ability of organisms to be passed, diversity of physical and hydraulic conditions leading to high diversity of passage opportunities, projects that are self-sustaining and durable, and passage of terrestrial organisms that move within the riparian corridor (Flosi *et al.* 2010)."

Projects that are authorized under the Program must be designed and implemented consistent with CDFW's *Culvert Criteria for Fish Passage* (Appendix IX-A, CDFW Manual, Flosi *et al.* 2010). A NMFS or CDFW engineer will be given the chance to review and comment and make recommendations on all fish passage improvement project designs.

1.3.1.3 Stream Bank and Riparian Habitat Restoration

The proposed activities will seek to reduce excess fine sediment from bank erosion by restoring incised or failing stream banks with appropriate site-specific techniques including: laying back stream banks, creating inset floodplains, and installing tree and native plant material revetments, willow wall and rootwad revetments, bank laybacks, brush mattresses, natural fiber rolls, and exclusionary fencing. These projects must improve salmonid habitat through increased stream shading that will lower stream temperatures, increased future LWD recruitment and invertebrate production, and increased instream habitat complexity. Riparian habitat restoration projects will aid in the restoration of riparian habitat by increasing the number of plants and plant groupings, and could include the following types of projects: natural native plant regeneration, bank laybacks, inset floodplains, livestock exclusionary fencing, bioengineering, removal of non-native trees (*e.g.*, eucalyptus trees) and revegetation projects. Reducing excessive fine instream sediment will improve fish habitat and fish survival by increasing fish embryo and alevin survival in spawning gravels, reducing injury to juvenile steelhead from high concentrations of suspended sediment, and minimizing the loss, or reduction in size, of pools from excess sediment deposition. Improved instream habitat complexity will help to ensure that failing stream banks do not result in continued loss of the in-channel habitat complexity needed by salmonids.

Part XI of the CDFW Manual, *Riparian Habitat Restoration,* contains some examples of these techniques. Some guidelines for stream bank restoration techniques are described in Part VII of the CDFW Manual, *Project Implementation*. Implementing these project types may require the use of heavy equipment. Depending upon complexity of the project after it is reviewed by RC technical monitor, a NMFS or CDFW engineer may be given the chance to review and comment on all project designs and decide level of review.

Proposed use of boulders must be limited in scope and quantity to the minimum necessary to stabilize the slope and protect it from expected stream flows during storm events. Boulder structures must be part of a larger restoration design with the primary purpose of providing habitat improvements, and must include a riparian revegetation plan. Bridge abutments and other structural improvements installed in the restoration design of fish passage projects may require additional boulder and rock bank stabilization. This Program is not meant to cover projects that are merely protecting private property bank erosion issues.

1.3.1.4 Upslope Watershed Restoration

Upslope watershed restoration projects will reduce excessive delivery of sediment to salmonid streams. Part X of the CDFW Manual, *Upslope Assessment and Restoration Practices*, describes methods for identifying and assessing erosion problems, evaluating appropriate treatments, and implementing erosion control treatments in salmonid watersheds. Road-related upslope watershed restoration projects will include: road decommissioning, road upgrading, and storm proofing roads. Implementation of these types of projects may require the use of heavy equipment.

1.3.2 Program Activities Not Described in the CDFW Manual

1.3.2.1 Removal of Small Dams (permanent, flashboard and other seasonal-type)

Dam removal is conducted to restore fisheries access to historic habitat for spawning and rearing and to improve long-term habitat quality and proper stream geomorphology. Types of eligible small dams include permanent, flashboard types, earthen and seasonal dams with the characteristics listed below.

Definition of a small dam is defined by the California Division of Dam Safety as any artificial barrier that is either: 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, or b) designed to have an impounding capacity of less than 50 acre-feet. This Program activity only includes small dam (as defined above) removal projects that will form a channel at natural grade and shape upstream of the dam, either naturally or through excavation, in order to minimize negative effects on downstream habitat. Dam removal projects will: 1) have a small volume of sediment available for release (relevant to the size of the stream channel, that when released by storm flows, will have minimal effects on downstream habitat (verified by qualified engineer and reviewed by either CDFW or 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. This can be accomplished by estimating the natural thalweg using an adequate longitudinal profile (see CDFW Manual Part XII Fish Passage

Design and Implementation) and designing a new channel that provides the same hydraulic conditions and habitat for listed fish as the historical, pre-dam channel.

Methods of restoring the channel: Implementing small dam removal projects may require the use of heavy equipment (*e.g.*, self-propelled logging yarders, mechanical excavators, backhoes, *etc.*). Some small dam removals can be accomplished with hand tools, such as jackhammers. One of two methods will be used 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 may be used are as follows:

Natural channel evolution: The natural channel evolution approach to restoring a channel bed consists of removing all hardened portions (by hand efforts or heavy equipment) of a dam and allowing the stream's natural flows to naturally shape the channel through the project reach over time. This method shall only be used in the following situations: 1) risks are minimal 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 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 habit; 3) project implementation should follow procedures that have been documented as having been successfully performed elsewhere under similar circumstances; and 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 shall not be permitted unless project funding is sufficient 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 situations where excessive sediment releases pose a threat to downstream habitat and organisms. Specifically, the sediment upstream of the dam will be physically removed and the channel through the excavated reach will be designed using stream simulation. Stream simulation designs shall be conducted in accordance with known stream restoration and fish passage guidance documents. This specifically includes: 1) the identification of a suitable reference reach; 2) quantification of the average cross-sectional shape, bank full 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 3) reproducing the geomorphic features found within the reference reach in the project reach.

1.3.2.2 Creation of Off-channel/Side-channel Habitat Features

Floodplain habitats such as wetlands, sloughs, and off-channel features are important habitat areas for salmonids, particularly during winter months, providing velocity refugia during high winter flow events and improving growth and survival of rearing juveniles (Tschaplinski 1988, Aitkin 1998, Martens and Connolly 2014). Although projects to increase off-channel and side-channel habitats are relatively new to California, many such projects have been built in western Washington and Canada. Estuarine restoration projects may include off-channel and side-channel habitat components that can provide rearing habitat for salmonids.

Historically, off-channel habitats were much more prevalent in the estuaries and lower reaches of California streams. Much of this off-channel habitat has been lost due to development such as road construction, urbanization, agriculture and associated fill (especially for Highways 1 and 101), rail line construction and associated fill, and other anthropogenic activities. Habitat complexity and ecological function have either been degraded or lost.

The type of side-channel or off-channel features proposed for inclusion under the proposed approach:

- Reconnection of abandoned side-channel or pond habitats to restore fish access.
- Connection of adjacent ponds, remnants from aggregate excavation.
- Reconnection of oxbow lakes on floodplains that have been isolated from the meandering channel by river management actions, or channel incision.
- New side-channel or off-channel habitat features that create self-sustaining channels that will be maintained through natural processes.
- Increasing the hydrologic connection between floodplains and or wetlands to main channels.

Projects that require the installation of a flashboard dam, head gate or other mechanical structure will not be considered. Off-channel ponds constructed under this programmatic consultation will not be used as a point of water diversion. Use of logs or boulders as stationary water level control structures will be allowed.

Projects that enhance or create off-channel/side-channel areas will provide important rearing areas and velocity refugia for salmonids. These restoration projects may include: removal or breaching of levees and dikes, channel and pond excavation, constructing wood or rock tailwater control structures, beaver dam analogues and construction of large woody material and rock boulder habitat features. Implementation of these types of projects may require the use of heavy equipment and construction of temporary access roads.

Information regarding consideration of water supply (channel flow/overland flow/ groundwater), water quality, and water source reliability; risk of channel change; as well as channel and hydraulic grade must be provided by project proponent for a possible NMFS or CDFW engineer to review. Project design and data must include characterizations such as those listed in Section 5.1.2, Side-Channel/Off-Channel Habitat Restoration, in the Washington Department of Fish and Wildlife's 2004 Stream Habitat Restoration Guidelines (Saldi-Caromile *et al.* 2004) and Chapter 6: Beaver Dam Analogues from the US Fish and Wildlife Service, National Oceanic and Atmospheric Administration, Portland State University, US Forest Service 2015 Beaver Restoration Guidebook, (Castro *et al.* 2015).

1.3.2.3 Water Conservation Projects

Water conservation projects are intended to increase local stream flow, and thus available stream rearing habitat. In addition, increased stream flow may increase spawning and rearing habitat, improve or reconnect upstream and downstream migration corridors, improve access to habitat, decrease water temperatures and increase dissolved oxygen and nutrient transport. Specific techniques for water conservation projects may include: developing an alternative off-stream water supply (installation/modification of wells and ponds); creating tail water collection ponds; improving infrastructure; installing water storage tanks; installing infiltration galleries, piping ditches and/or re-profiling ditches; and installing head gates and water measuring devices. Implementation of these types of projects may require the placement of infrastructure (head gates, pumps and piping) in or adjacent to the stream to provide alternative water intake facilities. Water conservation projects proposed under the Program will not create fish passage barriers. Mechanized equipment may be used to install the water conservation infrastructure, but hand labor will be utilized when possible. Pumping activities will not take more than 10% of the wetted channel at a time and will not strand salmonids. All instream pumps associated with tank projects will be screened in accordance with CDFW/NMFS screening criteria. All water conservation projects will require diverters to verify compliance with California state water rights.

a. Developing Alternative Off-stream Water Supply

Many landowners use off-stream reservoirs or ponds for agricultural uses to store water used for animals (*e.g.* dairies or pastures for grazing), vineyards or farms. These are often reservoirs that are filled either by wells or by pumping groundwater. The proposed Program will cover ponds and also cover water lines, watering troughs, and other physical components used to provide groundwater to livestock, vineyards, farms and other uses.

b. Water Storage Tanks

Creating off-channel water storage infrastructure will reduce the need for diversions during the low-flow season (late spring, summer and fall). These tanks could either be filled through rainwater catchment or by pumping surface or groundwater flow. Under this programmatic consultation, all water storage tank projects will be required to have a forbearance agreement for at least 15 years, which will provide temporal and quantitative assurances for pumping activities. The exact low-flow threshold for this programmatic consultation will be determined in collaboration with RC and NMFS hydrologists on a site-by-site basis.

c. Installation of water measuring devices

Water measuring devices include stream gauges and staff plates. While installation of stream gauges and staff plates typically only requires hand tools (*e.g.*, shovels to bury inlet pipes, *etc.*), installation or replacement can require minor site excavation. Heavy equipment from the top-of-bank is typically used for excavation of the site. Any work areas will be hydrologically isolated from fish bearing streams. If the gauge is located within or near flood-prone areas, typically rock or other “armoring” is installed to protect the gauge from scour and debris damage.

1.3.3 Number and Location of Anticipated Projects

The number of restoration projects implemented on a yearly basis will be influenced by the available funding, interest from and capacity of, restoration proponents to submit qualified project applications, project permitting and construction scheduling, and other factors. Potential sources of funding for stream restoration projects in this region that would be included in the Program are numerous across various agencies.

Approximately 35-40 projects are expected to be authorized each year under this programmatic approach (Program). It is possible that once this Program is in place, there will be increased interest among the restoration community to participate in this Program. Therefore, the Corps and RC propose a maximum of 40 projects per year to be authorized under the Program to provide for increased project activity as a result of this effort. There will also be an annual per-watershed limitation of three projects occurring in any one HUC 12 (10 to 40k acres) watershed per year to avoid numerous sediment-producing restoration projects within the same watershed. For projects such as dam removal and road decommissioning or upgrading which can cause more disturbance and sediment delivery, the Program will limit these to one dam removal and one road project per HUC 12 watershed.

1.3.4 Limitations on Size and Footprint of Projects

Adverse impacts that may result from construction activities authorized under this programmatic consultation would occur on a localized scale. In order to further minimize the potential for short-term adverse impacts, the following limitations apply to individual projects and to the total number of projects that can be authorized under the proposed programmatic consultation each year:

a. Limits on Area of Disturbance and Construction Timing for Individual Projects:

Limits on stream crossing projects:

1. Any stream crossing removals in a salmonid bearing stream must be 1500 meters apart.

2. Crossings in a non-fish bearing stream must be 100 feet apart.

Maximum length of stream dewatered per project: 1,000 linear feet

Maximum upslope disturbance (raw dirt, tree removal, canopy cover reduction):

1. The disturbance footprint for a project’s staging areas may not exceed a total of 1 acre.

2. Native trees with defects, large snags > 16 in. diameter at breast height (dbh) and 20 ft. high, cavities, leaning toward the stream channel, nests, late seral characteristics, or > 48 in. dbh will be retained. In limited cases removal will be permitted if trees/snags occur in the way of providing fish passage. No removal will occur without a site visit and written approval from the RC.

3. Downed trees (logs) > 24 in. dbh and 10 ft. long will be retained on upslope sites or used for instream habitat improvement projects.

1.3.5 Oversight and Administration

The following section outlines the proposed process for administration of projects under the proposed Program. Corps and RC staff will communicate directly with staff from NMFS to ensure efficient and productive use of the Program. RC staff will provide for the tracking and oversight of all projects that are implemented under Program. In addition, an informal team comprised of staff from the RC and the Corps-San Francisco District, with assistance from staff with the NMFS West Coast Region (as available), will assist in oversight of projects that are authorized each year under the Program. This collaboration will help ensure that the limits and protection measures described in the Program are adhered to, and that databases for tracking projects, as well as any incidental take of listed species that occurs during implementation of projects authorized under the Program, is accurate and available to all three cooperating parties.

The following summarizes the anticipated process for reviewing individual project applications for consideration and authorization under the Program and the process by which projects will be administered:

1.3.5.1 Submittal of Project Applications to be Considered for Authorization under the Program

a. Many applications for salmonid habitat restoration work consistent with approved project types discussed below and included in the Program, will receive technical assistance and approval from, the RC's Community-based Restoration Program. Projects funded by various other sources must receive section 404 or section 10 permits from the Corps, and must meet all the requirements and limitations described in the Program any other measures such as terms and conditions provided in this consultation.

b. The RC website will include contact information that enables project proponents to coordinate directly with RC staff. The RC website will also include a link to the Corps-San Francisco District Regulatory Division's website, which provides instructions for the Corps' section 404 application requirements and forms for this Program (Note: The RC will coordinate closely with the Corps to ensure that it has received the project application for the appropriate section 404 permit).

1.3.5.2 Timeline for Submittals/Review

Project applications will be submitted to both the RC and the Corps – San Francisco District throughout the year and distributed to/by RC and Corps staff for review and approval.

1.3.5.3 Submittal Requirements

Project applicants seeking coverage under the Program must submit sufficient information about their project to allow the Corps and RC to determine whether or not the project qualifies for coverage. The following information will be collected by the project applicants with assistance from qualified consulting biologists and other specialized personnel. Project applicants will submit the following information either to the Corps (as part of their application for a Corps permit) or the RC (for RC-funded projects). Applicants will be responsible for obtaining any other necessary permits or authorizations from appropriate agencies before the start of project, as stated in the Biological Assessment (NOAA RC 2015a). The following information is to be submitted on the attached programmatic application form.

a. Pre-project photo monitoring data (per CDFW guidelines);

b. Project description:
   1. Project problem statement;
   2. Project goals and objectives, *etc.*;
   3. Watershed context;
   4. Description of the type of project and restoration techniques utilized (culvert replacement, instream habitat improvements, *etc.*);
   5. Project dimensions;
   6. Description of construction activities anticipated (types of equipment, timing, staging areas or access roads required):
   7. If dewatering of the work site will be necessary, description of temporary dewatering methods, including qualified individual who will be onsite to capture and transport protect salmonids;
   8. Construction start and end dates; start and end dates for salmonid relocation;
   9. Estimated number of creek crossings and type of vehicle:
   10. Materials to be used;
   11. When vegetation will be affected as a result of the project, (including removal and replacement), provide a visual assessment of dominant native shrubs and trees, approximate species diversity, and approximate acreage;
   12. Description of existing site conditions and explanation of how proposed activities improve or maintain these conditions for salmonids within expected natural variability;
   13. Description of key habitat elements (*i.e*., temperature; type: pool, riffle, flatwater; estimate of instream shelter and shelter components; water depth; dominant substrate type, *etc.*) for salmonids in the project area.
   14. Description of applicable minimization and avoidance measures incorporated into the project (as described in *Section II. Protection Measures in the BA (NOAA RC, 2015a*).
   15. A proposed monitoring plan for the project describing how the applicant will ensure compliance with the applicable monitoring requirements described in this Program (photo monitoring, revegetation, *etc.*), including the source of funding for implementation of the monitoring plan.
   16. A checklist the applicant must sign, verifying that the applicant agrees to adhere to all project conditions and protection measures during project design and implementation.

1.3.5.4 Initial Project Screen by the Corps and RC

The RC will be the first level of review in screening potential RC-funded projects for authorization under the proposed Program. The RC will first determine whether the project's goals, techniques, location and design are consistent with the Program. Then, the RC will determine whether the project is: a) *No Effect* on ESA listed species and or critical habitat, or b) *May Affect* ESA listed species and/or designated critical habitat, and whether the proposed action comports to the conditions of the Program.

The Corps will be the first level of review in screening potential projects whose proponents are not contacted the RC but who have applied for a Corps permit and authorization under the Program. The Corps will make an affects determination for ESA listed species and critical habitat, and whether the proposed action comports to the conditions of the proposed Program. The appropriate NMFS Santa Rosa branch supervisor will be contacted as described below, prior to project approval, for the following project types: Instream Habitat Improvements (select projects), Instream Barrier Modifications (all projects), Stream Bank and Riparian Habitat Restoration (select projects), Removal of Small dams (all projects), Creation of Off-channel/Side-channel Habitat Features (all projects) and Water Conservation Projects (select projects).

1.3.5.5 Authorization of Projects and Field Checks

RC and Corps staff will utilize a pre-established checklist (called the "Application for Inclusion in the RC Santa Rosa Office Programmatic Approach") in reviewing submitted projects to determine whether the project meets the parameters of the Program. Field visits may be necessary before projects are authorized for inclusion under the Program.

Prior to the Corps or RC's approval/authorization under the Program, the Corps or the RC will contact the appropriate NMFS North-Central Coast Office Branch Chief to confirm that a project should be included in the Program. Contact will typically be by email and will include the information submitted and the response of NMFS and or California Department of Fish and Wildlife (CDFW) fish passage engineers. RC will assume a project qualifies for inclusion if it has not heard from NMFS within 2 weeks as to whether or not the project should be included in the Program. However, if the project is a stream crossing, dam removal, off-channel habitat feature, or any other fish passage project needing engineering review, RC will not move forward with the project until NMFS has finished engineering review or indicated via email that additional review is not needed. The transmittal and response emails will be maintained in each project file by RC and or the Corps.

1.3.5.6 Corps and RC Authorization and Project Construction

With the Corps' and RC's approval (and all other necessary approvals and permits obtained), authorized projects are then implemented by the applicants, incorporating all guidelines, protection measures, and additional required conditions (described in *Section 1.7 Protection Measures).*

1.3.5.7 Post-Construction Implementation Monitoring and Reporting

Qualifying applicants will be required to carry out all post-construction implementation monitoring for projects authorized under the Program. This will include photo-documentation (using standardized guidelines for photo-documentation consistent with the pre-construction monitoring requirements); as-built designs on engineered projects; evidence that required avoidance, minimization, and mitigation measures were implemented; and information about number (and species) of fish captured and relocated, and any fish injury or mortality that resulted from the project. This information will be submitted by each applicant to the RC for data assembly. Applicants will be required to use the *Santa Rosa Office Programmatic Approach Post-Project Monitoring Form,* which will be given to applicants along with approval of the project.

1.3.5.8 Project Tracking and the Annual Report

The RC (lead agency) and Corps will work with NMFS to maintain a database that includes information on all projects implemented under the Program. In order to monitor any impacts to salmonids and critical habitat over the term of the Program, and to track any incidental take of listed salmonids, the RC (lead agency) and Corps will annually prepare and submit to NMFS a report of the previous year's restoration activities. The annual report will contain information about projects implemented during the previous construction season as well as projects that were implemented in prior years under the Program.

1.3.6 Monitoring and Reporting Requirements

All applicants will utilize standard post-construction monitoring protocols developed under the lead of CDFW. These are the same monitoring protocols CDFW follows in implementing its Fisheries Restoration Grant Program. Current instructions used by CDFW are available online at: http://ftp.dfg.ca.gov/Public/FRGP/Qualitative_Monitoring_Forms/. In addition, applicants will utilize NMFS' September 2001 (or most recent update) Guidelines for Salmonid Passage at Stream Crossings for post-construction evaluation and long-term maintenance and assessment protocols. Applicants will also be required to fill out the *Santa Rosa Office Programmatic Approach Post-Project Monitoring Form,* which will be given to applicants by the Corps or the RC when approving their project.

a. Post-construction Monitoring and Reporting Requirements:

Implementation monitoring will be conducted for all projects implemented under the proposed Program. Following construction, project applicants must submit a post-construction implementation report to the RC and the Corps. Implementation reports shall include project as-built plans and photo documentation of project implementation taken before, during, and after construction, utilizing CDFW photo monitoring protocols. For fish relocation activities, the report should include: all fisheries data collected by a qualified fisheries biologist, including the number of any salmonids killed or injured during the proposed action; the number and size (in millimeters) of any salmonids captured and removed; and any unforeseen effects of the proposed action on salmonids.

b. Annual Report

Annually, the RC and Corps will prepare a report summarizing results of projects implemented under this Program during the most recent construction season, and results of post-construction implementation and effectiveness monitoring for that year and previous years. The annual report shall include a summary of the specific type and location of each project and the ESU or DPS affected. The report shall include the following project-specific summaries:

1. Fish relocation activities, including the number and species of fish relocated and the number and species injured or killed.

2. The number and type of instream structures implemented within the stream channel.

3. The size (acres, length, and depth) of off-channel habitat features enhanced or created.

4. The length of streambank (feet) restored or planted with riparian species.

5. The number of culverts replaced or repaired, including the number of miles of restored access to salmonid habitat.

6. The size and number of dams/barriers removed, including the number of miles of restored/improved access to unoccupied salmonid habitat.

7. The distance (feet) of aquatic habitat disturbed at each project site.

8. The distance (feet) of aquatic habitat restored.

1.3.7 Protection Measures

The following protection measures, as they apply to a particular project, shall be incorporated into the project descriptions for individual projects authorized under the proposed Program.

a. General Protection Measures for All Project Types:

1. Work shall not begin until a) the RC and/or Corps has notified the permittee that the requirements of the ESA and Clean Water Act have been satisfied and that the activity is authorized and b) all other necessary permits and authorizations are finalized.

2. The general construction season shall be from June 15 to October 31. Restoration, construction, fish relocation and dewatering activities within any wetted or flowing stream channel shall occur only within this period. If precipitation sufficient to produce runoff is forecast to occur while

construction is underway, work will cease and erosion control measures will be put in place sufficient to prevent significant sediment runoff from occurring. Exceptions regarding the construction season will be considered on a case-by-case basis only if justified and if measurable precipitation sufficient to produce runoff is not forecast to occur during any of the above activities, and if approved by the RC, Corps, and NMFS. Revegetation activities including limited soil preparation outside the active channel may occur beyond October 31 if necessary to better ensure successful plant establishment during the onset of winter precipitation.

3. Prior to construction, the land manager and each contractor shall be provided with the specific protective measures to be followed during implementation of the project by the project proponent or lead biologist. In addition, a qualified biologist shall provide the construction crew with information on all listed species (including state-listed and state fully protected species) in the project area, the protection afforded the species by ESA and CESA, and guidance on those specific protection measures that must be implemented as part of the project.

4. Select herbicides such as Imazipyr may be applied to control established stands of non-native plant species. Herbicides must be applied to those species according to the registered label conditions. Herbicides must be applied directly to plants (painted or sponges) and may not be sprayed or spread upon any water. Herbicide shall be tinted with a biodegradable dye to facilitate visual control of the spray. NMFS will approve any herbicides before use. Additionally, NMFS has recently completed several consultations with the US Environmental Protection Agency (EPA) for certain herbicides. These biological opinions include RPAs that are intended to avoid and minimize adverse impacts to listed species when herbicides are applied. The protective measures identified in the RPAs must be incorporated into future labeling detailing herbicide use, or their registration for use on some crops will be cancelled by the EPA. All application instructions on the labels are requirements under the EPA, and are therefore required to be implemented under federal law when applying these herbicides.

5. Until any RPA required measures are identified on the label, the measures from the appropriate RPA, as well as proven BMPs, will be relied on for the Program in addition to current label requirements.

6. If the thalweg of the stream has been altered due to construction activities, efforts shall be undertaken to reestablish it to its original configuration. (Note: Projects that include activities such as the use of willow baffles that may alter the thalweg are allowed under the proposed Program.)

1.3.7.1 Requirements for Fish Relocation and Dewatering Activities

a. Guidelines for Dewatering:

Project activities authorized under the Program may require fish relocation and/or dewatering activities. Dewatering may not be appropriate for some projects that will result in only minor input of sediment, such as placing logs with hand crews, installing boulder clusters or felling of trees. Dewatering can result in the temporary loss of aquatic habitat, and the stranding, displacement, or crushing of fish and amphibian species. Increased turbidity may occur from disturbance of the channel bed. The following general guidelines will minimize potential impacts for projects that do require dewatering of a stream/creek.

1. In those specific cases where it is deemed necessary to dewater a work site that is located in aquatic habitat, the work area shall be isolated and all the flowing water upstream of the work site shall be temporarily diverted around the work site to maintain downstream flows during construction. Prior to dewatering, determine the best means to bypass flow through the work area to minimize disturbance to the channel and avoid direct mortality of fish and other aquatic vertebrates (as described more fully below under *General Conditions for Fish Capture and Relocation*).

2. Fish will be excluded from reentering the work area by blocking the stream channel above and below the work area with fine-meshed net or screens. Mesh will be no greater than 1/8-inch diameter. The bottom of the seine must be completely secured to the channel bed to prevent fish from reentering the work area. Exclusion screening must be placed in areas of low water velocity to minimize fish impingement. Upstream and downstream screens must be checked daily (prior to, during, and after instream activities) and cleaned of debris to permit free flow of water. Block nets shall be placed and maintained throughout the construction 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 does not enter the areas proposed for dewatering between passes with the electro-fisher or seine.

3. Coordinate project site dewatering with a qualified biologist to perform fish and amphibian relocation activities. The qualified biologist(s) will possess all valid state and federal permits needed for fish relocation and will be familiar with the life history and identification of salmonids, state-listed fish, and listed amphibians within the action area.

4. Prior to dewatering a construction site, qualified individuals will capture and relocate fish and amphibians to avoid direct mortality and minimize take. This is especially important if listed species are present within the project site.

5. Bypass stream flow around the work area, but maintain the stream flow to channel below the construction site.

6. Minimize the length of the dewatered stream channel and duration of dewatering.

7. Any temporary dam or other artificial obstruction constructed shall only be built from materials such as sandbags or clean gravel that will cause little or no siltation. Impenetrable material shall be placed over sandbags used for construction of cofferdams construction to minimize water seepage into the construction areas. The impenetrable material shall be firmly anchored to the streambed to minimize water seepage. Cofferdams and the stream diversion systems shall remain in place and fully functional throughout the construction period.

8. When cofferdams 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, during the construction period. The contractor or project applicant shall remove all accumulated debris.

9. Bypass pipe diameter will be sized to accommodate, at a minimum, twice the existing summer baseflow.

10. The work area may need to be periodically pumped dry of seepage. Place pumps in flat areas, well away from the stream channel. Secure pumps by tying off to a tree or stake in place to prevent movement by vibration. Refuel in an area well away from the stream channel and place fuel absorbent mats under pump while refueling. Pump intakes shall be covered with appropriate sized screening material to prevent potential entrainment of fish or amphibians that failed to be removed. Check intake periodically for impingement of fish or amphibians.

11. 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 the contractor or project applicants operations to enter or be placed where they could enter a wetted channel. Projects will adhere to currently approved CDFW and NMFS *Fish Screening Criteria* (NMFS 2011).

12. Discharge wastewater from construction area to an upland location where it will not drain sediment-laden water back to the stream channel.

13. When construction is completed, 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. Coffer dams will be removed so surface elevations of water impounded above the cofferdam will not be reduced at a rate greater than one inch per hour. This will minimize the risk of beaching and stranding of fish as the area upstream becomes dewatered.

b. General Conditions for all Fish Capture and Relocation Activities:

1. Fish relocation and dewatering activities shall only occur between June 15 and October 31 of each year. If precipitation sufficient to produce runoff is forecast to occur while construction is underway, work will cease and erosion control measures will be put in place sufficient to prevent significant sediment runoff from occurring. Exceptions on the fish relocation/dewatering time period will be considered on a case-by-case basis only if justified and if precipitation sufficient to produce runoff is not forecast to occur during any of the above activities, and if approved by the RC, Corps and NMFS. If the channel is expected to be seasonally dry during this period, construction should be scheduled so that fish relocation and dewatering are not necessary.

2. A qualified fisheries biologist shall perform all seining, electrofishing, and fish relocation activities. The qualified fisheries biologist shall capture and relocate salmonids and other native fish prior to construction of the water diversion structures (*e.g.,* cofferdams). The qualified fisheries biologist shall note the number of salmonids observed in the affected area, the number of salmonids relocated, and the date and time of collection and relocation. The qualified fisheries biologist shall have a minimum of three years of field experience in the identification and capture of salmonids, including juvenile salmonids. The qualified biologist will adhere to the following requirements for capture and transport of salmonids:

    a) Determine the most efficient means for capturing fish. 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.

    b) Notify the RC one week prior to capture and relocation of salmonids to provide RC or NMFS staff an opportunity to attend.

    c) Initial fish relocation efforts will be conducted several days prior to the start of construction. This provides the fisheries biologist an opportunity to return to the work area and perform additional electrofishing passes immediately prior to construction if there is water in the isolated construction area. In these instances, additional fish could be captured that eluded the previous day's efforts. If water is left in the construction area, dissolved oxygen levels sufficient for salmonid survival must be maintained.

    d) At project sites with high summer water temperatures, perform relocation activities during morning periods.

    e) 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.

f) Periodically measure air and water temperatures and monitor captured fish. Temperatures will be measured at the head of riffle tail of pool interface. Cease activities if health of fish is compromised owing to high water temperatures, or if mortality exceeds three percent of captured salmonids.

c. Electrofishing Guidelines:

The following methods shall be used if fish are relocated via electrofishing:

1. All electrofishing will be conducted according to NMFS' *Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act* (NMFS 2000).

2. The backpack electro-fisher shall be set as follows when capturing fish: Voltage setting on the electro-fisher shall not exceed 300 volts.

	Initial	Maximum
A) Voltage:	100 Volts	300 Volts
B) Duration:	500 µs (microseconds)	5 ms (milliseconds)
C) Frequency:	30 Hertz	30 Hertz

3. A minimum of three passes with the electro-fisher shall be utilized to ensure maximum capture probability of salmonids within the area proposed for dewatering.

4. Water temperature, dissolved oxygen, and conductivity shall be recorded in an electrofishing log book, along with electrofishing settings.

5. A minimum of one assistant shall aid the fisheries biologist by netting stunned fish and other aquatic vertebrates.

d. Seining Guidelines:

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

1. A minimum of three passes with the seine shall be utilized to ensure maximum capture probability of all salmonids within the area.

2. All captured fish shall be processed and released prior to each subsequent pass with the seine.

3. The seine mesh shall be adequately sized to ensure fish are not gilled during capture and relocation activities.

e. Guidelines for Relocation of Salmonids:

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

1. Fish shall not be overcrowded into buckets, allowing no more than 150 0+ fish (approximately six cubic inches per 0+ individuals) per 5 gallon bucket and fewer individuals per bucket for larger/older fish.

2. Every effort shall be made not to mix 0+ salmonids with larger steelhead, or other potential predators, that may consume the smaller salmonids. Have at least two containers and segregate young-of-year (0+) fish from larger age-classes. Place larger amphibians in the container with larger fish.

3. Salmonid predators, including other fishes and amphibians, collected and relocated during electrofishing or seining activities shall not be relocated so as to concentrate them in one area. Particular emphasis shall be placed on avoiding relocation of predators into the salmonid relocation pools. To minimize predation of salmonids, these species shall be distributed throughout the wetted portion of the stream to avoid concentrating them in one area.

4. All captured salmonids shall be relocated, preferably upstream, of the proposed construction project 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.

5. All captured salmonids will be processed and released prior to conducting a subsequent electrofishing or seining pass.

6. All native captured fish will be allowed to recover from electrofishing before being returned to the stream.

7. Minimize handling of salmonids. However, when handling is necessary, always wet hands or nets prior to touching fish. Handlers will not wear insect repellants containing the chemical N,N-Diethyl-meta-toluamide (DEET).

8. 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.

9. Place a thermometer in holding containers and, if necessary, periodically conduct partial water changes to maintain a stable water temperature. If water temperature reaches or exceeds those allowed by CDFW and NMFS, fish shall

be released and rescue operations ceased.

10. In areas where aquatic vertebrates are abundant, periodically cease capture, and release at predetermined locations.

11. Visually identify species and estimate year-classes of fish at time of release. Count and record the number of fish captured. Avoid anesthetizing or measuring fish. Also identify hatchery (clipped adipose fin) and wild fish.

12. If more than 3 percent of the salmonids captured are killed or injured, the project permittee shall contact the RC (currently Joe Pecharich (707) 575-6095 or at joe.pecharich@noaa.gov). The RC will then contact NMFS within 24 hours.

13. The purpose of the contact is to review the activities resulting in take and to determine if additional protective measures are required. All salmonid mortalities must be retained, placed in an appropriately sized, zip-sealed bag, labeled with the date and time of collection, fork length, location of capture, and frozen as soon as possible. Frozen samples must be retained until specific instructions are provided by NMFS.

1.3.7.2 Measures to Minimize Disturbance from Instream Construction

Measures to minimize disturbance associated with instream habitat restoration construction activities are presented below. Measures are excerpted from *Measures to Minimize Disturbance from Construction,* on page IX-50 of the CDFW Manual:

a. Construction will occur between June 15 and October 31. Revegetation activities, including soil preparation, may extend beyond October 31, if necessary, to better ensure successful plant establishment during the onset of winter precipitation. If precipitation greater than one inch is forecast during the June 15 – October 31 work window, the RC must be notified, implementation work must stop, and erosion control BMP’s must be implemented. Extensions of this work window will be considered on a case-by-case basis only if justified and if precipitation sufficient to produce runoff is not forecast to occur during any of the above activities, the effects of this action are not outside the effects analyzed in the BA, and if approved by the RC, Corps and NMFS.

b. Debris, soil, silt, excessive bark, rubbish, creosote-treated wood, raw cement/ concrete or washings thereof, asphalt, paint or other coating material, oil or other petroleum products, or any other substances which could be hazardous to aquatic life, resulting from projected related activities, shall be prevented from contaminating the soil and/or entering the waters of the State. Any of these materials, placed within or where they may enter a stream or lake, by the applicant or any party working under contract, or with permission of the applicant, shall be removed immediately. During project activities, all trash that may attract potential predators of salmonids will be properly contained, removed from the work site, and disposed of daily.

c. Where feasible, the construction shall occur from the bank, or on a temporary pad underlain with filter fabric.

d. No heavy equipment will enter wetted channels.

e. Use of heavy equipment shall be avoided in a channel bottom with rocky or cobbled substrate. If access to the work site requires crossing a rocky or cobbled substrate, a rubber tire loader/backhoe is the preferred vehicle. Only after this option has been determined infeasible will the use of tracked vehicles be considered. The amount of time this equipment is stationed, working, or traveling within the creek bed shall be minimized. When heavy equipment is used, woody debris and vegetation on banks and in the channel shall not be disturbed if outside of the project's scope.

f. The use or storage of petroleum-powered equipment shall be accomplished in a manner to prevent the potential release of petroleum materials into waters of the state (Fish and Game Code 5650).

g. Areas for fuel storage, refueling, and servicing of construction equipment must be located in an upland location.

h. Prior to use, clean all equipment to remove external oil, grease, dirt, or mud. Wash sites must be located in upland locations so wash water does not flow into the stream channel or adjacent wetlands.

i. All construction equipment must be in good working condition, showing no signs of fuel or oil leaks. Prior to construction, all mechanical equipment shall be thoroughly inspected and evaluated for the potential of fluid leakage. All questionable motor oil, coolant, transmission fluid, and hydraulic fluid hoses, fitting, and seals shall be replaced. The contractor shall document in writing all hoses, fittings, and seals replaced and shall keep this documentation until the completion of operations. All mechanical equipment shall be inspected on a daily basis to ensure there is no motor oil, transmission fluid, hydraulic fluid, or coolant leaks. All leaks shall be repaired in the equipment staging area or other suitable location prior to resumption of construction activity.

j. Oil absorbent and spill containment materials shall be located on site when mechanical equipment is in operation with 100 feet of the proposed watercourse crossings. If a spill occurs, no additional work shall commence in-channel until (1) the mechanical equipment is inspected by the contractor, and the leak has been repaired, (2) the spill has been contained, and (3) NMFS and CDFW are contacted and have evaluated the impacts of the spill.

1.3.7.3 Measures to Minimize Degradation of Water Quality

Construction or maintenance activities for the projects proposed under this Program may result in temporary increases in turbidity levels in the stream. In general, these activities must not result in significant, or long term increases in turbidity levels beyond the naturally occurring, background conditions. The following measures shall be implemented to reduce the potential for impacts to water quality during and post-construction:

a. General Erosion Control during Construction:

1. When appropriate, isolate the construction area from flowing water until project materials are installed and erosion protection is in place.

2. Effective erosion control measures shall be in place at all times during construction. Do not start construction until all temporary control devices (straw bales with sterile, weed free straw, silt fences, *etc.)* are in place downslope or downstream of project site within the riparian area. The devices shall be properly installed at all location where the likelihood of sediment input exists. These devices shall be in place during and after construction activities for the purposes of minimizing fine sediment and sediment/water slurry input to flowing water and of detaining sediment-laden water on site. If continued erosion is likely to occur after construction is completed, then appropriate erosion prevention measures shall be implemented and maintained until erosion has subsided. Erosion control devices such as coir rolls or erosion control blankets will not contain plastic netting of a mesh size that would entrain, fish, reptiles or amphibians.

3. Sediment shall be removed from sediment controls once it has reached one-third of the exposed height of the control. Whenever straw bales are used, they shall be staked and dug into the ground to a minimum depth of 12 cm, and only sterile, weed-free straw shall be utilized.

4. Sediment-laden water created by construction activity shall be filtered before it leaves the right-of-way or enters the stream network or an aquatic resource area.

5. The contractor/project applicant is required to inspect and repair/maintain all practices 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 have been completed.

b. Guidelines for Temporary Stockpiling:

1. Minimize temporary stockpiling of material. Stockpile excavated material in areas where it cannot enter the stream channel. Prior to start of construction; determine if such sites are available at or near the project location. If nearby sites are unavailable, determine location where material will be deposited. Establish locations to deposit spoils well away from watercourses with the potential to delivery sediment into the stream network draining into current salmonid habitat, or historically supporting populations of salmonids. Spoils shall be contoured to disperse runoff and stabilized with mulch and (native) vegetation. Use devices such as plastic sheeting held down with rocks or

sandbags over stockpiles, silt fences, or berms of hay bales, to minimize movement of exposed or stockpiled soils.

2. If feasible, conserve topsoil for reuse at project location or use in other areas. End-haul spoils away from watercourses as soon as possible to minimize potential sediment delivery.

c. Minimizing Potential for Scour:

1. When needed, utilize instream boulder grade control structures to control channel scour, sediment routing, and headwall cutting.

2. For relief culverts or structures, if a pipe or structure that empties into a stream is installed, an energy dissipater shall be installed to reduce bed and bank scour. This does not apply to culverts installed in fish-bearing tributaries.

3. The toe of rock slope protection used for streambank stabilization shall be placed below bed scour to ensure stability.

d. Post-Construction Erosion Control:

1. Immediately after project completion and before close of seasonal work window, stabilize all exposed soil with mulch, seeding, and/or placement of erosion control blankets. Remove all artificial erosion control devices after the project area has fully stabilized. All exposed soil present in and around the project site shall be stabilized within 7 days. Erosion control devices such as coir rolls or erosion control blankets will not contain plastic netting of a mesh size that would entrain reptiles and amphibians.

2. All bare and/or disturbed slopes (larger than 10' x 10' of bare mineral soil) will be treated with erosion control methods such as straw mulching, netting, fiber rolls, and hydro-seed as permanent erosion control measures.

3. Where straw, mulch, or slash is used as erosion control on bare mineral soil, the minimum coverage shall be 95% with a minimum depth of two inches.

4. When seeding is used as an erosion control measure, only natives will be used. Sterile (without seeds), weed-free straw, free of exotic weeds, is required when hay bales are used as an erosion control measure.

1.3.7.4 Measures to Minimize Loss or Disturbance of Riparian Vegetation

Measures to minimize loss or disturbance to riparian vegetation are described below. The revegetation and success criteria that will be adhered to for projects implemented under the proposed Program that result in disturbance to riparian vegetation are also described below.

a. Minimizing Disturbance:

1. Retain as many trees and shrubs as feasible, emphasizing shade-producing and bank-stabilizing trees and brush.

2. Prior to construction, determine locations and equipment access points that minimize riparian disturbance. Pre-existing access points shall be used whenever possible. Avoid entering unstable areas, which may increase the risk of channel instability.

3. Minimize soil compaction by using equipment with a greater reach or that exerts less pressure per square inch on the ground, resulting in less overall area disturbed or less compaction of disturbed areas.

4. If riparian vegetation is to be removed with chainsaws, consider using saws currently available that operate with vegetable-based bar oil.

b. Revegetation and Success Criteria:

1. Any stream bank area left barren of vegetation as a result of the implementation or maintenance of the practices shall be restored to a natural state by seeding, replanting, or other agreed upon means with native trees, shrubs, and/or grasses. Barren areas shall typically be planted with a combination of willow stakes, native shrubs and trees and/or erosion control grass mixes.

2. Native plant species shall be used for revegetation of disturbed and compacted areas. The species used shall be specific to the project vicinity or the region where the project is located, and comprise a diverse community structure (plantings shall include both woody and herbaceous species).

3. For projects where re-vegetation is implemented to compensate for riparian vegetation impacted by project construction, a re-vegetation monitoring report will be required after 2 years to document success. Success is defined as 80% survival of plantings or 80% ground cover for broadcast planting of seed after a period of 2 years. 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. If at the end of 2 years, the vegetation has not successfully been re-established, the applicant will be responsible for replacement planting, additional watering, weeding, invasive exotic eradication, or any other practice, to achieve these requirements. If success is not achieved within the first 2 years, the project applicant will need to prepare a follow-up report in an additional year's time.

4. All plastic exclusion netting placed around plantings will be removed and recycled after 3 years, or earlier if appropriate.

1.3.7.5 Measures to Minimize Impacts from Road-related Restoration Projects

Road modification, repair and decommissioning activities are considered to be one project regardless of the number of individual work sites or the different techniques employed at each site.

Upon the completion of restoration activities, roads within the riparian zone affected by construction activities shall be weather proofed according to measures described in the *Handbook for Forest and Ranch Roads* by Weaver and Hagans (1994, revised 2014) of Pacific Watershed Associates and in Part X of the CDFW Manual, "*Upslope Assessment and Restoration Practices."* Following are some of the methods that may be applied to non-surfaced roads impacted by project activities implemented under the proposed Program:

a. Establish waterbreaks (*e.g.*, waterbars and rolling dips) on all seasonal roads, skid trails, paths, and firebreaks by November 30. Do not remove waterbreaks until May 15.

b. Maximum distance for waterbreaks shall not exceed the following standards; (1) for road or trail gradients less than 10%: 100 feet; (2) for road or trail gradients 11-25%: 75 feet; (3) for road or trail gradients 26% or greater: 50 feet. Depending on site-specific conditions, more frequent intervals may be required to prevent road surface erosion.

c. Locate waterbreaks to allow water to be discharged onto some form of vegetative cover, slash, rocks, or less erodible material. Do not discharge waterbreaks onto unconsolidated fill.

d. Waterbreaks shall be cut diagonally a minimum of 6 inches into the firm roadbed, skid trail, or firebreak surface and shall have a continuous firm embankment of at least 6 inches in height immediately adjacent to the lower edge of the waterbreak cut.

e. The maintenance period for waterbreaks and any other erosion control facilities shall occur after every major storm event for the first year after installation.

f. Rolling-dips are preferred over waterbars. Waterbars shall only be used on unsurfaced roads where winter use (including use by bikes, horses, and hikers) will not occur.

g. After the first year of installation, erosion control facilities shall be inspected prior to the beginning of the winter period (October 31), after the first major storm event, and prior to the end of the winter period (May 15).

h. Applicant will establish locations to deposit spoils well away from watercourses with the potential to delivery sediment into streams supporting, or historically supporting populations of salmonids. Spoils shall be contoured to disperse runoff and stabilized with mulch and (native) vegetation.

i. No berms are allowed on the outside of the road edge.

j. No herbicides shall be used on vegetation on inside ditches.

1.3.7.6 Measures to Minimize Impacts from Small Dam Removal

a. Projects will be deemed ineligible for the Program if: 1) sediments stored behind dam have a reasonable potential to contain environmental contaminants [dioxins, chlorinated pesticides, polychlorinated biphenyls (PCBs), or mercury] beyond the freshwater probable effect levels (PELs) summarized in the NOAA Office of Response and Restoration's Screening Quick Reference Table guidelines, or 2) the risk of significant loss or degradation of downstream spawning or rearing areas by sediment deposition is considered by RC and NMFS or CDFW engineers to be such that the project requires more detailed analysis. Sites shall be considered to have a reasonable potential to contain contaminants of concern if they are downstream of historical contamination sources such as lumber or paper mills, industrial sites, or intensive agricultural production going back several decades (since chlorinated pesticides were legal to purchase and use). In these cases, preliminary sediment sampling is advisable.

b. All construction will take place out of the wetted channel either by implementing the project from the bank and out of the channel or by constructing cofferdams, relocating aquatic species found within the project reach, and dewatering the channel. No more than 250 linear feet (125 feet on each side of the channel) of riparian vegetation will be disturbed for project access. All disturbed areas will be re-vegetated with native grasses, trees, or shrubs appropriate for the site.

c. Project applicants are required to provide project designs to RC technical monitors prior to project approval and implementation. A NMFS or CDFW engineer will be given the chance to review and comment on all project designs and decide level of review. Data requirements and analysis to be provided with dam removal project design should attempt to meet NMFS 2011 Anadromous Salmonid Passage Facility Design (NMFS 2011 Guidelines). If proposed project designs do not meet the NMFS 2011 Guidelines, a variance may be explored and granted at the discretion of RC and NMFS engineers if there is a clear benefit to fish passage. Applicants will be required to implement the RC Fish Passage Barrier Removal Performance Measures and Monitoring Worksheet (Fish Passage Barrier Removal Worksheet can be found at: http://www.habitat.noaa.gov/toolkits/restoration_center_toolkits/forms_and_guidance_documents/ori_monitoring_sheet_w_guidance.pdf) that includes regionally appropriate fish passage criteria for fish passage projects, and which have been incorporated into the data needs described below.

d. Data and Analysis Requirements:
Minimal and Potential Data Needs: Listed below are the minimal and potential data needs for conducting any small dam removal project. However, site

specific conditions may require additional information beyond what is identified here to adequately evaluate a small dam removal project. Similarly, unanticipated complications in a project such as the need to use a roughened channel and/or other fish passage techniques to pass fish over buried infrastructure (*e.g.*, gas, water, and sewer lines) will require additional data. The minimal data needed to conduct simpler small dam projects along with the potential data needs for more complex projects is listed in the project description section above.

1) Minimal Data Needs:

   A) A clear statement of the fish passage objectives of the project. Objectives shall be explicitly stated for any small dam removal project (*e.g.*, to improve fish passage, improve sediment continuity and downstream spawning habitat, and/or to provide passage meeting specific fish passage guidelines).

   B) A clear statement and justification for the project's method of restoring the channel along with a sediment management plan.

   C) The proposed time-frame for dam and sediment removal along with the time expected for channel equilibrium to occur at the project site. Include anticipated and actual start and end dates of project.

   D) The distance and location of nearest upstream grade control feature (natural or anthropogenic).

   E) An estimate of depth and volume of sediment stored above the dam. Evidence that the amount of sediment to be released above the dam is relatively small and unlikely to significantly affect downstream spawning, rearing, and/or over-summering habitats. The estimate should be determined with a minimum of five cross-sections - one downstream of the structure, three through the reservoir area upstream of the structure, and one upstream of the reservoir area outside of the influence of the structure - to characterize the channel morphology and quantify the stored sediment.

   F) Detailed information on project/reference reach including:
      1. Location of project/reference reach.
      2. Channel width (baseline and target range in feet): Should be determined by taking three measurements of active channel at the dam and immediately upstream and downstream of the dam.
      3. Any existing geomorphic features present and that will be incorporated into the channel (*e.g.* pools, riffles, runs, step-pools, *etc.*).
      4. Overall channel slope (% baseline and target): determined by taking a longitudinal profile throughout the project reach upstream

and downstream to the extent of dam influence on the channel slope.

5. Maximum channel slope: determined through the site before and after the project using pre-project and as-built (post-project) longitudinal profiles.
6. Photographs of pre and post project conditions, illustrating implementation of the dam removal, upstream sediment deposit/reservoir, and channel morphology upstream and downstream of the proposed project reach.
7. Maximum jump height (baseline and target range in inches): using the pre-project and/or as built longitudinal profile to determine the maximum height a fish would have to jump to migrate through the site.
8. A longitudinal profile of the stream channel thalweg for at least 20 channel widths upstream and downstream (pre and post project) of the structure or of a sufficient distance to establish the natural channel grade, whichever is greater, shall be used to determine the potential for channel degradation (as described in the CDFW Manual).
9. The number of stream miles opened by each project should be estimated before implementation and verified after project completion. The following sources may be used to verify the number of upstream miles made accessible as a result of the project: exiting aerial photos and maps of the project watershed, local or regional barrier databases, existing staff or local expert knowledge of project watershed, and/or field verification (in cases where there is permission to access the stream).
10. A survey of any downstream spawning areas that may be negatively affected by sediment released by removal of the dam.
11. Presence/absence of salmonids:
    <u>Pre-implementation:</u> Use one of the following survey techniques defined in California Coastal Salmonid Population Monitoring: Strategy, Design, and Methods (Adams *et al.* 2011) to identify and report presence/absence for either adults or juveniles upstream of the project site. Describe the survey techniques used to determine presence/absence status of salmonids. If a pre-implementation survey is not possible, report whether the barrier is a known full barrier or partial barrier for salmonids. Describe any pre-project data that is available. If no recent, biological information is available, include surrogate information (*e.g.* most recent observation of species above barrier, description of "completeness" of barrier, *etc.*).
    <u>Post-implementation:</u> If the pre-implementation status was determined to be "absent," use one of the survey techniques to identify and report presence/absence following implementation. If pre-project upstream status was determined to be “present” (*e.g.* partial barriers), report any change in presence/absence following implementation if possible. In this case, the post-implementation

result may be “continued presence." Describe the methodology used to determine presence/absence for the target fish species. Frequency /duration of sampling: The timing and frequency should correlate with the life history of the target fish species. At a minimum, if landowner access is allowed, this parameter should be monitored one time following implementation, and if funding and landowner access allows, would preferably be monitored on an annual or seasonal basis. Monitoring for this measure is likely to yield meaningful results in the first 3 years after project implementation, although in some situations it may be valuable to monitor for the first 5 years. Optional monitoring: for partial barriers or projects where the pre-implementation fish presence/absence status was identified as "present," the proportional change in the number of adults or juveniles due to project implementation may be measured.

2) Potential data needs for more complex projects:

NMFS engineers and/or the RC lead may request additional information from more complex projects to include:

A) Hydraulic modeling immediately upstream and downstream of the project site, and throughout the project reach.

B) Sediment modeling immediately upstream and downstream of the project site, and throughout the reach of the stream in which the project is located, including: Sediment grain size distribution within the dam depositional area and the sediment grain size distributions of the channel bed material within the equilibrium reaches upstream and downstream of the dam; recurrence interval of the discharge needed to mobilize the sediment particles and any established vegetation within the sediment deposit upstream of the dam that is to be removed; and bed and bank grain size distributions.

C) Detailed geomorphic assessment of the watershed and/or stream reach.

D) Detailed hydrologic analysis of the watershed and how it will drive the geomorphic conditions within the watershed before and after dam removal.

E) A detailed assessment of the habitat conditions within the watershed and/or upstream and downstream of the reach of the stream in which the project is located.

e. Two conditions that may preclude a project from eligibility for coverage under the Program are: 1) if sediments stored behind dam have a reasonable potential to contain environmental contaminants (may include but not limited to: dioxins, chlorinated pesticides, polychlorinated biphenyls (PCBs), or mercury) beyond the freshwater probable effect levels (PELs) summarized in the NOAA Screening Quick Reference Table guidelines found at: http://response.restoration.noaa.gov/book_shelf/122_NEW-SQuiRTs.pdf, or 2) if the risk of significant loss or degradation of downstream spawning or rearing areas by sediment deposition is considered to be such that the project requires more detailed analysis. Sites should be considered to have a reasonable potential to contain contaminants of concern if they are downstream of historical contamination sources such as industrial sites, or sites where intensive agricultural production going back several decades occurred (since chlorinated pesticides were legal to purchase and use for many years). In these cases, preliminary sediment sampling is advisable for a project to be considered for coverage under the proposed Program.

1.3.8 Specific Requirements for Off-channel Habitat Projects

Restoring off-channel habitat features is a relatively new restoration technique in California and the lessons learned through monitoring these features will provide valuable information for adaptive management and future projects. All off-channel habitat projects included in this Program will require an additional level of physical and biological monitoring. Project applicants will collect the following information with assistance from qualified consulting biologists, and submit the information to the RC and Corps:

a. Pre- and post-project photo monitoring data (per CDFW guidelines);

b. Project Description:
   1. Project problem statement
   2. Project goals and objectives, *etc.*
   3. Watershed context
   4. Description of the type of off-channel feature and restoration techniques utilized
   5. Project dimensions
   6. Description of outlet control feature (if present)
   7. If dewatering of the work site will be necessary, description of temporary dewatering methods including qualified individual who will be onsite to transport protected steelhead
   8. Construction start and end dates
   9. Materials to be used
   10. When vegetation will be affected as a result of the project (including removal and replacement), provide a visual assessment of dominant native shrubs and trees, approximate species diversity, and approximate acreage
   11. Description of existing site conditions and explanation of how proposed activities improve or maintain these conditions for salmonids, within the range of natural variability expected at the site
   12. Description of key habitat elements (*i.e.*, temperature; type: pool, riffle, flatwater; estimate of instream shelter and shelter components; water depth; dominant substrate type, *etc.*) for salmonids in the project area
   13. Pre- and post-construction (after winter flow event) information on the elevation of the inlet and outlet structure relative to the 2-year flood event

14. A description of if and when the off-channel feature became disconnected from the main channel. This will require checking the project site daily when the off-channel feature is becoming disconnected from the main channel.
15. A description of any stranded fish observed. If salmonids are stranded, the applicant will contact NMFS and RC staff immediately to determine if a fish rescue action is necessary. CDFW may also be contacted and provided with fish rescue information and/or mortalities by species.

1.4 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, riparian areas, and hydrologically linked upslope areas that will be affected by the implementation of the proposed restoration projects that are authorized under the Program. Qualifying restoration projects occurring within the NMFS North- Central Coastal California Office boundaries will be implemented under the Program (Figure 1). Because restoration projects could potentially occur within any stream within ESUs and DPSs located in Figure 1, the action area includes all coastal anadromous streams and estuaries (excluding the San Francisco Bay) from San Luis Obispo County (Salinas River and tributaries) north to, but not including, the Mattole River.

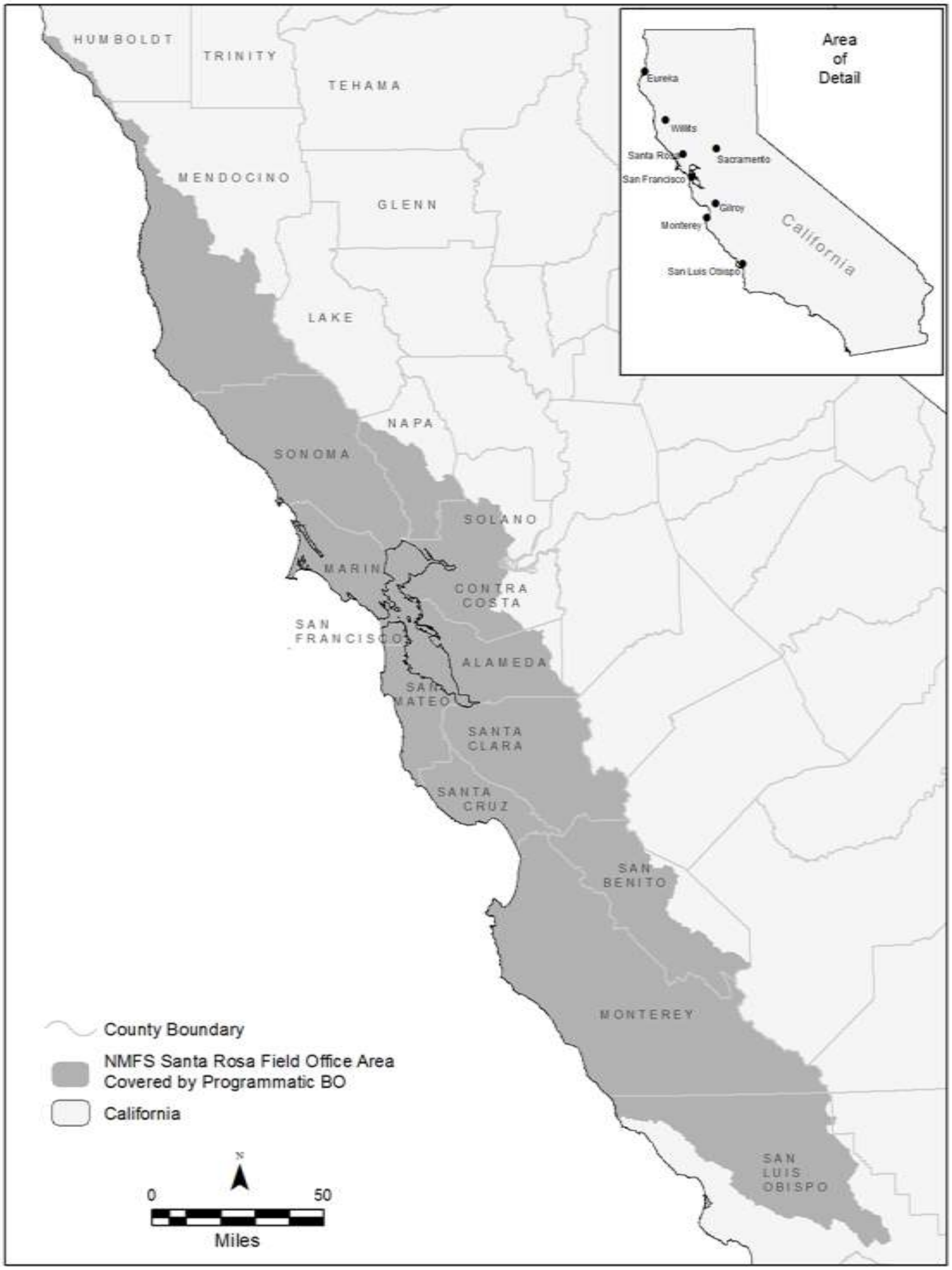

Figure1. Map showing the action area included in the proposed RC and Corps restoration program. Action area does not include the San Francisco Bay.

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

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

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

The adverse modification analysis considers the impacts of the Federal action on the conservation value of designated critical habitat. This biological opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (81 FR 7214).[1]

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

- Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.

[1] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

- Reach jeopardy and adverse modification conclusions.
- If necessary, define a reasonable and prudent alternative to the proposed action.

2.2 Life History and Range-wide Status of the Species and Critical Habitat

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

This biological opinion analyzes the effects of the action on the following listed salmonids and their designated critical habitat:

- **Endangered CCC coho salmon (*Oncorhynchus kisutch)* Evolutionarily Significant Unit (ESU)**
  Listing determination (70 FR 37160; June 28, 2005)
  Critical habitat designation (64 FR 24049; May 5, 1999);

- **Threatened CC Chinook salmon (*O. tshawytscha)* ESU**
  Listing determination (70 FR 37160; June 28, 2005)
  Critical habitat designation (70 FR 52488; September 2, 2005);

- **Threatened CCC steelhead (*O. mykiss*) Distinct Population Segment (DPS)**
  Listing determination (71 FR 834; January 5, 2006)
  Critical habitat designation (70 FR 52488; September 2, 2005);

- **Threatened NC steelhead (*O. mykiss)* Distinct Population Segment (DPS)**
  Listing determination (71 FR 834; January 5, 2006)
  Critical habitat designation (70 FR 52488; September 2, 2005);

- **Threatened S-CCC steelhead (*O. mykiss*) Distinct Population Segment (DPS)**
  Listing determination (62 FR 43937; August 18, 1997)
  Critical habitat designation (70 FR 52488; September 2, 2005).

2.2.1 Species Description and Life History

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 (Stein *et al.* 1972, 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.

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 during June through November, with peak migration periods occurring in September and October. Spawning occurs from late September through December, with peaks 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 outmigrate during April through July (Myers *et al.* 1998).

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 is correlated with higher flow events, such as freshets or sandbar breaches. Adult summer steelhead migrate upstream from March through September. 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 (CDFG 2001).

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 edgewater 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 Status of Species and Critical Habitat

In this biological opinion, NMFS assesses four population viability parameters to help us understand the status of each species and their ability to survive and recover. These population viability parameters are: abundance, population growth rate, special structure, and diversity (McElhaney *et al.* 2000). While there is insufficient information to evaluate these population viability parameters in a thorough quantitative sense, NMFS has used existing information, including the NOAA Fisheries' Recovery Plan for the Evolutionary Significant Unit of Central California Coast Coho salmon (NMFS 2012) and NOAA Fisheries' Coastal Multispecies Recovery Plan Public draft (NMFS 2015), to determine the general condition of each population and factors responsible for the current status of each DPS or ESU.

We use these population viability parameters as surrogates for numbers, reproduction, and distribution, the criteria found within the regulatory definition of jeopardy (50 CFR 402.20). For example, the first three parameters are used as surrogates for numbers, reproduction, and distribution. We relate the fourth parameter, diversity, to all three regulatory criteria. Numbers, reproduction, and distribution are all affected when genetic or life history variability is lost or constrained resulting in reduced population resilience to environmental variation at local or landscape-level scales.

CCC Coho Salmon

Historically, the CCC coho salmon ESU was comprised of approximately 76 coho salmon populations. Most of these were dependent populations that needed immigration from other nearby populations to ensure their long term survival, as described above. Historically, there were 11 functionally independent populations and one potentially independent population of CCC coho salmon (Spence *et al.* 2008, Spence *et al.* 2012). Most of the populations in the CCC coho salmon ESU are currently doing poorly; low abundance, range constriction, fragmentation, and loss of genetic diversity is documented, as described below.

Brown *et al.* (1994) estimated that annual spawning numbers of coho salmon in California ranged between 200,000 and 500,000 fish in the 1940's, which declined to about 100,000 fish by the 1960's, followed by a further decline to about 31,000 fish by 1991. More recent abundance estimates vary from approximately 600 to 5,500 adults (NMFS 2005). Recent status reviews (NMFS 2003, NMFS 2005, Williams *et al.* 2011) indicate that the CCC coho salmon are likely continuing to decline in number. CCC coho salmon have also experienced acute range restriction and fragmentation. Adams *et al.* (1999) found that in the mid 1990's, coho salmon were present in 51 percent (98 of 191) of the streams where they were historically present, and documented an additional 23 streams within the CCC coho salmon ESU in which coho salmon were found for which there were no historical records. Recent genetic research in progress by both the NMFS Southwest Fisheries Science Center (SWFSC) and the Bodega Marine Laboratory has documented reduced genetic diversity within CCC coho salmon subpopulations (Bjorkstedt *et al.* 2005). The influence of hatchery fish on wild stocks has also contributed to the poor diversity through outbreeding depression and disease.

Available data from the few remaining independent populations shows continuing declines and many independent populations that supported the species overall numbers and geographic distributions have been extirpated. This suggests that populations that historically provided support to dependent populations via immigration have not been able to provide enough immigrants for many dependent populations for several decades. The near-term (10 - 20 years) viability of many of the extant independent CCC coho salmon populations is of serious concern. These populations may not have enough fish to survive additional natural and human caused environmental change.

The substantial decline in the Russian River coho salmon abundance led to the formation of the Russian River Coho Salmon Captive Broodstock Program *(*RRCSCBP) in 2001. Under this program, offspring of wild captive-reared coho salmon are released as juveniles into tributaries within their historic range with the expectation that some of them will return as adults to naturally reproduce. Juvenile coho salmon and coho salmon smolts have been released into several tributaries within the lower Russian River and Dry Creek watersheds.

Williams *et al.* (2011), in the most recent SWFSC status update, note that for all available time series, recent population trends have been downward with particularly poor adult returns from 2006 to 2010. In addition, any independent populations are well below low-risk abundance targets and several are either extinct or below the high-risk dispensation thresholds that were identified by Spence *et al.* (2008). It appears that none of the five diversity strata defined by Bjorkstedt *et al.* (2005) currently support viable populations based on criteria established by Spence et al (2008). The risk of extinction for this ESU appears to have increased since the last formal review when Good *et al.* (2005) concluded that the ESU was in danger of extinction. The best available updated information on the biological status of this ESU and the threats facing this ESU (Williams *et al.* 2011, NMFS 2011a, Spence 2016) indicate that it continues to remain endangered, and its condition is worsening (76 FR 50447). Based on this information, NMFS chose to maintain the endangered listing of CCC coho salmon (Williams 2016).

The NMFS's recovery plan (NMFS 2012) for the CCC coho salmon ESU identified the major threats to population recovery. These major threats include: roads, water diversions and impoundments; residential and commercial development; and severe weather. The impacts of these major threats are described in the effects to critical habitat section.

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).

Data on CC Chinook abundance, both historical and current, is sparse and of varying quality (Bjorkstedt *et al.* 2005). Estimates of absolute abundance are not available for populations in this ESU (Myers *et al.* 1998). In 1965, CDFG (1965) estimated escapement for this ESU at over 76,000. 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.

CC Chinook salmon populations remain widely distributed throughout much of the ESU. Notable exceptions include the area between the Navarro River and Russian River and the area between the Mattole and Ten Mile River populations (Lost Coast area). The lack of Chinook salmon populations both north and south of the Russian River (the Russian River is at the southern end of the species' range) makes it one of the most isolated populations in the ESU. Myers *et al.* (1998) reports no viable populations of Chinook salmon south of San Francisco, California.

Because of their prized status in the sport and commercial fishing industries, CC Chinook salmon have been the subject of many artificial production efforts, including out-of-basin and out-of-ESU stock transfers (Bjorkstedt *et al.* 2005). It is therefore likely that CC Chinook salmon genetic diversity has been significantly adversely affected despite the relatively wide population distribution within the ESU. An apparent loss of the spring-run Chinook life history in the Eel River Basin and elsewhere in the ESU also indicates risks to the diversity of the ESU.

Data from the 2009 adult CC Chinook salmon return counts and estimates indicated a further decline in returning adults across the range of CC Chinook salmon on the coast of California (Jeffrey Jahn, NMFS, personal communication 2010). Ocean conditions are suspected as the principal short term cause because of the wide geographic range of declines (SWFSC 2008). However, the number of adult CC Chinook salmon returns in the Russian River Watershed increased substantially in 2010/2011 compared to 2008/09 and 2009/10 returns[2]. Increases in adult Chinook salmon returns during 2010/2011 have been observed in the Central Valley populations as well.

Using an updated analysis approach, Williams *et al.* (2011) did not find evidence of a substantial change in conditions since the last status review (Good *et al.* 2005). Williams *et al.* (2011) found that the loss of representation from one diversity stratum, the loss of the spring-run history type in two diversity substrata, and the diminished connectivity between populations in the northern and southern half of the ESU pose a concern regarding viability for this ESU. Based on consideration of this updated information, Williams *et al.* (2011) concluded the extinction risk of the CC Chinook salmon ESU has not changed since the last status review. On August 15, 2011, NMFS affirmed no change to the determination that the CC Chinook salmon ESU is a threatened species, as previously listed (NMFS 2011b, 76 FR 50447). The latest status review of this CC Chinook salmon determined that there is no change in the extinction risk for this ESU (Spence 2016).

The NMFS's recovery plan (NMFS 2015) for the CC Chinook salmon ESU identified the major threats to recovery. These major threats include: channel modification, roads, logging and timber harvesting; water diversions and impoundments; and severe weather. The impacts of these major threats are described in the effects to critical habitat section.

CCC Steelhead

Historically, approximately 70 populations[3] of steelhead existed in the CCC steelhead DPS (Spence *et al.* 2008). Many of these populations (about 37) were independent, or potentially

[2] http://www.SCWA.ca.gov/chinook/

[3] Population as defined by Bjorkstedt *et al*. 2005 and McElhaney *et al*. 2000 as, in brief summary, a group of fish of the same species that spawns in a particular locality at a particular season and does not interbreed substantially with fish from any other group. Such fish groups may include more than one stream. These authors use this definition as a starting point from which they define four types of populations (not all of which are mentioned here).

independent, meaning they had a high likelihood of surviving for 100 years absent anthropogenic impacts (Bjorkstedt *et al.* 2005). The remaining populations were dependent upon immigration from nearby CCC steelhead DPS populations to ensure their viability (McElhaney *et al.* 2000, Bjorkstedt *et al.* 2005).

While historical and present data on abundance are limited, CCC steelhead numbers are substantially reduced from historical levels. A total of 94,000 adult steelhead were estimated to spawn in the rivers of this DPS in the mid-1960's, including 50,000 fish in the Russian River – the largest population within the DPS (Busby *et al.* 1996). Near the end of the 20th century, McEwan (2001) estimated that the wild steelhead population in the Russian River watershed was between 1,700 and 7,000 fish. Abundance estimates for smaller coastal streams in the DPS indicate low but stable levels, with recent estimates for several streams (Lagunitas, Waddell, Scott, San Vicente, Soquel, and Aptos creeks) of individual run sizes of 500 fish or less (62 FR 43937).

Some loss of genetic diversity has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt *et al.* 2005). In San Francisco Bay streams, reduced population sizes and habitat fragmentation has likely also led to loss of genetic diversity in these populations. For more detailed information on trends in CCC steelhead abundance, see: Busby *et al.* 1996, NMFS 1997, Good *et al.* 2005, and Spence *et al.* 2008.

CCC steelhead have experienced serious declines in abundance and long-term population trends suggest a negative growth rate. This indicates the DPSs may not be viable in the long term. DPS populations that historically provided enough steelhead immigrants to support dependent populations may no longer be able to do so, placing dependent populations at increased risk of extirpation. However, because CCC steelhead have maintained a wide distribution throughout the DPS, roughly approximating the known historical distribution, CCC steelhead likely possess a resilience that is likely to slow their decline relative to other salmonid DPSs or ESUs in worse condition. The 2005 status review concludes that steelhead in the CCC steelhead DPS remain "likely to become endangered in the foreseeable future" (Good *et al.* 2005), a conclusion that was consistent with a previous assessment (Busby *et al.* 1996) and supported by the most recent NMFS Technical Recovery Team work (Spence *et al.* 2008). On January 5, 2006, NMFS issued a final determination that the CCC steelhead DPS is a threatened species, as previously listed (71 FR 834). Although numbers did not decline further during 2007/08, the 2008/09 adult CCC steelhead return data indicated a decline in returning adults across their range. Escapement data from 2009/2010 indicated a slight increase; however, the returns were still well below data observed within recent decades (Jeffrey Jahn, personal communication, 2010).

The most recent status review by the Williams *et al.* (2011) concludes that steelhead in the CCC steelhead DPS remain "likely to become endangered in the foreseeable future" (Williams *et al.* 2011), as new and additional information available since Good *et al.* (2005) does not appear to suggest a change in extinction risk. On December 7, 2011, NMFS affirmed no change to the determination that the CCC steelhead DPS is a threatened species, as previously listed (NMFS 2011c, 76 FR 76386). In the most recent status review, Williams (2016) found that there is little evidence to suggest that the extinction risk for this DPS has changed appreciably in either direction since the publication of the last viability assessment

(Williams *et al.* 2011).

The NMFS's recovery plan (NMFS 2015) for the CCC steelhead DPS identified the major threats to recovery. These major threats include: channel modification, residential and commercial development; roads, and water diversions and impoundments. The impacts of these major threats are described in the effects to critical habitat section.

NC Steelhead

Historically, the NC steelhead DPS was comprised of 41 independent populations (19 functionally and 22 potentially independent) of winter run steelhead and 10 functionally independent populations of summer run steelhead (Bjorkstedt *et al.* 2005). Based on the limited data available (dam counts of portions of stocks in several rivers), NMFS' initial status review of NC steelhead (Busby *et al.* 1996) determined that population abundance was very low relative to historical estimates (1930s and 1960s dam counts), and recent trends were downward in most stocks. Overall, population numbers are severely reduced from pre-1960s levels, when approximately 198,000 adult steelhead migrated upstream to spawn in the major rivers supporting this Distinct Population Segment (DPS) (Busby *et al.* 1996, 65 FR 36074).

Updated status reviews reach the same conclusion, and noted the poor amount of data available, especially for winter run steelhead (NMFS 1997, Good *et al.* 2005). The information available suggests that the population growth rate is negative. Comprehensive geographic distribution information is not available for this DPS, but steelhead are considered to remain widely distributed (NMFS 1997). It is known that dams on the Mad River and Eel River block large amounts of habitat historically used by NC steelhead (Busby *et al.* 1996). 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. Historical hatchery practices at the Mad River hatchery are of particular concern, and included out-planting of non-native Mad River hatchery fish to other streams in the DPS and the production of non-native summer steelhead (65 FR 36074). The conclusion of the most recent status review (Good *et al.* 2005) echoes that of previous reviews. Abundance and productivity in this DPS are of most concern, relative to NC steelhead spatial structure (distribution on the landscape) and diversity (level of genetic introgression). The lack of data available also remains a risk because of uncertainty regarding the condition of some stream populations.

NMFS evaluated the listing status of NC steelhead and proposed maintaining the threatened listing determination (71 FR 834) in 2006. The most recent status review by Williams *et al.* (2011) reports a mixture of patterns in population trend information, with more populations showing declines than increases. Although little information is available to assess the status for most population in the NC steelhead DPS, overall Williams *et al.* (2011) found little evidence to suggest a change in status compared to the last status review by Goode *et al.* (2005). The most recent status review by Williams (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 last viability assessment (Williams *et al.* 2011).

SCCC Steelhead

Populations of SCCC steelhead throughout the DPS have exhibited a long-term negative trend since at least the mid-1960s. In the mid-1960s, total spawning population was estimated at 17,750 individuals (Goode *et al.* 2005). Available information shows SCCC steelhead population abundance continued to decline from the 1970s to the 1990s (Busby *et al.* 1996) and more recent data indicate this trend continues (Good *et al.* 2005). Current SCCC steelhead run- sizes in the five largest river systems in the DPS (Pajaro River, Salinas River, Carmel River, Little Sur River, and Big Sur River) are likely reduced from 4,750 adults in 1965 (CDFG 1965) to less than 500 returning adult fish in 1996. More recent estimates for total run-size do not exist for the SCCC steelhead DPS (Goode *et al.* 2005) as few comprehensive or population monitoring programs are in place.

Recent analyses conducted by the SCCC steelhead Technical Review Team (TRT) indicate the SCCC steelhead DPS consists of 12 discrete sub-populations representing localized groups of interbreeding individuals, and none of these sub-populations currently meet the definition of viable (Boughton *et al.* 2006; Boughton *et al.* 2007). Most of these sub-populations are characterized by low population abundance, variable or negative population growth rates, and reduced spatial structure and diversity. The sub-populations in the Pajaro River and Salinas River[4] watersheds are in particularly poor condition (relative to watershed size) and exhibit a greater lack of viability than many of the coastal populations.

Although steelhead are present in most of the streams in the SCCC DPS (Good *et al.* 2005), their populations are small, fragmented, and unstable (more subject to stochastic events) (Boughton *et al.* 2006). In addition, severe habitat degradation and the compromised genetic integrity of the some populations pose a serious risk to the survival and recovery of the SCCC steelhead DPS (Good *et al.* 2005). During the winter of 2010/11, adult returns appeared to rebound toward the numbers seen at the beginning of the decade. This is largely based on a significant in adult returns counted at the San Clemente Dam on the Carmel River[5], and a notable increase in the number of observed adults in Uvas Creek in the Pajaro Watershed. However, these increases in the adult returns have not persisted in the most recent years due to onset and continuation of drought conditions that have impacted the region since the winter of 2011/12. This is evident by the much reduced numbers of juvenile steelhead captured and adults observed at sites in Corralitos Creek (Alley 2015) and Uvas Creeks (Casagrande 2014, 2015), in the neighboring Salinas river where flows have not reached the lagoon, or the ocean, since 2013, and in the Carmel River where only 7 adults were counted at the San Clemente fish ladder during the winter of 2014-15.

In the most recent status update, NMFS concluded there was no evidence to suggest the status of the SCCC steelhead DPS has changed appreciably since the publication of the previous status review (Goode *et al.* 2005), and therefore, SCCC steelhead remain listed as threatened (Williams *et al.* 2011). The most recent status review (Williams 2016) concludes

[4] The TRT only identified multiple populations in the Salinas River system for the purposes of DPS viability analysis. However, for the purposes of the threat analysis (and corresponding recovery actions), the Pajaro River was broken into the Uvas Creek tributary and the remainder of the Pajaro River system (which includes the mainstem and other tributaries). Uvas Creek was singled out because of its importance and the large number of threats.

[5] http://www.mpwmd.dst.ca.us/fishcounter/fishcounter.htm

that this DPS is one of eight steelhead DPS's that show no appreciable change since the last status review.

CCC, NC, & SCCC steelhead, CC Chinook salmon, and CCC coho salmon critical habitat

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 7414) replace 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 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.

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

1. freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;
2. freshwater rearing sites with:
    a. water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
    b. water quality and forage supporting juvenile development; and
    c. 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.
3. 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.

For CCC 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).

The condition of CCC coho salmon, CC Chinook salmon, and CCC, NC, S-CCC steelhead critical habitat, specifically 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[6]: 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.

2.2.3 Additional Threats to CC Chinook salmon, CCC Coho Salmon, CCC, NC, S-CCC Steelhead and their critical habitat

Global climate change presents an additional potential threat to salmonids and their critical habitats. 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 Mountains has declined (Kadir *et al.* 2013). However, total annual precipitation amounts have shown no discernable change (Kadir *et al.* 2013). Listed salmonids 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.

The threat to listed salmonids 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).

For Northern California, most models project heavier and warmer precipitation. Extreme wet and dry periods are projected, increasing the risk of both flooding and droughts (DWR 2013). Estimates show that snowmelt contribution to runoff in the Sacramento/San Joaquin Delta

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[6] Other factors, such as over fishing and artificial propagation, have also contributed to the current population status of these species. All these human induced factors have exacerbated the adverse effects of natural environmental variability from such factors as drought and poor ocean conditions.

may decrease by about 20 percent per decade over the next century (Cloern *et al.* 2011). Many of these changes are likely to further degrade listed salmonid habitat by, for example, reducing streamflows during the summer and raising summer water temperatures. 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 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).

2.3 Environmental Baseline

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

The action area includes all coastal anadromous California streams south of the Mattole River in Humboldt/Mendocino County south to headwaters of the Salinas River in San Luis Obispo County and all streams draining into San Francisco and San Pablo bays eastward to the Napa River (inclusive), excluding the Sacramento-San Joaquin River Basin (Figure 1).

The action area encompasses approximately 15,000 square miles of the central and northern California Coast Range. Native vegetation varies from redwood (*Sequoia sempervirens*) forest along the lower drainages to Douglas fir (*Pseudotsuga menziesii*) intermixed with hardwoods and chaparral, to ponderosa pine (*Pinus ponderosa*) and Jeffery pine (*Pinus jefferyi*) stands along the upper elevations. Areas of grasslands are also found along the main ridge tops and south facing slopes of the watersheds.

The action area has a Mediterranean climate characterized by cool wet winters with typically high runoff, and dry warm summers characterized by greatly reduced 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 above 1,600 ft. Along the coast, average air temperatures range from 46E to 56E Fahrenheit (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 100EF 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 road systems, urbanization, 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.

2.3.1 Status of the Species and/or Critical Habitat in the Action Area

This section provides a synopsis of the four geographic areas of consideration, the ESUs/DPSs and HUCs present within each area, specific recent information on the status of coho salmon or 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 (Weitkamp *et al.* 1995, Busby *et al.* 1996, NMFS 1996, Myers *et al.* 1998, NMFS 1998, CDFG 2002, CRWQCB 2001). The following is a summary of the factors affecting the environment of the species or critical habitat within each HUC. Information in this section is delineated by the following geographic areas: North Central Coast Area, San Francisco Bay Area, and the Central Coast Area, and subdivided by 4th Field HUCs.

The discussion of information from the North Central Coast, San Francisco Bay, and Central Coast areas are organized by HUCs. A few HUCs in these areas contain one river system, but most contain several small systems.

2.3.1.1 North Central Coast Area

The North Central Coast area includes all coastal California streams entering the Pacific Ocean in Mendocino, Sonoma, and Marin counties, excluding streams draining into San Francisco and San Pablo bays. The North Central Coast Area includes portions of three ESUs/DPSs (CCC coho salmon, NC steelhead, and CCC steelhead) and five USGS 4th field HUCs (Big-Navarro-Garcia, Bodega Bay, Gualala-Salmon, Russian, and Tomales-Drakes Bay). Forestry is the dominant land-use throughout the northern part of this area (north of the Russian River). Agriculture and urbanization are more predominant in the Russian River and areas south.

a. Big, Navarro, and Garcia River

This HUC-8 includes all coastal watersheds from Jackass Creek south to, but not including, the Gualala River. This HUC is wholly within Mendocino County and includes most of the coastal streams in the county. There are several medium-sized watersheds present within the HUC: Garcia River, Navarro River, Albion River, Big River, Noyo River, and Ten Mile River. The HUC also includes many smaller watersheds draining directly to the Pacific Ocean. The urban development within the HUC is limited primarily to coastal towns on the estuaries of the larger streams, though there are some small towns in other areas of the HUC. In the larger basins within this HUC, private forest lands average about 75 percent of the total acreage (65 FR 36074). Forestry is the dominant land use activity; in some subwatersheds, significant portions (up to 100 percent) have been harvested (CRWQCB 2001). Excessive sedimentation, low LWD abundance and recruitment, and elevated water temperature are issues throughout the HUC; these issues are largely attributable to forestry activities (NMFS 2015). Agriculture has likely contributed to depressed habitat conditions within the Navarro River watershed, and gravel mining may affect salmonids in the Ten Mile and Garcia River watersheds. The effects of land use activities are exacerbated by the naturally erosive geology, the mountainous and rugged terrain, and legacy impacts from historically large storms (*e.g.*, 1964, 1982). Estuaries throughout the HUC have likely decreased in size due to sedimentation and flood control actions (*e.g.*, diking and channelization). All of the larger watersheds within this HUC are included on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012), and have TMDLs in place that address sediment pollution.

This HUC is within the CCC coho salmon ESU, CC Chinook salmon ESU, and NC steelhead DPS. Salmonid abundance has declined throughout the HUC. Steelhead are widespread yet reduced in abundance, and coho salmon have a patchy distribution with populations significantly reduced from historic levels (Weitkamp *et al.* 1995; Busby *et al.* 1996; CRWQCB 2001). The most recent status review noted positive but non-significant population trends for coho salmon within the Ten Mile River, Big River, and Albion River over the last several years, but overall, but most populations remain below or near depensation levels (Williams 2016). Small numbers of Chinook salmon continue to appear within the Ten Mile, Noyo and Big rivers, although these numbers remain well below depensation thresholds for each population (Williams 2016). Recent estimates of NC steelhead abundance within the North-Central Coast Stratum have generally improved during the past several years; yet similar to Chinook and coho salmon, many of these steelhead populations remain at or below population depensation levels. On a positive note, both the Big River and Ten Mile River populations have experienced positive growth trends during the past six years (Williams 2016). Likewise, Garcia River steelhead escapement has averaged 326 adults annually for the past 6 years, and the population trend is also positive (although insignificantly so).

b. Gualala-Salmon River
This HUC-8 includes the entire Gualala River watershed and all coastal watersheds between the Gualala River watershed and the Russian River watershed. The Gualala River is the only large watershed within the HUC, though there are several small coastal watersheds. There is limited urban development within the HUC. Within the Gualala River watershed, private forest lands make up about 94 percent of the total acreage, and forestry is the dominant land use of the watershed (65 FR 36074). Agriculture has been a significant land use within the Gualala River watershed; historically orchards and grazing were the dominant agricultural activities, though more recently vineyard development and illicit marijuana cultivation has become more common within the basin (NMFS 2014). Gravel mining is largely a historic activity, although a rather large gravel mining operation near the confluence of the Wheatfield Fork remains (Matt Goldsworth, personal communication). Gravel extraction is currently limited to 40,000 tons per year, though extractions in the past 10 years have not reached that limit (CRWQCB 2001). The Gualala River is included on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012). The pollution factors for the Gualala River are sedimentation, temperature, DO, and a host of chemical pollutants; forestry, agriculture, and land development are listed as the potential sources for those factors (CSWRCB 2012). In 2001, a TMDL for sediment was approved for the Gualala River (www.epa.gov).

This HUC contains CCC coho salmon, CC Chinook salmon and NC steelhead. Higgins *et* *al.* (1992) considered coho salmon from the Gualala River as being at a high risk of extinction. The CDFG (2002) concluded that the Gualala River contains no known remaining viable coho salmon populations; no population data exists from the past 5 years, and NMFS suspects the number of coho salmon in the Gualala River is very low (SWFSC 2016). Recent steelhead data suggests the Gualala River may contain the largest remaining steelhead population within the CCC DPS (Williams 2016). Three small coastal watersheds within this HUC and outside the Gualala River watershed, historically contained coho salmon: Fort Ross Creek, Russian Gulch, and Scotty Creek (Brown and Moyle 1991; Hassler *et al.* 1991).

c. Russian River

This HUC-8 contains the entire Russian River basin and no other watersheds. Portions of the HUC are in Sonoma and Mendocino counties. There is significant urban development within this HUC centered on the Highway 101 corridor, though there are small towns and rural residences throughout the HUC. Santa Rosa is the largest city within the HUC. Forestry and agriculture are other significant land uses within the HUC, and there are some in-channel gravel mining operations. Brown and Moyle (1991) reported that logging and mining in combination with naturally erosive geology have led to significant aggradation of up to 10 feet in some areas of Austin Creek - a lower Russian River tributary. NMFS's status reviews (Weitkamp *et al.* 1995; Busby *et al.* 1996; Myers *et al.* 1998) identified two large dams within the Russian River that block access to anadromous fish habitat: Coyote Valley Dam and Warm Springs Dam. Steiner Environmental Consulting (SEC) (1996) cite unpublished data from the California State Water Resources Control Board (CSWRCB), which state that there are over 500 small dams on the Russian River and its tributaries. These dams have a variety of functions including residential, commercial, and agricultural water supply, flood and/or debris control, and recreation. These small dams interfere with fish migration, affect sediment transport, and affect water flow and temperature.

The Corps (1982) concluded that the loss of tributary habitat was the primary factor limiting the recovery of the anadromous fishery in the Russian River. The Russian River is included on the 2013 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2013). The pollution factors for the Russian River are vary by sub-watershed, but commonly include sediment, temperature, dissolved oxygen, various nutrients, and many chemical pollutants and pathogens. Forestry, agriculture, dams with flow regulation, urban and land development, and nonpoint sources are listed as the potential sources for these factors. Lake Sonoma, a reservoir impounded by Warm Springs Dam, is included on the section 303(d) list because of elevated levels of mercury associated with historic mining. Currently, there is no approved TMDL for the Russian River watershed (www.epa.gov).

Many releases of in-basin and out-of-basin Chinook salmon, coho salmon and steelhead occurred throughout the Russian River since the late 1800s (Weitkamp *et al.* 1995; Busby *et al.* 1996; Myers *et al.* 1998; NMFS 1999a). For the last 20 years, the Don Clausen Fish Hatchery operated at Warm Springs Dam and released coho salmon, Chinook salmon, and steelhead into the Russian River watershed. However, significant changes in hatchery operations began in 1998, in which the production of coho salmon and Chinook salmon was discontinued. Traditional production of steelhead continues at Don Clausen Fish

Hatchery.

This HUC is within the CCC coho salmon ESU, CC Chinook salmon ESU, and CCC steelhead DPS. The CDFG (2002) reported that recent monitoring data indicate that widespread extirpation of coho salmon has occurred within the Russian River basin. In 2001, a conservation hatchery program was developed for coho salmon at the Don Clausen Fish Hatchery. Juvenile coho salmon from the program have been released for reintroduction into several historical coho salmon Russian River tributaries annually beginning in Fall 2004. Recent monitoring data indicate the coho salmon population in the lower Russian River (Dry Creek downstream, inclusive) ranged from 206 to 536 adult fish during the past four years (Williams 2016). The Russian River population of Chinook salmon has shown no discernable trend in population abundance during the past 14-year period, with an average annual escapement counted at the Mirabell counting facility of 3,257 fish (Williams 2016). The lack of adequate spawner surveys within the Russian River precludes the estimation of wild steelhead escapement within the basin; however, hatchery returns suggest the vast majority of returning fish are of hatchery origin. Current population abundance for all three species remains a mere fraction of their target recovery levels.

d. Bodega Bay

This HUC-8 contains all of the coastal watersheds from the Estero de San Antonio north to the mouth of the Russian River. There are three moderate-sized watersheds within the HUC (Salmon Creek, Americano Creek, and Stemple Creek) and few small coastal watersheds directly tributary to the Pacific Ocean. The Salmon Creek watershed is wholly within Sonoma County, whereas the Americano Creek and Stemple Creek watersheds are in both Sonoma and Marin counties. There is limited urban development within the HUC; agriculture is the dominant land use within all of the watersheds within this HUC, with dairy farming being the primary activity. There are some forest lands in the headwaters of Salmon Creek. Large winter storms have exacerbated the impact of land use activities and natural erosive geology of Salmon Creek (Brown and Moyle 1991) and negatively affected rearing habitat quality and quantity. Americano Creek and Stemple Creek and their estuaries are included on the 2012 Clean Water Act section 303(d) list of water quality limited segments for elevated levels of nutrients and sediment (CSWRCB 2012). The pollution factors for these streams are sedimentation, nutrients, invasive species, and temperature; Diazinon is listed as a pollutant in Estero de San Antonio. Agriculture and land development are listed as the potential sources for those factors. Many of the streams lack riparian cover, causing increased water temperatures.

This HUC is within the CCC coho salmon ESU and CCC steelhead DPS. The distribution and abundance of salmonids within the HUC are highly reduced. Within this HUC, coho salmon have been found in two watersheds: Salmon Creek and Valley Ford Creek (Brown and Moyle 1991; Hassler *et al.* 1991; Weitkamp *et al.* 1995). Excess coho salmon broodstock fish from Warm Springs Hatchery have been released into Salmon Creek during the past several years in an attempt to re-establish a self-sustaining run within the watershed (Williams 2016). NMFS found no historical coho salmon collections from watersheds of this HUC between Valley Ford Creek and Tomales Bay. The watersheds of this HUC historically contained steelhead. Steelhead are found throughout Salmon Creek, but the status of steelhead distribution in tributary streams is unknown. Steelhead are likely extirpated from San Antonio Creek and Americano Creek (Cox 2004).

e. Tomales-Drakes Bay

This HUC-8 includes all watersheds draining into the Pacific Ocean from Rodeo Cove north to Tomales Bay. The entire HUC is in Marin County, with the exception of a small portion of the headwaters of Walker Creek, which is in Sonoma County. Most of the watersheds in this HUC are small with the exception of Walker Creek and Lagunitas Creek, both tributaries of Tomales Bay, a prominent artifact of the San Andreas Rift Zone. Urban development within the HUC ranges from single homes to small towns and municipal complexes. Although urbanization has been limited, flood control activities, contaminated runoff from paved lots and roads, and seepage from improperly designed and/or maintained septic systems, continue to impact habitat and water quality in portions of the watershed (Ketcham 2003). Recreation is a significant factor in land use within the HUC as there are county, state, and Federal parks within the HUC. Agriculture is a dominant land-use, particularly in the northern half of the HUC, and forestry was a historic land use activity within the HUC. Lagunitas Creek, Walker Creek, and Tomales Bay are included on the 2002 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012); nutrients, pathogens, and sedimentation are the factors and are attributed to agriculture and urban runoff or storm sewers. Mercury, associated with mining, is an additional factor for Walker Creek and Tomales Bay. The construction of Kent Reservoir and Nicasio Reservoir cut off 50 percent of the historical salmonid habitat within the Lagunitas Creek watershed; and construction of two large reservoirs within the Walker Creek watershed, Laguna Lake, and Soulejoule Reservoir, cut off access to significant amounts of habitat (Weitkamp *et al.* 1995; Busby *et al.* 1996; Myers *et al.* 1998, CDFG 2002, NMFS 2015). Sedimentation has had a profound effect on fish habitat in Walker Creek. Many of the deep, cool pools and gravel that salmonids depend on for spawning and rearing, have been filled in with fine sediment.

Elevated stream temperatures are also a concern within many watersheds throughout the HUC. Summer water temperatures are usually below lethal thresholds for salmonids, but can be high enough to retard growth. It was reported that juvenile salmonids in Lagunitas Creek did not show appreciable growth during the summer of 1984, and it is believed that this lack of growth was due to the relatively high summer water temperatures that occurred during this time (Bratovich and Kelly 1988). The National Park Service has documented water temperatures well over the preferred range for salmonids in Olema Creek and one of its tributaries (Ketcham 2003).

This HUC is within the CCC coho salmon ESU and CCC steelhead DPS. With the exception of Lagunitas Creek, the abundance of coho salmon is very low throughout the HUC. Lagunitas Creek may have the largest populations of coho salmon remaining in the CCC coho salmon ESU. Although Lagunitas Creek is presumed to have a relatively stable and healthy population of coho salmon, at least when compared with other CCC coho salmon streams, NMFS (2001) noted that this stream has experienced a recent reduction in coho salmon abundance. Small persistent populations of coho salmon are in Pine Gulch Creek and Redwood Creek. Anecdotal evidence of a once thriving coho salmon and steelhead run in Walker Creek exists. Yet the species was thought to be extirpated from the watersheds of this HUC by both Adams *et al.* (1999) and CDFG (2002) as recently as fifteen years ago. In an attempt to increase population spatial distribution, excess coho salmon broodstock from Warm Spring hatchery were introduced into Walker Creek from 2008-2014, and observations of juvenile coho salmon following those plantings indicate successful spawning by those released broodstock fish (Spence 2016).. Small numbers of Chinook salmon are often encountered within Lagunitas Creek, which is outside the current CC ESU boundary that ends at the Russian River. NMFS is currently considering extending the CC ESU boundary to include these fish (Williams 2016).

2.3.1.2 San Francisco Bay Area

The San Francisco Bay Area encompasses the region between the Golden Gate Bridge and the confluence of the San Joaquin and Sacramento rivers. All of the watersheds in this area drain into San Francisco Bay, San Pablo Bay, or Suisun Bay at Chipps Island. Watersheds within this area are in portions of several counties: Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, San Mateo, and San Francisco. This area contains four HUC-8s (4^{th} field HUCs): San Pablo Bay, Suisun Bay, San Francisco Bay, and Coyote. Anthropogenic factors affecting listed salmonids in these HUCs are related primarily to urbanization, though agriculture is another prevalent land use in the San Pablo Bay and Suisun HUCs. Urban development is extensive within this area and has negatively affected the quality and quantity of salmonid habitat. Human population within the San Francisco Bay Area is approximately six million, representing the fourth most populous metropolitan area in the United States, and continued growth is expected (www.census.gov). In the past 150 years, the diking and filling of tidal marshes has decreased the surface area of the greater San Francisco Bay by 37 percent. More than 500,000 acres of the estuary's historic tidal wetlands have been converted for farm, salt pond, and urban uses (San Francisco Estuary Project 1992). These changes have diminished tidal marsh habitat, increased pollutant loadings to the estuary, and degraded shoreline habitat due to the installation of docks, shipping wharves, marinas, and miles of rock riprap for erosion protection. Most tributary streams have lost habitat through channelization, riparian vegetation removal, water development, and reduced water quality. Dams blocking anadromy are present on many streams and are used for water supply, aquifer recharge, or recreational activities. Streams have been affected by surface water diversion and groundwater withdrawal. Channelization for flood control, roadway construction, and commercial/ residential development have further affected the quality and quantity of available salmonid habitat. Most watersheds within this area are listed under the 2012 Clean Water Act section 303(d) list of impaired water bodies for high levels of industrial pollutants (*e.g.*, polychlorinated biphenyl, dichlorodiphenyltrichloroethane, furan compounds, *etc.*), reflecting the impacts of urban and industrial development (CSWRCB 2012). These human induced changes have substantially degraded natural productivity, biodiversity, and ecological integrity in streams throughout the area.

The area provides a critical link in the migratory pathway between the ocean and freshwater habitat in the Central Valley for three listed salmonid ESUs/DPSs: Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead. CCC steelhead occur in tributary streams around the Bay Area. CCC steelhead also utilize the bay for migration and possibly rearing.

a. San Pablo Bay Tributaries

This HUC contains all of the watersheds draining into San Pablo Bay located east of the

Golden Gate Bridge, north of the San Francisco-Oakland Bay Bridge, and west of the Carquinez Bridge. This HUC contains several small to medium-sized watersheds within portions of six counties: Marin, Sonoma, Napa, Solano, Contra Costa, and San Francisco. Agriculture has been a significant land use within the San Pablo Bay HUC; historically orchards, dairy, and grazing were the dominant agricultural activities, though more recently vineyard development has become common within the HUC. Agricultural practices have resulted in numerous small dams and water diversions that alter streamflows and water temperature conditions. Also, agricultural practices have likely altered sedimentation rates of streams. Urbanization is the dominant land use throughout this HUC and has affected habitat through flood control activities, urban runoff, and water development. The following streams are included on the 2012 Clean Water Act section 303(d) list of impaired water bodies for high levels of Diazinon, which can likely be attributed to urban runoff; Arroyo Corte Madera del Presidio, Corte Madera Creek, Coyote Creek, Napa River, Novato Creek, Petaluma River, Pinole Creek, Rodeo Creek, San Antonio Creek, San Pablo Creek, Sonoma Creek, and Wildcat Creek (CSWRCB 2012). In addition, Napa River, Petaluma River, Sonoma Creek are included on the section 303(d) list for nutrients, pathogens, and sedimentation related to agriculture, land development, and urban runoff. The lower Petaluma River has exceeded the California Toxic Rule and National Toxic Rule criteria for nickel; potential sources of nickel are municipal point source, urban runoff, and atmospheric deposition.

Presently, CCC steelhead occur in Arroyo Corte Madera del Presidio, Corte Madera Creek, Napa River, Sonoma Creek, Petaluma River, Novato Creek, and Pinole Creek. Environmental conditions in the upper portions of Arroyo Corte Madera del Presidio, Corte Madera Creek, and Pinole Creek watersheds are protected in parks or open space preserves. Recent surveys confirm steelhead presence in tributaries of San Pablo Bay (*e.g.*, Napa River and Petaluma River), but are insufficient to equivocally describe population trends or suggest a status change (Williams 2016). Coho salmon are thought to be extirpated from San Francisco Bay tributaries (NMFS 2012).

b. Suisun Bay Tributaries

This HUC includes all of the watersheds draining into Suisun Bay located east of the Carquinez Bridge and west of the confluence of the San Joaquin and Sacramento rivers. This HUC contains several small to medium-sized watersheds within Solano and Contra Costa counties. Urbanization, farming, cattle grazing, and vineyard development have all contributed to habitat degradation in streams in the northern portion of the HUC. Urbanization and industrial development have contributed to habitat degradation in the southern portion of the HUC. Laurel Creek, Ledgewood Creek, Mt. Diablo Creek, Pine Creek, and Walnut Creek are included on the 2012 Clean Water Act section 303(d) list of impaired water bodies for high levels of Diazinon attributable to urban runoff (CSWRCB 2012).

Suisun Creek, Green Valley Creek, and an unnamed tributary to Cordelia Slough currently support small populations of CCC steelhead (Spence 2016); these streams are all in Solano County. Streams flowing north from eastern Contra Costa County into south Suisun Bay are generally characterized by very dry summer conditions, and these streams do not currently support steelhead (Williams 2016).

c. San Francisco Bay Tributaries

This HUC includes all of the watersheds draining into San Francisco Bay south of the San Francisco-Oakland Bay Bridge and north of the Dumbarton Bridge. This HUC contains several small to medium-sized watersheds within Alameda and Contra Costa counties and contains the largest watershed draining into San Francisco Bay - Alameda Creek. Urbanization and industrial development are the predominant land use throughout the HUC; most watersheds within the HUC have severely degraded habitat. The following streams are included on the 2012 Clean Water Act section 303(d) list of impaired water bodies for high levels of Diazinon attributable to urban runoff: Alameda Creek, Alamitos Creek, Arroyo de la Laguna, Arroyo del Valle, Arroyo las Positas, Arroyo Mocho, Miller Creek, San Leandro Creek, San Lorenzo Creek, and San Mateo Creek (CSWRCB 2012). Islais Creek and Mission Creek in San Francisco are particularly polluted, and both are included on the 2002 Clean Water Act section 303(d) list of impaired water bodies for factors related to industrial point sources and combined sewer overflow. These streams are included on the list because of high levels of ammonia, chlordane, Chlorpyrifos, chromium, copper, dieldren, endosulfan sulfate, hydrogen sulfide, lead, mercury, mirex, PAHs, PCBs, silver, and zinc (CSWRCB 2012). Alameda Creek, Mt. Diablo Creek, San Leandro Creek, San Lorenzo Creek, and Walnut Creek historically supported steelhead, but access is currently blocked by dams, flood control facilities, or other barriers. Habitat conditions in the lower reaches of these streams are highly degraded by urbanization, but large portions of the upper watersheds located within public park land are protected from anthropogenic pollution and are generally in relatively good condition. Currently, small populations of CCC steelhead are found in Cordinices Creek, San Leandro Creek, and San Lorenzo Creek below dams. Most other drainages that historically supported steelhead presently do not (Leidy *et al*. 2005).

d. South San Francisco Bay Tributaries

This HUC includes the watersheds draining into San Francisco Bay south of the Dumbarton Bridge. This HUC contains all of the watersheds within Santa Clara County, and a few small watersheds from San Mateo and Alameda counties. Coyote Creek is the largest watershed within the HUC. Urbanization and industrial development are the predominant land uses throughout the HUC and are the primary factors affecting aquatic habitat. The following streams from this HUC are included on the 2012 Clean Water Act section 303(d) list of impaired water bodies for high levels of Diazinon attributable to urban runoff: Calabazas Creek, Coyote Creek, Guadalupe Creek, Guadalupe River, Los Gatos Creek, Matadero Creek, San Felipe Creek, San Francisquito Creek, Saratoga Creek, and Stevens Creek (CSWRCB 2012). Calero Reservoir, Guadalupe Reservoir, and Guadalupe River are included on the section 303(d) list because of elevated levels of mercury associated with historic surface mining and associated tailings, and San Francisquito Creek is included because of excess sedimentation from nonpoint sources (CSWRCB 2012). Flood control and water development have degraded habitat throughout the HUC and numerous road crossings impair fish passage. In the Guadalupe River watershed, groundwater recharge operations release water imported from the Sacramento-San Joaquin Delta into local stream channels. On Coyote Creek, gravel mining has resulted in large in-channel pools that are populated with non-native predatory bass (*Micropterus* spp.).

Reduced numbers of CCC steelhead occur in a few watersheds of this HUC: Coyote

Creek, Guadalupe River, San Francisquito Creek, and Stevens Creek. Anadromy is blocked in each watershed by water supply reservoirs; however, small populations of CCC steelhead continue to persist downstream. Built in 1890, Searsville Dam on San Francisquito Creek blocks access to a major portion of the upper watershed including a large tributary, Corte Madera Creek. Three San Francisquito Creek tributaries downstream of Searsville Dam, Los Trancos, West Union, and Bear creeks, all currently support steelhead populations. Unfortunately, no robust data sets exists within interior San Francisco Bay watersheds that would allow conclusions to be drawn regarding current population status or trends (Spence 2016).

2.3.1.3 Central Coast Area

The Central Coast Area encompasses the coastal area from San Francisco County south along the California coast to the southern extent of San Luis Obispo County. This area includes the following seven counties: San Francisco, San Mateo, Santa Cruz, Santa Clara, Monterey, San Benito, and San Luis Obispo. Metropolitan areas within the Central Coast Area include San Francisco, Pacifica, Half Moon Bay, Santa Cruz, the Monterey Peninsula, Hollister, Gilroy, Salinas, and San Luis Obispo. The Central Coast Area includes watersheds that flow into the Pacific Ocean, which support the following three ESUs/DPSs: CCC coho salmon, CCC steelhead and S-CCC steelhead, and includes their designated critical habitats.

In general, available stream flow decreases from north to south within the Central Coast Area. In addition to highly urbanized areas, portions of the Central Coast Area are experiencing low density rural residential development. The majority of the Central Coast Area is privately owned, though there are portions under public ownership including Open Space in San Mateo County, State parklands in Santa Cruz County, and Federal lands in southern Monterey County.

The Central Coast Area contains eight HUC-8s (4th field HUCs): San Francisco Coastal South, San Lorenzo-Soquel, Pajaro, Alisal-Elkhorn Sloughs, Salinas, Estrella, Carmel, and Central Coastal. Anthropogenic factors affecting listed salmonids in these HUCs include dams constructed for water storage and aquifer recharge, summer dams constructed for recreational activities, urbanization, surface water diversion and groundwater withdrawal, in-channel sediment extraction, agriculture, flood control projects, and logging. It is unknown what surface water diversions are screened. Agriculture has had the greatest impact on the Pajaro and Salinas HUCs, while logging and urbanization have had the greatest impact on the San Lorenzo-Soquel HUC.

a. San Francisco Coastal South

This HUC contains all of the coastal watersheds from the Golden Gate Strait south to approximately the San Mateo/Santa Cruz county line. The watersheds within this HUC are wholly within San Mateo County. There are seven moderate-sized watersheds within the HUC: Pilarcitos Creek, Arroyo Leon, Purisima Creek, Tunitas Creek, San Gregorio Creek, San Pedro Creek, Pescadero Creek, and Butano Creek. There is limited urban development within this HUC; agriculture (*e.g.*, brussel sprouts and cattle) is the dominant land use within all of the watersheds. There are several State Parks and Open Space areas within this HUC. Butano Creek, San Gregorio Creek, Pomponio Creek, and Pescadero Creek are included on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012). The pollution factors for these streams are high coliform count and sedimentation/siltation. The potential sources of these pollutants are nonpoint sources.

This HUC is within the CCC coho salmon ESU and CCC steelhead DPS. Long-term data on the abundance of coho salmon in this HUC are limited. Historical records document the presence of coho salmon in Butano Creek, Pescadero Creek, and San Gregorio Creek, though coho salmon have not been found during recent stream surveys (NMFS 2001). Five or fewer juvenile coho salmon were observed in Peters Creek in 1999, but no juveniles were observed during surveys conducted in 2000 (NMFS 2001). Aside from artificial coho production supporting the Scott Creek population (and producing strays), the species appears extirpated, or nearly so, within other surrounding watersheds (Spence 2016). Steelhead are widely distributed throughout this HUC. Steelhead were once abundant in the San Gregorio Creek watershed but are believed to be at critically low levels. Pescadero Creek likely supports the most viable steelhead population in this HUC (Titus *et al.* 2002). Recent population surveys suggest a few to several hundred adult steelhead return to the largest watersheds within this HUC (San Gregorio and Pescadero) (Williams 2016).

b. San Lorenzo-Soquel

This HUC begins approximately at the San Mateo/Santa Cruz county line in the north, containing Arroyo de los Frijoles in southern San Mateo County, south to and including Valencia Creek in Santa Cruz County. The HUC extends eastward to the Santa Cruz/Santa Clara county line. There are several moderate-sized streams within this HUC, including Gazos Creek, Carbonera Creek, Waddell Creek, Laguna Creek, Bear Creek, Bean Creek, Branciforte Creek, and Soquel Creek. The San Lorenzo River is the largest river in the HUC and the largest between the two closest major river systems - the Russian River in Sonoma County to the north and the Salinas River to the south. There is a fair amount of urban development within the HUC. Several State Parks (*e.g.*, Big Basin, Henry Cowell Redwoods, The Forest of Nisene Marks) are located within this HUC. Forestry operations are conducted on private timberlands and State forest in this HUC, including Big Creek Lumber Company and the Soquel Demonstration State Forest, respectively.

Aptos Creek, Bean Creek, Bear Creek, Boulder Creek, Branciforte Creek, Carbonera Creek, East Branch Waddell Creek, Fall Creek, Kings Creek, San Lorenzo River, San Lorenzo River Lagoon, Soquel Lagoon, Valencia Creek, and Zayante Creek are included on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012). The pollutants in these streams are varied, including, but not limited to, pathogens, nutrients, and sedimentation/siltation. The potential sources of these pollutants are also varied. Nonpoint source, urban runoff, and road construction are just a few of the potential sources.

This HUC is within the CCC coho salmon ESU, including designated critical habitat south to, and including, the San Lorenzo River and within the CCC steelhead DPS, including critical habitat south to, and including Aptos Creek. Long-term data on the abundance of coho salmon in this HUC are limited. Historical records document the presence of coho salmon in Waddell Creek, East Branch Waddell Creek, Scott Creek, Big Creek, San

Vicente Creek, San Lorenzo River, Hare Creek, Soquel Creek, and Aptos Creek. A coho salmon captive broodstock program operates on Scott Creek at Kingfisher Flat Hatchery, one of two such broodstock programs within the CCC ESU (the other is at Warm Springs Hatchery in the Russian River). Records of adult spawners and outmigrating smolts from Waddell Creek between 1932 and 1942 (Shapovalov and Taft 1954) constitute the only historical record of abundance in this HUC (NMFS 2001). The San Lorenzo River represents the southern extent of designated critical habitat for CCC coho salmon although they were historically documented at least as far south as Aptos Creek. Alteration of stream flow (due to in-channel stream flow diversions and pumping via wells for domestic use) and excessive sedimentation are two primary factors affecting CCC steelhead and CCC coho salmon critical habitat in the San Lorenzo River. Rearing juvenile coho salmon were observed in 2005 in the San Lorenzo River for the first time since 1982. Coho salmon are still found in Scott and Waddell Creeks and were rediscovered in San Vicente Creek in 2002 and observed for the first time in Laguna Creek in 2005. Steelhead are widely distributed throughout this HUC. Gazos, Waddell, and Scott Creeks are in relatively good condition, overall, for CCC steelhead.

c. Pajaro

This HUC is comprised of the Pajaro River and its tributaries and is located in portions of Santa Cruz, Santa Clara, Monterey, and San Benito counties. Moderate-sized tributaries to the Pajaro River include Corralitos Creek, Uvas Creek, Llagas Creek, Pacheco Creek, and Santa Ana Creek. The San Benito River is also a tributary to the Pajaro River. This HUC encompasses several municipalities, including the cities of Watsonville, Gilroy, Morgan Hill, and Hollister. Agriculture is the dominant land use within all of the watersheds in this HUC. Clear Creek, Corralitos Creek, Hernandez Reservoir, Llagas Creek, Tequisquita Slough, and Watsonville Slough are included on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012). The pollutants in these streams are varied, including, but not limited to, mercury, fecal coliform, and sedimentation/siltation. The potential sources of these pollutants are also varied. Nonpoint source, resource extraction (*e.g.*, via in-channel gravel mining), and pasture grazing are just a few of the potential sources. The Pajaro River is also included on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012). The Pajaro River contains the following pollutants: fecal coliform, nutrients, and sedimentation/siltation. Agriculture and pasture grazing are two potential sources of the pollutants.

The Pajaro HUC is within the S-CCC steelhead DPS and designated critical habitat. The distribution and abundance of steelhead within this HUC are significantly reduced. The majority of the streams where steelhead are known to be present, are located in the northwest portion of the HUC (*e.g.*, Uvas, Llagas, Corralitos, and Pachecho creeks). The mainstem Pajaro River once contained suitable spawning and rearing habitat for S-CCC steelhead, but currently functions solely as a migratory corridor because of impacts from flood control projects, agriculture, and water withdrawals for agricultural use.

The San Benito River has been adversely impacted by water withdrawals for agricultural use and in-channel sediment extraction. Steelhead have not been documented in the San Benito River since the mid-1990s, although no formal surveys have been undertaken. However, *O. mykiss* were documented in Bird Creek (San Benito River tributary) adjacent to Hollister Hills State Park in 2003. The San Benito River is also on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012) due to fecal coliform and sedimentation/siltation. The source of fecal coliform is unknown; agriculture, resource extraction, and nonpoint source have been identified as potential sources of this pollutant.

d. Alisal-Elkhorn Sloughs
The Alisal-Elkhorn Slough HUC encompasses watersheds between the Pajaro and Salinas rivers. This HUC has little permanent flowing water. S-CCC steelhead have been observed in the headwaters of Gabilan Creek, which contains the best freshwater habitat remaining in the HUC. The HUC features mixed oak woodlands and grasslands on rolling hills overlooking tidal salt marsh. Elkhorn Slough is a principal wetland complex in central California, and is considered one of the most ecologically important estuaries in the state and is part of the National Estuarine Research Reserve System. Land use within this HUC is primarily agriculture, though there is some urban/rural development present. Habitat within the HUC has been degraded. Portions of both nominal watersheds within this HUC are included on the 2002 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012). Alisal Slough and Gabilan Creek are included for high levels of fecal coliform and nitrates attributable to agriculture, urban runoff, natural sources, nonpoint sources, and unknown sources. Elkhorn Slough has high levels of pathogens, pesticides, and sedimentation from agricultural and nonpoint sources.

e. Salinas
The Salinas HUC is the largest in the Central Coast Area and contains the largest individual watershed within the Central Coast Area, the Salinas River. This HUC lies within interior Monterey and San Luis Obispo counties, as well as a portion of San Benito County. In addition to the Salinas River, there are three other large rivers in this HUC: the Arroyo Seco River, the San Antonio River, and the Nacimiento River. There are isolated areas of urban development, including Salinas, King City, and Paso Robles. Outside of these urban developments, agriculture is the dominant land use. Portions of the Los Padres National Forest, Ventana Wilderness, Fort Hunter Liggett, and Camp Roberts Military Reservation lie within this HUC. Several water bodies, including, but not limited to, Atascadero Creek, Blanco Drain, Cholame Creek, and the Nacimiento Reservoir, are on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012) due to a variety of pollutants from several sources. The Salinas River is also on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012) due to fecal coliform, nutrients, pesticides, chloride, and other pollutants derived from a variety of sources, principally agriculture.

The Salinas HUC is within the S-CCC steelhead DPS. The distribution and abundance of steelhead within the HUC are greatly reduced. The Salinas River is used as a migration corridor by S-CCC steelhead. Two of the largest tributaries, the San Antonio and Nacimiento rivers, have been dammed, eliminating steelhead access to valuable spawning and rearing habitat and severely modifying stream flow. These dams, along with an additional dam on the upper mainstem, in-channel sediment extraction, channel modification and water withdrawals for agricultural use, have significantly affected the Salinas River. The Arroyo Seco River contains the best spawning and rearing habitat for S-CCC steelhead in this HUC. A number of partial passage barriers affect steelhead access to habitat.

f. Estrella

This HUC is comprised of the Estrella River and its tributaries. Streams within the HUC include Little Chalome Creek, Cholame Creek, Navajo Creek, Sixteen Spring, and San Juan Creek. Only one creek in this HUC, Cholame Creek, is listed on the 2002 Clean Water Act section 303(d) list of water quality limited segments. Cholame Creek is listed as impaired for boron and fecal coliform (CSWRCB 2012). S-CCC steelhead use of this HUC is believed to be extremely limited due to infrequent and inadequate winter flow regimes in the HUC and the mainstem Salinas River. Critical habitat of S-CCC steelhead was not designated for the Estrella River HUC. Historic occurrences of steelhead were documented by Franklin (2001), however, it is unknown if steelhead persist in this HUC.

g. Carmel

This HUC is comprised of the Carmel River and its tributaries. Moderate-sized streams within the HUC include Las Gazas Creek, Chupines Creek, and Tularcitos Creek. None of the streams within this HUC are on the 2012 Clean Water Act section 303(d) list of water quality limited segments. There is urban development within the Monterey Peninsula and limited rural residential development elsewhere. Portions of the Los Padres National Forest lie within this HUC. The Carmel River presently maintains the largest adult run of steelhead in the S-CCC DPS (Titus *et al.* 2002) and is designated critical habitat. Impacts to S-CCC steelhead include three dams on the mainstem that hinder migration, water withdrawals for domestic use, agricultural, and golf course use, and channel modifications for flood control purposes.

h. Central Coastal

This long and narrow HUC contains all of the coastal watersheds from San Jose Creek near Point Lobos State Reserve in Monterey County down to the San Luis Obispo/Monterey County border. Most of the streams in this HUC are short-run and high-gradient, draining directly to the Pacific Ocean. Moderate-sized streams within this HUC include the Little Sur River and the Big Sur River. This HUC is within the S-CCC steelhead DPS and is designated critical habitat. This Central Coastal HUC has experienced the least amount of adverse impacts within the Central Coast Area. The Little Sur River is recognized as the most productive steelhead river (per stream mile) south of San Francisco Bay at this time (Titus *et al.* 2002). The Big Sur River is in relatively good condition as well, but anadromy is limited due to natural barriers.

2.3.2 Previous Section 7 Consultations in the Action Area

The North Central Coastal California Office conducts numerous informal and formal section 7 consultations across their jurisdictional area each year. The majority of the consultations are informal consultations that did not adversely affect listed species. A low number (less than 30) of formal biological opinions are produced each year that authorize take and have terms and conditions that minimize take of listed anadromous fish. One jeopardy biological opinion in the Russian River watershed exists and the applicants are currently implementing the RPAs associated with the biological opinion.

2.3.3 Climate Change Impacts in the Action Area

Information discussed above in the species status section indicates that listed salmonids in the action area have already experienced some detrimental impacts from climate change. These detrimental impacts across the action area are likely to be minor because natural and local climate factors continue to drive most of the climatic conditions salmonids experience. These natural factors are likely less influential on salmonid abundance and distribution than anthropogenic impacts across the action area. However, in the future impacts in the action area from climate change are likely to increase as air and water temperatures warm, and precipitation rates change. Based on the likely climate change impacts, NMFS assumes that fewer areas of the watersheds in the action area will be suitable for listed salmonids by the latter half of this century, absent efforts to improve habitat conditions and increase resistance and resiliency to climate change impacts.

2.4 Effects of the Action

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

Of the proposed restoration project types, several types are expected to have only beneficial effects to listed species. Water conservation projects that occur beyond a diversion point (barrier to fish), do not interact with fish or their habitat and provide benefits by increasing instream water availability. Riparian habitat restoration actions occurring outside of the wetted channel are expected to have only beneficial effects to fish and their habitat.

Except for riparian habitat restoration and streamflow augmentation, all proposed restoration types are expected to result in adverse effects to listed species. Despite the different scope, size, intensity, and location of these proposed restoration actions, the potential adverse effects to listed salmonids all result from dewatering, fish relocation, and increased sediment into rivers and streams. Dewatering, fish relocation, and structural placement will result in direct effects to listed salmonids, where a small percentage of individuals are expected to be injured or killed. The effects from increased sediment mobilization into streams are usually indirect effects, where the effects to habitat, individuals, or both, are reasonably certain to occur and are later in time.

a. Insignificant Miniscule or Discountable Improbable Effects to Listed Species or Their Critical Habitat

   The following seven proposed project types may adversely affect listed species; however, some components of the projects also may result in effects, such as habitat disturbance from heavy equipment operation, riparian vegetation disturbance, chemical contamination, and reduced benthic macroinvertebrate production that are not likely to adversely affect listed species or their critical habitats. These effects are expected to be insignificant or discountable as explained further below.

1. Noise, Motion, and Vibration Disturbance from Heavy Equipment Operation

Noise, motion, and vibration produced by heavy equipment operation is expected at most instream restoration sites. However, the use of equipment, which will occur primarily outside the active channel, and the infrequent, short-term use of heavy equipment in the wetted channel to construct cofferdams, is expected to result in insignificant adverse negligible effects to listed fishes. Listed salmonids will be able to avoid interaction with instream machinery by temporarily relocating either upstream or downstream into suitable habitat adjacent to the worksite. In addition, the minimum distance between instream project sites and the maximum number of instream projects under the proposed Program would further reduce the potential aggregated effects of heavy equipment disturbance on listed salmonids

2. Disturbance to Riparian Vegetation

Most proposed fisheries restoration actions are expected to avoid disturbing riparian vegetation through the proposed avoidance and minimization measures. In general, the restorative nature of these projects is to improve habitat conditions for salmonids, and thus, riparian vegetation disturbance is expected to be avoided, as practicable. However, there may be limited situations where avoidance is not possible.

In the event that streamside riparian vegetation is removed, the loss of riparian vegetation is expected to be small, due to minimization measures, and limited to mostly shrubs and an occasional tree. Most riparian vegetation impacts are expected to affect typical riparian species such as willows and other shrubs, which are generally easier to reestablish since they resprout and grow quickly. In addition, the revegetation of disturbed riparian areas is expected to further minimize the loss of vegetation. Therefore, NMFS anticipates only an insignificant negligible loss of riparian habitat and function within the action area to result from the proposed restoration activities.

3. Chemical Contamination from Equipment Fluids

Equipment refueling, fluid leakage, and maintenance activities within and near the stream channel pose some risk of contamination and potential take. In addition to toxic chemicals associated with construction equipment, water that comes into contact with wet cement during construction of a restoration project can also adversely affect water quality and may harm listed salmonids. However, all fisheries restoration projects will include the measures outlined in the sections entitled, *Measures to Minimize Disturbance From Instream Construction* and *Measures to Minimize Degradation of Water Quality* within Part IX of the CDFW Manual, which address and minimize pollution risk from equipment operation. Therefore, water quality degradation from toxic chemicals associated with the habitat restoration projects is discountable improbable.

4. Reduced Benthic Macroinvertebrate Community

Benthic (*i.e*., bottom dwelling) aquatic macroinvertebrates may be temporarily lost or their abundance reduced when stream habitat is dewatered (Cushman 1985). Effects to aquatic macroinvertebrates resulting from stream flow diversions and dewatering will be temporary because instream construction activities occur only during the low flow season, and rapid recolonization (about one to two months) of disturbed areas by macroinvertebrates are expected following rewatering (Cushman 1985, Thomas 1985, Harvey 1986). In addition, the effect of macroinvertebrate loss on juvenile coho salmon, Chinook salmon, or steelhead is likely to be negligible because food from upstream sources (via drift) would be available downstream of the dewatered areas since stream flows will be maintained around the project work site. Based on the foregoing, the loss of aquatic macroinvertebrates resulting from dewatering activities is not likely to adversely affect coho salmon, Chinook salmon, or steelhead.

2.4.1 Effects to Listed Salmonids

a. Dewatering

Although all project types include the possibility of dewatering, not all individual project sites will need to be dewatered. Based on the RC's biological assessment (NOAA 2015), there were 35 projects of 71 that required dewatering during a nine year period from 2006-2015. When dewatering is necessary, only a small reach of stream at each project site will be dewatered for instream construction activities. Dewatering encompasses placing temporary barriers, such as a cofferdam, to hydrologically isolate the work area, re-routing stream flow around the dewatered area, pumping water out of the isolated work area, relocating fish from the work area (discussed separately), and restoring the project site upon project completion. The length of contiguous stream reach that will be dewatered for most projects is expected to be less than 500 feet and no greater than 1000 feet for any one project site.

Because the proposed dewatering would occur during the low flow period, the species and life stages most likely to be exposed to potential effects of dewatering are juvenile coho salmon and juvenile steelhead. Most juvenile Chinook salmon would be avoided since the timing of the instream activities occur after they have migrated to the ocean. A few juvenile Chinook salmon, especially with a stream-type life history strategy, as well as adult summer run steelhead and half-pounder steelhead, may also be exposed where these individuals are present at or near the proposed project sites, although past relocation results indicated the chances of encountering these species and life stages is very low (Flosi *et al.* 2010). Dewatering will occur during a short period (usually one to two weeks) from June 15 to October 31 and, therefore, should avoid exposure to adult salmonids.

The effects of dewatering result from the placement of the temporary barriers, the trapping of individuals in the isolated area, and the diversion of streamflow. Rearing juvenile coho salmon, steelhead, and to a much lesser extent, juvenile stream-type Chinook salmon could be killed or injured if crushed during placement of the temporary barriers, such as cofferdams, though crushing is expected to be minimal due to evasiveness of most juveniles. Stream flow diversions could harm salmonids by concentrating or stranding them in residual wetted areas (Cushman 1985) before they are relocated, or causing them to move to adjacent areas of poor habitat (Clothier 1953, Clothier 1954, Kraft 1972, Campbell and Scott 1984). Salmonids, especially juveniles since they are not as visible as adults, not caught during the relocation efforts would be killed from either construction activities or desiccation.

Changes in flow are anticipated to occur within and downstream of project sites during dewatering activities. These fluctuations in flow, outside of dewatered areas, are anticipated to be small, gradual, and short-term, which should not result in any harm to salmonids. Stream flow in the vicinity of each project site should be the same as free-flowing conditions, except during dewatering and in the dewatered reach where stream flow is bypassed. Stream flow diversion and project work area dewatering are expected to cause temporary loss, alteration, and reduction of aquatic habitat.

Dewatering may result in the temporary loss of rearing habitat for juvenile salmonids. The extent of temporary loss of juvenile rearing habitat should be minimal because habitat at the restoration sites is typically degraded and the dewatered reaches are expected to be less than 500 feet per site and no more than a total of 1000 feet per project. These sites will be restored prior to project completion, and should be enhanced by the restoration project.

Effects associated with dewatering activities will be minimized due to the multiple minimization measures that will be utilized as described in the section entitled, *Measures to Minimize Impacts to Aquatic Habitat and Species During Dewatering of Projects* within Part IX of the CDFW Manual. Juvenile coho salmon, steelhead and stream-type Chinook salmon that avoid capture in the project work area will die during dewatering activities. NMFS expects that the number of coho salmon, Chinook salmon, or steelhead that will be killed as a result of barrier placement and stranding during site dewatering activities is very low, likely less than three percent of the total number of salmonids in the project area. The low number of juveniles expected to be injured or killed as a result of dewatering is based on the low percentage of projects that require dewatering (*i.e.*, generally only up to three percent), the avoidance behavior of juveniles to disturbance, the low number of juveniles in the typically degraded habitat conditions common to proposed restoration sites, and the low numbers of juvenile salmonids expected to be present within each project site after relocation activities.

b. Fish Relocation Activities

All project sites that require dewatering will include fish relocation. Typically, designated agents capture and relocate fish (and amphibians) away from the restoration project work site to minimize adverse effects of dewatering to listed salmonids. Fish in the immediate project area will be captured by seine, dip net and/or by electrofishing, and will then be transported and released to a suitable instream location. Post monitoring of project sites may also require fish relocation if juveniles are stranded or they are in poor water quality conditions.

Juvenile coho salmon and steelhead life stages are most likely to be exposed to fish relocation during dewatering and fish relocation. Most juvenile Chinook salmon will not be exposed since the timing of instream construction occurs after they have emigrated from streams. However, a few juvenile Chinook salmon, especially those with a stream-type life history strategy, may also be exposed where these individuals are stranded within the dewatering area.

Fish relocation activities may injure or kill rearing juvenile coho salmon and steelhead because these individuals are most likely to be present in the project sites. Any fish collecting gear, whether passive or active (Hayes 1983) has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of injury and mortality attributable to fish capture varies widely depending on the method used, the ambient conditions, and the expertise and experience of the field crew. The effects of seining and dip-netting on juvenile salmonids include stress, scale loss, physical damage, suffocation, and desiccation. Electrofishing can kill juvenile salmonids, and researchers have found serious sublethal effects including spinal injuries (Reynolds 1983, Habera *et al.* 1996, Habera *et al.* 1999, Nielsen 1998, Nordwall 1999). Based on prior experience with current relocation techniques and protocols likely to be used to conduct the fish relocation, unintentional mortality of listed juvenile steelhead and salmon expected from capture and handling procedures is not likely to exceed 3 percent of the fish subjected to handling, and can be reduced to near 1 percent with increased skill and experience of the operator.

Most of the stress and death from handling result from differences in water temperature between the stream and the temporary holding containers, dissolved oxygen levels, the amount of time that fish are held out of the water, and physical injury. Handling-related stress increases rapidly if water temperature exceeds 18 °C or dissolved oxygen is below saturation. A qualified fisheries biologist will relocate fish, following both CDFW and NMFS electrofishing guidelines. Because of these measures, direct effects to, and mortality of, juvenile coho salmon and steelhead during capture will be greatly minimized.

Although sites selected for relocating fish will likely have similar water temperature as the capture site and should have ample habitat, in some instances relocated fish may endure short-term stress from crowding at the relocation sites. Relocated fish may also have to compete with other salmonids, which can increase competition for available resources such as food and habitat. Some of the fish at the relocation sites may choose not to remain in these areas and may move either upstream or downstream to areas that have more habitat and lower fish densities. As each fish moves, competition remains either localized to a small area or quickly diminishes as fish disperse.

Fish relocation activities are expected to minimize individual project impacts to juvenile coho salmon and steelhead by removing them from restoration project sites where they would have experienced high rates of injury and mortality. Fish relocation activities are anticipated to only affect a small number of rearing juvenile coho salmon and/or steelhead within a small stream reach at and near the restoration project site and relocation release site(s). Rearing juvenile coho salmon and/or steelhead present in the immediate project work area will be subject to disturbance, capture, relocation, and related short-term effects. Most of the take associated with fish relocation is anticipated to be non-lethal, however, a very low number of rearing juvenile (mostly young of the year) coho salmon and/or steelhead captured may become injured or die. In addition, the number of fish affected by increased competition is not expected to be significant at most fish relocation sites, based upon the suspected low number of relocated fish inhabiting the small project areas. Also, most juvenile Chinook salmon are expected to migrate to estuarine or the ocean environment by June 15th of each year, but in some cases small numbers of juvenile Chinook salmon are expected to be encountered during fish relocation. Similar affects from electrofishing or seining during fish relocation are expected for Chinook salmon as for coho salmon and steelhead juveniles.

Effects associated with fish relocation activities will be significantly minimized due to the multiple minimization measures that will be utilized, as described in the section entitled, *Measures to Minimize Injury and Mortality of Fish and Amphibian Species During Dewatering* within Part IX of the CDFW Manual. NMFS expects that fish relocation activities associated with implementation of individual restoration projects will not significantly reduce the number of returning listed salmonid adults. Fish relocation activities will occur during the summer low-flow period after emigrating smolts have left the restoration project sites and before adult fish travel upstream. Therefore, the majority of listed salmonids that will be captured during relocation activities will be young of the year coho and juvenile steelhead of various ages. Although most mortalities of coho salmon and/or steelhead during fish relocation activities will occur almost exclusively at the young of the year stage, there is a potential of unintentional mortality of a one- or two-year old fish.

NMFS is able to estimate the maximum number of federally listed salmonids expected to be captured, injured, and killed each year from relocation activities using electrofishing and seining from past project information. From 2006-2015, thirty-five fish relocation projects relocated 4,770 juvenile salmonids with 91 mortalities which resulted in a mortality of 1.9 percent. Approximately the same numbers of projects are expected to occur on an annual basis which is 4 to 5 projects requiring dewatering and/or relocation. Given past numbers of salmonids captured over nine years of similar activities, we expect that approximately 500 to 600 juveniles to be relocated each year. This average number of expected individual fish captured can be much higher when high numbers of young of the year salmonids are present. Typically this occurs with steelhead that spawn late in the spring and young of the year fry are abundant and have not yet found suitable habitat or experienced natural mortality associated with density dependent habitat factors. For example, one past project relocated over 1700 juvenile steelhead at one restoration site. In this case the number of mortalities was under the expected 3 percent, but totaled 45 young of the year steelhead. It is possible to have one or two of these types of dewatering projects per DPS, or ESU each year (J. Pecharich, personal communication 2016). For CCC coho salmon and CC Chinook we do not expect large numbers of young of the year since spawning occurs in the previous fall, and most Chinook migrate out during the spring. CCC coho numbers are low across much of their range, and we expect fewer coho than steelhead will need to be relocated.

The maximum number of individual juvenile steelhead in each DPS expected to be injured or killed is based on the maximum number of juveniles relocated and a 3 percent mortality rate which results in 120 fish each year. This assumes two projects in a DPS that has large numbers of young of the year steelhead (2000 per project) and a 3 percent mortality rate. As described above, a relatively low mortality rate is expected due to the proposed measures for fish capture and relocation outline above in the project description. For salmon ESUs much lower numbers of juvenile fish are expected to injured or killed during each construction season. From 2006 to 2015 very few juvenile salmon were captured during dewatering and relocation activities and only one juvenile Chinook salmon mortality was observed. Given that restoration actions across ESUs are likely to increase numbers of salmon we expect that an increase in salmon will be captured. Based on past relocation information, we estimate that as many as 300 juvenile CCC coho salmon could be captured in each year, and 100 Chinook salmon given their respective life histories and the variability in flow and habitat conditions across each ESU. Therefore, with an expected 3 percent mortality associated with these activities results in the potential loss of 9 juvenile coho, and 3 juvenile Chinook salmon annually. In general the measures ensure that fish capture and relocation will occur during the appropriate habitat conditions, by qualified individuals numbers of mortalities are expected to be much lower than maximum numbers that could occur given conditions and population variability across DPSs and ESUs.

c. Increased Mobilization of Sediment within the Stream Channel

The proposed restoration project types involve various degrees of earth disturbance. Inherent with earth disturbance is the potential to increase background suspended sediment loads for a short period during and following project completion.

All project types involving ground disturbance in or adjacent to streams are expected to increase turbidity and suspended sediment levels within the project work site and downstream areas. Therefore, instream habitat improvement, instream barrier modification for fish passage improvement, stream bank stabilization, fish passage improvements at stream crossings, small dam removal[7], creation of off channel/side channel habitat, and upslope watershed restoration may result in increased mobilization of sediment into streams.

In general, sediment-related effects are expected during the summer construction season (June 15 to November 1), as well as during peak-flow winter storm events when remaining loose sediment is mobilized. During summer construction, the species and life stages most likely to be exposed to potential effects of increased sediment mobilization are juvenile coho salmon and juvenile steelhead. As loose sediment is mobilized by higher winter flows, adult Chinook salmon, coho salmon, and steelhead may also be exposed to increased turbidity. Removal of small dams and road crossing projects will have potential for releasing sediment due to sediment volume typically stored behind these structures. However, minimization measures, such as removing excess sediment stored upstream of the dam will limit the amount of sediment released to downstream reaches. The increased mobilization of sediment is not likely to degrade spawning gravel because project related sediment mobilization would be minimal due to the use of sideboards and minimization measures. These include the size of the dam allowed in this program (25 feet or less), engineering and biological review, only one project allowed per HUC 12 each year and removal of sediment if required. Based on past projects implemented through this program, the NOAA RC staff report that relatively small amount of sediment is expected from these projects and affect only a short distance downstream, and should be easily

[7] Because of the sideboards and engineering requirements described in the proposed action, small dam removal is expected to have similar sediment mobilization effects as culvert replacement or removal.

displaced by either higher fall/winter flows or redd building (J. Pecharich, personal communication 2015). In the winter, the high flows will carry excess fine sediment downstream to point bars and areas with slower water velocities. Because redds are built where water velocities are higher, the minimally increased sediment mobilization is not expected reach levels that will smother existing redds. Therefore, salmonid eggs and alevin are not expected to be exposed to the negligible increase in fine sediment on redds. Since most restoration activities will focus on improving areas of poor instream habitat, NMFS expects low numbers of fish inhabiting individual project areas (NOAA RC 2015b) during these periods of increased sediment input, and thus directly affected by construction activities, to be relatively small.

Restoration activities may cause temporary increases in turbidity and deposition of excess sediment may alter channel dynamics and stability (Habersack and Nachtnebel 1995, Hilderbrand *et al.* 1997, Powell 1997, Hilderbrand *et al.* 1998). Erosion and runoff during precipitation and snowmelt will increase the supply of sediment to streams. Heavy equipment operation in upland and riparian areas increases soil compaction, which can increase runoff during precipitation. High runoff can then, in turn, increase the frequency and duration of high stream flows in construction areas. Higher stream flows increase stream energy that can scour stream bottoms and transport greater sediment loads farther downstream than would otherwise occur.

Sediment may affect fish by a variety of mechanisms. High concentrations of suspended sediment can disrupt normal feeding behavior (Berg and Northcote 1985), reduce growth rates (Crouse *et al.* 1981), and increase plasma cortisol levels (Servizi and Martens 1992). Increased sediment deposition can fill pools and reduce the amount of cover available to fish, decreasing the survival of juveniles (Alexander and Hansen 1986) and holding habitat for adults. Excessive fine sediment can interfere with development and emergence of salmonids (Chapman 1988). Upland erosion and sediment delivery can increase substrate embeddedness. These factors make it harder for fish to excavate redds, and decreases redd aeration (Cederholm *et al.* 1997). High levels of fine sediment in streambeds can also reduce the abundance of food for juvenile salmonids (Cordone and Kelly 1961, Bjornn *et al.* 1977).

Short-term increases in turbidity are anticipated to occur during dewatering activities and/or during any instream construction activities. Research with salmonids has shown that high turbidity concentrations can: reduce feeding efficiency, decrease food availability, reduce dissolved oxygen in the water column, result in reduced respiratory functions, reduce tolerance to diseases, and can also cause fish mortality (Berg and Northcote 1985, Gregory and Northcote 1993, Velagic 1995, Waters 1995). Mortality of very young coho salmon and steelhead fry can result from increased turbidity (Sigler *et al.* 1984). Even small pulses of turbid water will cause salmonids to disperse from established territories (Waters 1995), which can displace fish into less suitable habitat and/or increase competition and predation, decreasing chances of survival. Nevertheless, much of the research mentioned above focused on turbidity levels significantly higher than those likely to result from the proposed restoration activities, especially with implementation of the proposed avoidance and minimization measures.

In contrast, the lower concentrations of sediment and turbidity expected from the proposed restoration activities are unlikely to be severe enough to cause injury or death of listed juvenile coho salmon and/or steelhead. Instead, the anticipated low levels of turbidity and suspended sediment resulting from instream restoration projects will likely result in only temporary behavioral effects. Monitoring of replaced culverts[8] within the action area detailed a range in turbidity changes downstream of newly replaced culverts following winter storm events (Humboldt County 2002, 2003 and 2004). During the first winter following construction, turbidity rates (NTU) downstream of newly replaced culverts increased an average of 19 percent when compared to measurements directly above the culvert. However, the range of increases within the 11 monitored culverts was large (n=11; range 123% to 21%). Monitoring results from one- and two-year-old culverts were much less variable (n=11; range: 12% to 9%), with an average increase in downstream turbidity of one percent. Although the culvert monitoring results show decreasing sediment effects as projects age from year one to year three, a more important consideration is that most measurements fell within levels that were likely to only cause slight behavioral changes [*e.g.*, increased gill flaring (Berg and Northcote 1985), elevated cough frequency (Servizi and Marten 1992), and avoidance behavior (Sigler *et al.* 1984)]. Turbidity levels necessary to impair feeding are likely in the 100 to 150 NTU range (Harvey 1986). Only one of the Humboldt County measurements exceeded 100 NTU (NF Anker Creek, year one), whereas the majority (81 percent) of downstream readings were less than 20 NTU. Importantly, proposed minimization measures, some of which were not included in the culvert work analyzed described above will likely ensure that future sediment effects from fish passage projects will be less than those discussed above. Therefore, the small pulses of moderately turbid water expected from the proposed instream restoration projects will likely cause only minor physiological and behavioral effects, such as dispersing salmonids from established territories, potentially increasing interspecific and intraspecific competition, as well as predation risk for the small number of affected fish.

Upslope watershed restoration activities, such as road decommissioning and upgrading, are expected to mobilize sediment through ripping and re-contouring. However, these activities are generally higher up in the watersheds where the adjacent streams are typically first or second order, and are typically not fish bearing. Sediment mobilization will be minimized through road outsloping, reseeding and mulching disturbed areas, and other erosion control measures. These erosion control measures should prevent a majority of the sediment from reaching fish bearing streams. In addition, road assessments which are required prior to funding implementation projects which have been funded by the RC indicate that the subject roads pose significant sediment problems for salmonids, and are in need of upgrading, repair, or decommissioning. Therefore, upslope road work (*e.g.*, road decommissioning), when implemented with the proposed preventative erosion control measures, will reduce overall yield to streams over the short and long term.

Upslope restoration activities, in the long term, should result in reduced sediment volume than unimproved roads. Road upgrading and decommissioning activities have been documented to reduce road-related erosion and landslide risk (Madej 2001, McCaffery *et al.* 2007). Road decommissioning studies in the Redwood Creek watershed, Humboldt

[8] When compared to other instream restoration projects (*e.g.*, bank stabilization, instream structure placement), culvert replacement/upgrade projects typically entail a higher degree of instream construction and excavation, and by extension greater sediment effects. Thus, we have chosen to focus on culvert projects as a "worst case" scenario when analyzing potential sediment effects from instream projects.

County, have found that treated roads, on average, contributed only 25% of the sediment volume produced from untreated roads (Madej 2001). Vegetation, in particular, when reestablished on decommissioned roads, leads to reduced fine sediment in adjacent streams (McCaffery *et al.* 2007). The amount of fine sediment mobilized from highly revegetated decommissioned roads can be at levels that existed prior to the road construction (McCaffery *et al.* 2007).

Road restoration projects may entail culvert replacement or removal, the resulting sediment effect is expected to be significantly smaller when compared to a typical fish passage improvement project. Road restoration projects typically deal with upslope road networks located high within the watershed drainage network. As a result, typical road crossings in these upslope areas largely occur in higher gradient, first or second order stream channels and feature small (*e.g.*, less than 4-foot diameter) culverts. In contrast, fish passage projects funded through the Program typically focus limited restoration funding on high-priority fish passage issues located on third or fourth order stream networks that, when completed, will re-establish fish access to large expanses of upstream habitat. In effect, both the size and gradient of upslope channels and culverts largely limit downstream sediment impacts during road projects. Small, high gradient stream channels typically transport sediment downstream more efficiently (and therefore store less upstream of the culvert) than lower gradient, higher order stream reaches where flow and channel morphology favor sediment deposition. Furthermore, the comparative size of these upslope road culverts (16-48 inch diameter) likely limit the volume of any sediment wedge that can develop upstream of the structure. Because of these unique characteristics common to culverts typically found on upslope roads, NMFS anticipates individual culvert projects that are part of a larger road project will not approach an effect level similar to larger fish passage projects, and thus are consider as part of the road project when computing maximum project density per HUC 12 watershed (as detailed in the section titled “Number and Location of Anticipated Projects” within the Proposed Action).

NMFS does not expect sediment effects to accumulate at downstream restoration sites within a given watershed. Sediment effects generated by each individual project will likely impact only the immediate footprint of the project site and up to approximately 500 to 1500 meters of channel downstream of the site. Studies of sediment effects from culvert construction determined that the level of sediment accumulation within the streambed returned to control levels between 358 to 1,442 meters downstream of the culvert (LaChance *et al.* 2008). Because of the multiple measures to minimize sediment mobilization, described in the CDFW Manual under *Measures to Minimize Degradation of Water Quality*, on pages IX-50 and IX-51, downstream sediment effects from the proposed restoration projects are expected to extend downstream for a distance consistent with the range presented by LaChance *et al.* (2008). The proposed limitation of three projects (only one road and one dam project) per HUC 12 each year will ensure that sediment disturbance across a watershed is minimized sufficiently to avoid sediment effects from accumulating in downstream stream reaches. Furthermore, the temporal and spatial scale at which project activities are expected to occur will also likely preclude significant additive sediment related effects. Assuming projects will continue to be funded and implemented similar to the past several years, NMFS expects that individual restoration projects sites will occur over a broad spatial scale each year. In other words, restoration projects occurring in close proximity to other projects during a given restoration season is unlikely, thus diminishing the chance that project effects would combine. Finally, effects to instream habitat and fish are expected to be short-term, since most project-related sediment will likely mobilize during the initial high-flow event the following winter season. Subsequent sediment mobilization may occur following the next two winter seasons, but generally should subside to baseline conditions by the third year as found in other studies, such as Klein *et al.* (2006), and suggested by the Humboldt County data (Humboldt County 2004).

2.4.2 Effects to Critical Habitat

2.4.2.1 Adverse Effects to PBFs

The critical habitat designation for salmonid species includes several PBFs which will be affected under the proposed action. These PBFs include spawning, rearing, and migration habitats.

Juvenile rearing sites require cover and cool water temperatures during the summer low flow period. Over-wintering juvenile salmonids require refugia to escape high flows in the winter. Adverse effects to rearing habitat will primarily occur as a result of dewatering the channel and increasing sediment input during instream restoration activities. Loss or reduction in quality of rearing sites can occur through dewatering habitat and the filling of pools with sediment. However, these adverse effects are expected to occur during one construction period during the summer and wetted habitat will be typically be restored within in one to two weeks. Post project sediment impacts to stream reaches are expected to be minor due to sediment reduction BMPs implemented at projects that create ground disturbance. The activities described in the proposed action will increase quality of rearing habitat over the long term. Rearing habitat will be improved by adding complexity that will increase pool formation, cover structures, and velocity refugia.

As explained above, spawning habitat is not likely to be adversely affected by the temporary increase in fine sediment resulting from proposed activities. Spawning habitat is located where water velocities are higher, where mobilized fine sediment is less likely to settle. Where limited settling does occur in spawning habitat, the minor increased sediment is not expected to degrade spawning habitat due to the small amounts and short term nature of the effects. Minor amounts of sediment transported by the first winter rains are expected to be redeposited to low velocity areas (sand bars which are not spawning areas) by high flow events throughout the winter period. Activities described in the proposed action will improve the quality of spawning habitat over the long term. Spawning habitat will be improved by reducing the amount of fine sediment that enters the stream in the long term through various types of erosion control. Additionally, specific gravel augmentation projects, described in the proposed action will increase the amount of spawning habitat available.

Migratory habitat is essential for juvenile salmonids outmigrating to the ocean as well as adults returning to their natal spawning grounds. Juvenile migratory habitat may be affected during the temporary re-routing of the channel during project implementation, however a migratory corridor will be maintained at all times. The proposed action will have long term beneficial effects to migratory habitat. Activities adding complexity to habitat will increase the number of pools, providing resting areas for adults, and the removal of barriers will increase access to habitat.

Misguided restoration efforts often fail to produce the intended benefits and can even result in further habitat degradation. Improperly constructed projects can cause greater adverse effects than the pre-existing condition. The CDFW Manual provides design guidance and construction techniques that facilitate proper design and construction of restoration projects. Properly constructed stream restoration projects will increase available habitat, habitat complexity, stabilize channels and streambanks, increase spawning gravels, decrease sedimentation, and increase shade and cover for salmonids. Since 2004, the percentage of fisheries restoration projects implemented under CDFG's FRGP rated as either good or excellent ranged between 71 to 96 percent, with an average of 87 percent (Collins 2005, CDFG 2006, 2007, 2008, 2009, 2010). NMFS assumes similar success rates will result from the proposed Program due to the similarity between this proposed Program and the FRGP program. Therefore, most of the proposed restoration actions should continue to be effectively implemented, and thus enhance existing habitat conditions at the project sites.

In addition to instream restoration projects, barrier modification for fish passage improvement and small dam removal activities may cause delivery of fine and course sediments to salmonid habitat. These activities generally utilize heavy equipment (*e.g.*, self-propelled logging yarders, mechanical excavators, backhoes, *etc.*) to conduct in-channel work and regrade the channel post barrier removal. The RC and Corps have recognized the higher level of sediment disturbance by these project types require additional review by the RC and NMFS staff. Because of this, the proposed action specifies that eligible dam removal projects must (1) be approved by CDFW and/or NMFS fish passage engineers (2) have a relatively small volume of sediment available for release (relevant to the size of the watershed), that when released by storm flows, will have minimal effects on downstream habitat, or (3) be designed to remove sediment trapped by the dam down to the elevation of the target thalweg including design channel and floodplain dimensions. As a result of these proposed conditions and others included in the project description, NMFS believes that these measures are sufficient to minimize impacts associated with increased mobilization of fine sediment in action area creeks because the instream sediment source will either be minimal in quantity, removed in its entirety, or of a quality that will enhance sediment starved reaches downstream.

In summary, the Program activities described in the *Proposed Action* are restoration projects that are intended to restore natural watershed functions that have been disrupted by anthropogenic activities. Inherent within these Program activities is the potential that certain activities (*e.g.*, culvert replacement, small dam removal, and bank restoration) will increase background suspended sediment loads. With regard to fine sediments, minor releases into flowing water during dewatering activities are expected, then additional minor amounts are not expected until the first fall rains occur. The sideboards proposed not only limit the duration of effects, also limit the magnitude of the effects. Sediment effects are expected to remain minimal and not accumulate by implementing sideboards that limit the number of, and distance between sediment producing activities. Because of the proposed protection measures, it is anticipated that the expected increase in background sediment levels resulting from restoration activities will only cause some short term adverse effects to steelhead or salmon critical habitat.

2.4.2.2 Beneficial Effects to PBFs

Habitat restoration projects that are funded by the RC and authorized by the Corps will be designed and implemented consistent with the techniques and minimization measures presented in the CDFW Manual to maximize the benefits of each project while minimizing effects to salmonids. Most restoration projects are for the purpose of restoring degraded salmonid habitat and are intended to improve instream cover, pool habitat, spawning gravels, and flow levels; remove barriers to fish passage; and reduce or eliminate erosion and sedimentation sources. Although some habitat restoration projects may cause small losses to the juvenile life history stage of listed salmonids in the project areas during construction, all of these projects are anticipated to improve salmonid habitat and salmonid survival over the long-term.

a. Instream Habitat Improvements

Instream habitat structures and improvement projects will provide escape from predators and resting cover, increase spawning habitat, improve upstream and downstream migration corridors, improve pool to riffle ratios, and add habitat complexity and diversity. Some structures will be designed to reduce sedimentation, protect unstable banks, stabilize existing slides, provide shade, and create scour pools.

Placement of LWD into streams can result in the creation of pools that influence the distribution and abundance of juvenile salmonids (Spalding *et al.* 1995, Beechie and Sibley 1997). LWD influences the channel form, retention of organic matter and biological community composition. In small (<10 m bankfull width) and intermediate (10 to 20 m bankfull width) streams, LWD contributes channel stabilization, energy dissipation and sediment storage (Cederholm *et al.* 1997). Presence and abundance of LWD is correlated with growth, abundance and survival of juvenile salmonids (Fausch and Northcote 1992, Spalding *et al.* 1995). The size of LWD is important for habitat creation (Fausch and Northcote 1992).

For placement of root wads, digger logs, upsurge weirs, boulder weirs, vortex boulder weirs, boulder clusters, beaver dam analogues and boulder wing-deflectors (single and opposing), long-term beneficial effects are expected to result from the creation of pools that will provide rearing habitat for juvenile coho salmon and steelhead. Improper use of weir and wing-deflector structures can cause accelerated erosion on the opposing bank, however, this can be avoided with proper design and implementation. Proper placement of single and opposing log wing-deflectors and divide logs, will provide long-term beneficial effects from the creation or enhancement of pools for summer rearing habitat and cover for adult salmonids during spawning. Proper placement of digger logs will likely create scour pools that will provide complex rearing habitat, with overhead cover, for juvenile salmonids and low velocity resting areas for migrating adult salmonids. Spawning gravel augmentation will provide long-term beneficial effects by increasing spawning gravel availability while reducing inter-gravel fine sediment concentrations.

Also, for projects where stream bank erosion is a concern, the various weir structures and wing-deflector structures likely to be authorized under the proposed program direct flow away from unstable banks and provide armor (a hard point) to protect the toe of the slope from further erosion. Successfully reducing streambank erosion will offset the increased sediment mobilization into streams from other restoration actions authorized under the proposed program. Boulder faces in the deflector structures have the added benefit of providing invertebrate habitat, and space between boulders provides juvenile salmonid escape cover.

The various weir structures can also be used to replace the need to annually build gravel push up dams. Once these weir structures are installed and working properly, construction equipment entering and modify the channel would no longer be needed prior to the irrigation season. The benefits of reducing or eliminating equipment operation during the early spring reduces the possibility of crushing salmon and steelhead redds and young salmonids.

b. Stream Bank and Riparian Habitat Restoration

Stream bank and riparian habitat restoration projects will reduce sedimentation from bank erosion, decrease turbidity levels, and improve water quality for salmonids over the long-term. Reducing sediment delivery to the stream environment 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 quality and quantity of pools from excessive sediment deposition. Successful implementation of stream bank and riparian habitat restoration projects will offset the increased sediment delivery into streams from other restoration actions authorized under the proposed Program. In addition, the various proposed streambank and riparian habitat restoration activities are likely to enhance native riparian forests or communities, provide increased cover (large wood, boulders, and vegetation structures) and a long-term source of all sizes of instream wood.

c. Fish Passage Improvement at Stream Crossings and small dams

Thousands of old or poorly designed stream crossings exist on roadways throughout the coastal drainages of northern and central California, many preventing listed salmonids from accessing vast expanses of historic spawning and rearing habitat located upstream of the structure. In recent years, much attention has been focused on analyzing fish passage at stream crossings through understanding the relationship between culvert hydraulics and fish behavior (Six Rivers National Forest Watershed Interaction Team 1999).

Reestablishing the linkages between mainstem migratory habitat and headwater spawning/rearing habitat will help to facilitate the recovery of salmonids throughout the action area. Reestablishing passage for listed salmonids into previously unavailable upstream habitat will also likely increase reproductive success and ultimately fish population size in watersheds where the amount of quality freshwater habitat is a limiting factor.

d. Upslope Watershed Restoration

Upslope watershed restoration projects will stabilize potential upslope sediment sources, which will reduce excessive delivery of sediment to anadromous salmonid streams. Some of these projects will reduce the potential for catastrophic erosion and delivery of large amounts of sediment to stream channels. Road improvement projects will reduce sediment delivery to streams in the long-term. Road decommissioning projects should be even more beneficial than road improvement projects in that all or nearly all of the hydrologic and sediment regime effects of the roads would be removed. Long-term beneficial effects resulting from these activities include restored hydrologic function including transport of sediment and LWD, reduced risk of washouts and landslides, and reduced sediment delivery to streams. In the long-term, these projects will tend to rehabilitate substrate habitat by reducing the risk of sediment delivery to streams and restore fish passage by correcting fish barriers caused by roads. Road decommissioning projects will also tend to rehabilitate impaired watershed hydrology by reducing increases in peak flows caused by roads and reducing increases in the drainage network caused by roads.

2.5 Cumulative Effects

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

Non-Federal activities that are reasonably certain to occur within the action area include agricultural practices, water withdrawals/diversions, mining, state or privately sponsored habitat restoration activities on non-Federal lands, road work, timber harvest, and residential growth.

A search of upcoming timber harvest plans on the CalFire website confirms that timber harvesting is expected to continue in the next five years (http://www.fire.ca.gov/ResourceManagement/THPStatusUpload/THPStatusTable.html). NMFS assumes these activities, and similar resultant effects (as described in the *Status of the Species* and *Environmental Baseline* sections), on listed salmonids species 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 in the Environmental Baseline section.

2.6 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5), 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) reduce the value of designated or proposed critical habitat for the conservation of the species.

The CCC coho salmon ESU has not shown improvement since its original listing in 1996 as threatened (61FR56138), and then as endangered in 2012 (77FR19523). The best available updated information on the biological status of this ESU and the threats facing this ESU indicate that it continues to be in danger of extinction (Williams 2016).

The NMFS's recovery plan (NMFS 2012) for the CCC coho salmon ESU identified the major threats to population recovery. These major threats include: roads, water diversions and impoundments; residential and commercial development; and severe weather. The impacts of these major threats are described in the effects to critical habitat section.

Steelhead populations throughout northern and central California have also shown a decrease in abundance, but are still widely distributed throughout most of the DPS. Although NC, CCC, and SCCC steelhead have experienced significant declines in abundance, and long-term population trends suggest a negative growth rate, they have maintained a better distribution overall when compared to the CCC coho salmon ESU. This suggests that, while there are significant threats to the population, they possess a resilience (based in part, on a more flexible life history) that likely slows their decline. However, the poor condition of their habitat in many areas and the compromised genetic integrity of some stocks pose a risk to the survival and recovery of these steelhead DPSs. Based on the above information, recent status reviews and available information indicate NC, CCC, and SCCC steelhead are likely to become endangered in the foreseeable future.

The most recent CC Chinook salmon status review found continued evidence of low population sizes relative to historical abundance. Although mixed abundance trends within some larger watersheds in the north may suggest some populations are persisting, the low abundance, low productivity, and potential extirpations of populations in the southern part of the CC Chinook salmon ESU are of concern. The reduced abundance contributes significantly to long-term risk of extinction, and is likely to contribute to short-term risk of extinction in the foreseeable future. Thus, NMFS concludes the CC Chinook salmon ESU falls far short of historic population numbers and distribution, and is therefore not viable in regards to the population size VSP parameter. The ESU's geographic distribution has been moderately reduced, but especially for southern populations in general, and spring-run Chinook populations in particular. Based on the above information, recent status reviews and available information indicate CC Chinook are likely to become endangered in the foreseeable future.

Currently accessible salmonid habitat throughout the action area has been severely degraded, and the condition of designated critical habitats, specifically their ability to provide for long-term salmonid conservation, has also been degraded from conditions known to support viable salmonid populations. Intensive land and stream manipulation during the past century (*e.g.*, logging, agricultural/livestock development, mining, urbanization, and river dams/diversion) has modified and eliminated much of the historic salmonid habitat in central and northern California. Impacts of concern include alteration of stream bank and channel morphology, alteration of water temperatures, loss of spawning and rearing habitat, fragmentation of habitat, loss of downstream recruitment of spawning gravels and LWD, degradation of water quality, removal of riparian vegetation resulting in increased stream bank erosion, increases in erosion entry to streams from upland areas, loss of shade (higher water temperatures), and loss of nutrient inputs (61 FR 56138).

Projects authorized under the Program are for the purpose of restoring anadromous salmonid habitat, take will likely result from fish relocation activities and the temporary effects of sediment mobilization, modified hydrology, and other minor effects. NMFS anticipates only small numbers of juvenile salmon and/or steelhead may be adversely affected at each individual restoration project work site. Adverse effects to listed salmonids at these sites are primarily expected to be in the form of short-term behavioral effects with minimal mortality. Salmonids present during project construction may be disturbed, displaced, injured or killed by project activities, and salmonids present in the project work area will be subject to capture, relocation, and related stresses. Most unintentional mortalities of salmon and/or steelhead during fish relocation activities and dewatering will occur exclusively at the juvenile stage. Short-term impacts to salmonid habitat from restoration activities will be minimal and localized at each project site. The duration and magnitude of direct effects to listed salmonids and to designated critical habitat associated with implementation of individual restoration projects will be significantly minimized due to the multiple minimization measures that will be utilized during implementation. The temporal and spatial limits (*i.e.*, sideboards) included in the proposed action will minimize significant additive effects. NMFS anticipates the effects of individual restoration projects will not reduce the number of returning listed salmonid adults. Even though salmonid numbers are dramatically reduced from historical abundance in the affected ESU and DPSs, juvenile losses are very small compared to the total number of juveniles that continue to rear in each watershed in the action area each year, and these small losses, by their small size alone, are unlikely to affect adult returns in a watershed or ESU/DPS. In addition, the low numbers of juvenile fish to be captured, injured or killed will be spread over a large geographical area and therefore reduce the effect to abundance and distribution by not concentrating all effects on any one population.

NMFS has determined these effects are not likely to appreciably reduce the numbers, distribution or reproduction of salmon and/or steelhead within each watershed where restoration projects occur. This is based on the Program's numeric limit on projects each year (maximum of 40), projects are spaced across a large geographic area, and that projects have required minimization and avoidance measures that result in short-term effects from restoration project construction. All of the restoration projects are intended to restore degraded salmonid habitat and improve instream cover, pool habitat, and spawning gravel; remove barriers to fish passage; and reduce or eliminate erosion and sedimentation impacts. These restoration projects are selected based the priorities set forth in current recovery plans and in close coordination with CDFW and NMFS staff biologists working in watershed recovery areas. Projects are generally prioritized based on the population structure with priority given to independent populations that are a priority for achieving viability across ESUs and DPSs.

Although there will be short-term impacts to salmonid habitat associated with some of the projects implemented each year, NMFS anticipates nearly all projects implemented will provide long-term improvements to salmonid habitat. NMFS also anticipates that the additive beneficial effects to instream salmonid habitat conditions for multiple life stages of salmonids and should improve survival of local populations of salmonids into the future. High threats to salmonid recovery, such as poorly designed roads, and passage migration barriers will be reduced as a result of implementing the proposed action. In addition, restored habitat resulting from restoration projects should improve adult spawning success, juvenile survival, and smolt outmigration, which will in turn lead to improved abundance, productivity, spatial structure, and diversity within the watershed population. As individual population viability improves, the viability of the ESU's and DPS are expected to improve as well. The likely improvements in population viability will help these populations become more resistant and resilient to climate change impacts which are likely to increase in the action area and across the ESUs and DPSs as the Program continues forward into the future.

2.7 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed Program is not likely to jeopardize the continued existence of CCC coho salmon, CC Chinook salmon, NC steelhead, CCC steelhead, or SCCC steelhead and is not likely to destroy or adversely modify designated critical habitat for the CCC coho salmon, CC Chinook salmon, NC steelhead, CCC steelhead, or SCCC steelhead.

2.8 Incidental Take Statement

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

The measures described below are nondiscretionary, and must be undertaken by RC and the Corps so that they become binding conditions of any grant or permit issued for the exemption in section 7(o)(2) to apply. The RC and Corps have a continuing duty to regulate the activity covered by this incidental take statement. If the RC or Corps (1) fails to assume and implement the terms and conditions or (2) fails to require an applicant to the Program to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the RC or the Corps must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement (50 CFR §402.14(i)(3)).

2.8.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take would occur as follows:

NMFS expects the proposed project will result in incidental take of listed CCC coho salmon, CC Chinook salmon, NC steelhead, CCC steelhead and SCCC steelhead on an annual basis. Juvenile coho salmon, steelhead and to a lesser extent stream-type juvenile Chinook salmon will be harmed, injured, or killed from the dewatering and fish relocating activities at the project sites. Specifically, incidental take is expected to be in the form of capture during dewatering and fish relocation activities. NMFS expects no more than 3 percent of the juvenile salmon and steelhead captured will be injured or killed each year. For each of the steelhead DPSs which can have large numbers of young of the year fish present during dewatering and relocation activities we expect up to 4000 juvenile steelhead to be captured and relocated and up to 120 juveniles (most will be young of the year) injured or killed during each year of the program. Much lower numbers of juvenile CCC coho salmon and CC Chinook salmon are expected at restoration sites and based on past dewatering and relocation information we expect 300 CCC coho salmon to be captured and relocated and the loss of 9 CCC coho salmon and the capture and relocation of 100 CC Chinook salmon juveniles, and 3 to be injured or killed during each year of the Program.

2.8.2 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.

2.8.3 Reasonable and Prudent Measures

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

a. Measures shall be taken to minimize the amount or extent of incidental take of listed salmonids resulting from fish relocation, dewatering, or instream construction activities.

b. Measures shall be taken to ensure that individual restoration projects authorized annually through the Program will minimize take of listed salmonids, monitor and report take of listed salmonids, and to obtain specific project information to better assess the effects and benefits of salmonid restoration projects authorized through the Program.

c. Measures shall be taken to handle or dispose of any individual CCC coho salmon, CC Chinook salmon, NC steelhead, CCC steelhead, or SCCC steelhead actually killed.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the RC and Corps or any applicant must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). The RC and Corps or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (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.

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

   Measures shall be taken to minimize the amount or extent of incidental take of listed salmonids resulting from fish relocation, dewatering, or instream construction activities:

      1. Fish relocation data must be provided annually as described in Term and Condition 2b (below). Any injuries or mortality from a fish relocation site that exceeds three percent[9] of a listed species shall be reported to the nearest NMFS office within 48 hours and relocation activities shall cease until a RC biologist is on site to supervise the remainder of relocation activities.

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

   Measures shall be taken to ensure that individual restoration projects authorized annually through the Program will minimize take of listed salmonids, monitor and report take of listed salmonids, and to obtain specific project information to better account for the effects and benefits of salmonid restoration projects authorized through the Program.

      1. In order to monitor the impact and to track incidental take of listed salmonids, the RC and/or the Corps must annually submit to NMFS a report of the previous year's restoration activities. The annual report shall include a summary of the specific type and location of each project, stratified by individual project, watershed, affected species and ESU/DPS. The report shall include the following project-specific summaries:

         - Summary detailing fish relocation activities, including the number and species of fish relocated and the number and species injured or killed. Any capture, injury, or mortality of adult salmonids will be noted in the monitoring data and report. Any injuries or mortality from a fish relocation site that exceeds three percent of the affected listed species shall have an explanation describing why.

         - The number and type of instream structures implemented within the stream channel.

[9] Only when injury or mortality exceeds 10 individuals of the affected species, to minimize the need to report when only a small number of listed species are injured or killed from a small total capture size.

- The length of streambank (feet) restored or planted with riparian species.

- The number of culverts replaced or repaired, including the number of miles of restored access to unoccupied salmonid habitat.

- The distance (miles) of road decommissioned.

- The distance (feet) of aquatic habitat disturbed at each project site.

This report shall be submitted annually by March 1 to the North-Central Coast NMFS office:

National Marine Fisheries Service
North-Central Coast Office
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

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

Measures shall be taken to handle or dispose of any individual CCC coho salmon, CC Chinook salmon, NC, CCC, or SCCC steelhead actually taken (mortality).

1. All steelhead, Chinook salmon, and coho salmon mortalities must be retained, placed in an appropriately sized whirl-pak or zip-lock bag, labeled with the date and time of collection, fork length, location of capture, and frozen as soon as possible. Frozen samples must be retained until specific instructions are provided by NMFS.

2.9 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 conservation recommendation for this proposed action.

2.10 Reinitiation of Consultation

This concludes formal consultation for the Program to fund, and/or permit restoration projects within the NMFS Santa Rosa Office jurisdictional area in California.

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

2.11 "Not Likely to Adversely Affect" Determinations

NMFS does not anticipate the proposed action will adversely affect Southern Green Sturgeon DPS (*Acipenser medirostris*). The Southern DPS of North American green sturgeon spawn in the upper reaches of the Sacramento River. Adult green sturgeon exhibit an extensive marine existence, traveling as far north along the Pacific west coast as Alaska. These fish return from the ocean every few years in the late winter to spawn, and generally show fidelity to their upper Sacramento River spawning sites. Therefore, individuals from Southern DPS of Green Sturgeon are not expected to be present in the action area (freshwater streams and estuaries located in Figure 1 above[10]) during the implementation of habitat restoration projects , and restoration projects affects will be discountable or insignificant due to implementation of project design and minimization measures. NMFS concurs with the RCs determination that the proposed action is not likely to adversely affect Green Sturgeon or its critical habitat because its effects are expected to be insignificant.

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

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

This analysis is based, in part, on the EFH assessment provided by the NOAA Restoration Center and the Corps of Engineers and descriptions of EFH for Coastal pelagic species (PFMC 2011), Pacific coast salmon (PFMC 2014), Pacific coast groundfish (PFMC 2016) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

Pacific coast salmon, Pacific groundfish, and Coastal pelagic EFH may be adversely affected

[10] Action area in Figure 1 does not include the San Francisco Bay.

by the proposed action. EFH areas for these species are shown in Figure 2 below. Specific habitats identified in PFMC (2014) for Pacific coast salmon include Habitat areas of Particular Concern (HAPCs), identified as: 1) complex channels and floodplain habitats; 2) thermal refugia; and 3) spawning habitat. HACPs for salmon also include all waters and substrates and associated biological communities falling within the habitat areas defined above. Essentially, all coho and Chinook habitat located within the proposed action are considered HACP as defined in PFMC (2014). These HAPC EFH areas include current and historical distribution of salmon in California obtained from Calfish (2012) and NMFS (2005a; 2005b)(as cited in PFMC 2014).

Estuaries in the action area that may be adversely affected for pacific groundfish (PFMC 2016), and coastal pelagic species (PFMC 2011) are those existing within the area shaded in Figure 2 (excluding the San Francisco Bay). Many of these estuaries contain eelgrass (*Zostera marina*), which is also designated as EFH-HAPCs for groundfish. EFH for coastal pelagic species includes estuaries and ocean waters outward to the limit of the U.S. exclusive economic zone.

Restoration activities typically occur in watersheds and estuaries subjected to significant levels of logging, road building, urbanization, mining, grazing, and other activities that have reduced the quality and quantity of instream habitat available for native anadromous salmonids. Types of permitted projects include: instream habitat improvement, fish passage improvement (including construction of new fish ladders/fishways and maintenance of existing ladders), bank restoration, riparian restoration, upslope restoration, and stream or estuary restoration. The majority of the actions considered in the accompanying biological opinion (BO) follow those described in: (1) California Department of Fish and Game's (CDFG) *California Salmonid Stream Habitat Restoration Manual, Third Edition, Volume II* with three new chapters *(Part IX: Fish Passage Evaluation at Stream Crossings, Part X: Upslope Assessment and Restoration Practices, and Part XI: Riparian Habitat Restoration*) added in 2003 and 2004 (Flosi *et al.* 2010), (2) NMFS' *Guidelines for Salmonid Passage at Stream Crossings* (NMFS 2000), and (3) NMFS' *Fish Screening Criteria for Anadromous Salmonids* (NMFS 2011).

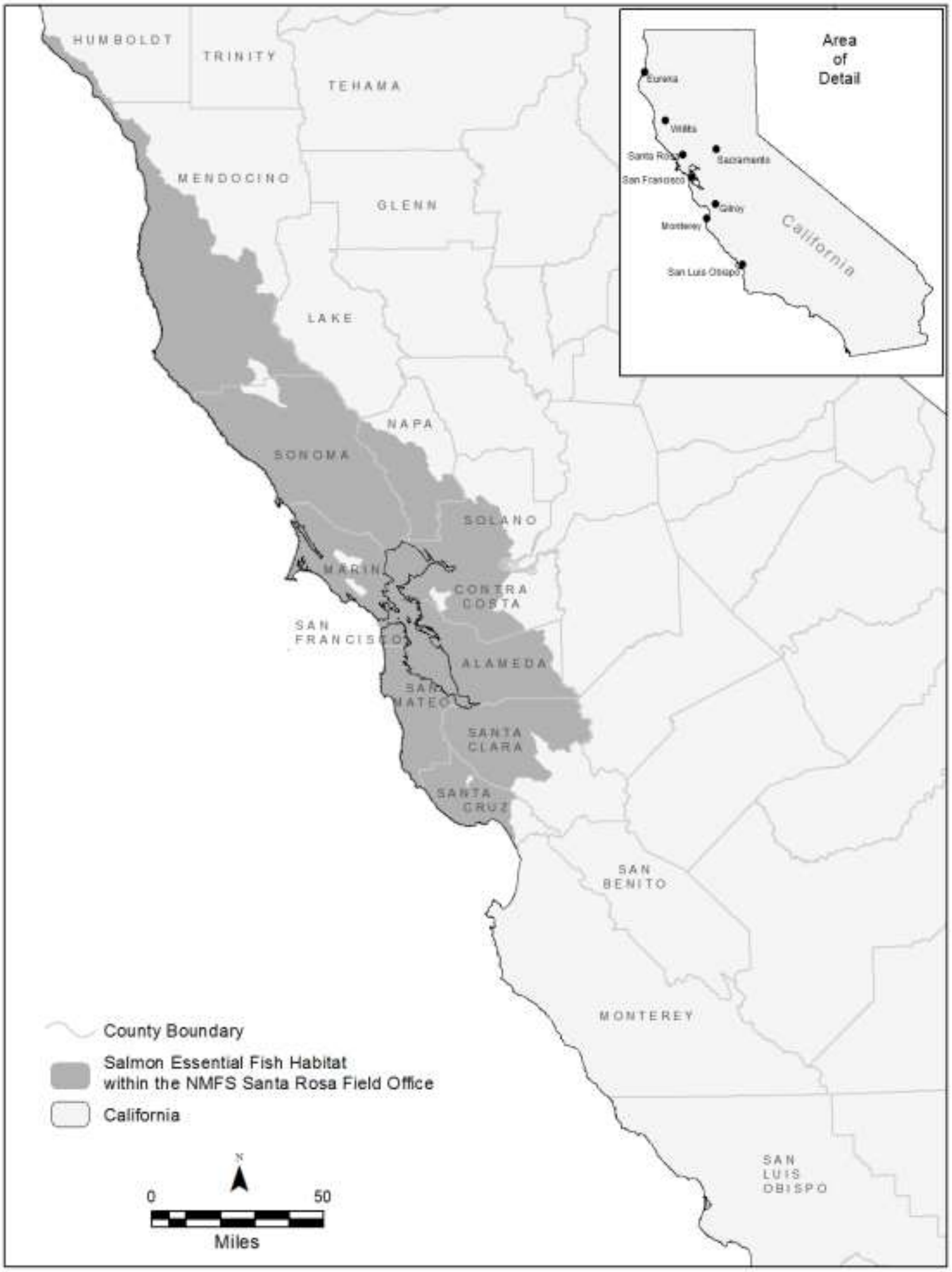

Figure 2. EFH area included in the RC and Corps restoration program for CC Chinook and CCC coho salmon as indicated by shaded regions. Estuaries occurring along the shaded area are included for Pacific groundfish and coastal pelagic species. Action area does not include the San Francisco Bay.

3.2 Adverse Effects on Essential Fish Habitat

NMFS has evaluated the proposed project for potential adverse effects to EFH pursuant to Section 305(b)(2) of the MSFCMA. As described and analyzed in the accompanying BO, NMFS anticipates some short-term sediment impacts will occur downstream of the project locations and outward from banks of estuarine areas. Increased fine sediment could further degrade already degraded habitat conditions in many of the proposed project locations. Flowing water may be temporarily diverted around some projects (salmon EFH only), resulting in short-term loss of habitat space and short-term reductions in macroinvertebrates (food for EFH species).

The duration and magnitude of direct effects to EFH associated with implementation of individual conservation projects will be significantly minimized due to the multiple minimization measures utilized during project execution. Short-term adverse effects that occur will be offset by long-term beneficial effects to the function and value of EFH.

3.3 Essential Fish Habitat Conservation Recommendations

Section 305(b)(4)(A) of the MSFCMA authorizes NMFS to provide EFH Conservation Recommendations that will minimize adverse effects of an activity on EFH. Although short-term potential adverse effects anticipated as a result of project activities, the proposed minimization and avoidance measures in the Enclosure 1 are sufficient to avoid, minimize and/or mitigate for the anticipated affects. Therefore, no EFH additional Conservation Recommendations are necessary at this time to avoid, minimize, mitigate, or otherwise offset the adverse effects to EFH.

3.4 Supplemental Consultation

The NOAA Restoration Center and the Corps of Engineers 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 Corps of Engineers. Other interested users could include permit or license applicants, restoration grand recipients, citizens of affected areas, others interested in the conservation of the affected ESUs/DPS. Individual copies of this opinion were provided to the NOAA Restoration Center and the Corps of Engineers. This opinion will be posted on the Public Consultation Tracking System web site (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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